3. Summary of Field Activities

A work plan was developed to provide a consistent approach to collecting samples, testing samples, and reporting results for the Bremo, Chesterfield, and Possum Point Power stations. The recommended sampling approach was based on two criteria:

- One sample (boring) location per 20 accessible acres, with a minimum of four samples per pond
- One composite sample per 10 vertical feet of boring

However, field conditions necessitated modifications to the plan. Table TM2-9 provides a summary by station of the planned and actual number of borings and samples collected and an explanation for the modifications. A summary of the boring depths and observed ash depths is provided in Table TM2-10.

Table TM2-9: Summary of Borings Completed and Samples Collected

Pond	Proposed		Actual		Explanation of Modifications
	Borings	Samples	Borings	Samples	
Bremo North Ash Pond	4	30	4	17	Limited recovery of CCR per planned depth interval and shallower-than-expected ash depths
Chesterfield Lower Ash Pond	4	8	4	10	Greater-than-expected ash depths
Chesterfield Upper Ash Pond	5	40	5	37	Limited recovery of CCR per planned depth interval
Possum Point Ash Pond D	4	16	5	8	Shallow DPT refusal

CCR = coal combustion residuals; DPT = direct push technology

Table TM2-10: Summary of Ash Depth by Station and Ash Pond

Station / Pond	Boring ID	Boring Depth (ft bgs)	Ash Depth (ft bgs)	Reason for Termination
Bremo Power Station / North Ash Pond	BRN-B01	70.0	63.5	Native materials
	BRN-B02	85.0	79.0	Native materials
	BRN-B03	70.0	66.0	Native materials
	BRN-B04	60.0	34.0	Native materials
Chesterfield Power Station / Lower Ash Pond	LAPPB-1	40.0	32.1	Native materials
	LAPPB-2	50.0	39.5	Native materials
	LAPPB-3	50.0	34.2	Native materials
	LAPPB-4	50.0	38.3	Native materials
Chesterfield Power Station / Upper Ash Pond	UAPPB-1	70.0	69.0	Native materials
	UAPPB-2	110.0	99.3	Native materials
	UAPPB-3	90.0	79.9	Native materials
	UAPPB-4	90.0	80.3	Native materials
	UAPPB-5	90.0	84.9	Native materials
Possum Point Power Station / Ash Pond D	PPD-B01	15.0	Unknown	DPT refusal
	PPD-B02	19.5	Unknown	DPT refusal
	PPD-B03	18.8	Unknown	DPT refusal
	PPD-B04	16.6	Unknown	DPT refusal
	PPD-B05	13.6	Unknown	DPT refusal

DPT= direct push technology; ft bgs = feet below ground surface; ID = identifier

All sampling was only conducted in in areas where there was not surface water on the ponds. Boring locations are shown on Figure TM2-1 (Bremo Power Station), Figure TM2-2 (Chesterfield Power Station), and Figure TM2-3 (Possum Point Power Station) in Section 7. The aerial photographs presented on these figures may not represent pond conditions at the time the borings were completed.

3.1 Drilling Procedures and Sample Retrieval Method

Sampling was completed at Ash Pond D at the Possum Point Power Station on July 31 and August 1, 2017. Borings were advanced using a direct-push technology (DPT) drill rig (Geoprobe 6620DT) operated by Cascade Drilling LP of New Ellenton, South Carolina. The drilling equipment used included 5-foot long, 2.25-inch outside diameter DPT rods and dual-tube sampling equipment. The equipment was decontaminated using a pressure washer and phosphate-free laboratory detergent before starting work and between sampling locations.

A new, clean, 2-inch inside diameter Macro-Core® sample liner was placed inside the sample rod before each push to collect CCR samples. After the sample rod was pushed to the appropriate depth, the rod was retracted and the liner removed. A new, clean Macro-Core liner was then placed in the sampler and another rod was added to the run. DPT sample rods were driven and retracted repeatedly until equipment refusal was encountered. Based on the presence of a pond liner, the target depth at Possum Point Ash Pond D was 40 feet below ground surface (bgs). However, equipment refusal was encountered between 13.6 and 19.5 feet bgs. The cause of the shallow DPT refusal is unknown.

Because of the shallow refusal encountered at Ash Pond D, a Terra Sonic Compact Crawler operated by Cascade Drilling LP of Midland, North Carolina, was mobilized to complete the proposed borings at the Bremo Power Station and the Chesterfield Power Station. The field activities at Bremo Power Station were conducted between August 3 and August 5, 2017, and the field activities at Chesterfield Power Station were conducted between August 8 and August 11, 2017. Equipment refusal was not encountered with this rig, and each boring at Bremo Power Station and Chesterfield Power Station was completed to a depth where native materials were encountered. The boring depths and the observed ash depths are summarized in Table TM2-10. Continuous CCR samples were collected using 6-inch outer and 4-inch inner sonic casings. The 6-inch outer casing was advanced ahead of the 4-inch casing to prevent collapse of the borehole, and sample cores were collected via the 4-inch inner casing. Borings were advanced in 10- or 20-foot runs, depending on field conditions. On retrieval of the 4-inch inner casing, ash sample cores were extruded into plastic sleeves to allow logging and sample collection.

A cutter was used to slice open the Macro-Core liners or sonic sample sleeves for sample retrieval. Materials that were not considered part of the representative sample (i.e., slough) were discarded. The sample length was measured to calculate sample recovery. Materials obtained in each Macro-Core liner or sonic sample sleeve were logged and photographed by an experienced geologist. Cores collected from each boring were logged for vertical variations in color, grain size, moisture content, and other physical characteristics. The presence, depth, and characteristics of native materials were also recorded, and each core was photographed before collection of samples for laboratory analysis. Boring logs are provided in Appendix A.

3.2 Sample Collection and Labeling

After logging, approximate 10-foot vertical intervals from each boring were composited and homogenized. Due to limited recovery at certain borings/depth intervals, some composite samples extend across intervals greater than 10 vertical feet. Composited and homogenized CCR samples were placed into new 1-gallon paint cans, appropriately labeled, and submitted to TEC Services Inc. of Lawrenceville, Georgia, for laboratory analysis according to the methods specified in Table TM2-8.

All drilling spoils not collected into laboratory containers were spread at the site of the CCR sample collection.

3.3 Sample Identifier Nomenclature

Each CCR sample collected for laboratory analysis was assigned a unique sample identifier (ID). The sample IDs were developed according to the following format.

Station/Pond ID-Location ID-Depth Interval

where:

Station/Pond ID =

- BRN – North Ash Pond (Bremo)
- LAPP – Lower Ash Pond (Chesterfield)
- UAPP – Upper Ash Pond (Chesterfield)
- PPD – Ash Pond D (Possum Point)

Location ID = assigned boring number

Depth Interval = (beginning depth-ending depth [e.g., 10.0 to 20.0]), measured in feet bgs to the nearest 0.1 foot below ground surface

Station/Pond ID examples:

- Bremo North Ash Pond CCR sample collected from the 20- to 30-foot bgs composite at boring 1: BRN-B01-(20.0-30.0)
- Chesterfield Lower Ash Pond CCR sample collected from 0-to 10-foot bgs composite at boring 1: LAPPB-1-(0.0-10.0)

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4. Findings

AECOM reviewed the laboratory analytical data for boring samples collected at each site and compared the results to the applicable criteria defined in the various specifications or methods for use of Class F fly ash in concrete manufacturing applications. Data from the methods described in Section 2 were reviewed.

A discussion of ASTM Methods C618 and C40 results for each of the four sampled ash ponds is presented below, followed by discussion of the ASTM Method D6913/1921 PSD results and additional considerations regarding the potential impacts of air pollution control systems on fly ash properties. Detailed laboratory data for chemical and physical parameters are tabulated by station in Appendix B. Laboratory test reports are provided in Appendix C.

4.1 Test Results for ASTM Methods C618/C40

This section presents the testing results for the four sample ash ponds at three of the Dominion power stations are discussed in this technical memorandum.

4.1.1 Bremo Power Station

4.1.1.1 North Ash Pond at Bremo Power Station

Table TM2-11 summarizes sample data for key parameters identified at North Ash Pond at the Bremo Power Station. Seventeen samples from four boring locations were analyzed. Other than LOI and as-received moisture, the other ASTM C618 chemical parameter data were well within the acceptance criteria for all samples. All but one sample had LOI that was above the 6% by weight criterion, with values in the range of 5.9% to 17.6% by weight. Values are well within the range of acceptable LOI in the CCR feed for one or more of the beneficiation technologies. As-received moisture content exceeded 30% weight for 10 of 17 samples (59%), indicating that drying of some material before beneficiation may be required. For most boring locations, moisture increased with increasing boring depth. Six of the 17 samples met the acceptance criteria for all physical parameters.

Table TM2-11: Statistical Summary of Selected Ash Characteristics for Bremo North Ash Pond

Parameter	ASTM C618 or ASTM C40 Criteria	Min	Max	Avg	Median	Samples Failing ASTM C618	
						Number	Percent
Chemical							
SiO_2, wt%		54.7	84.6	59.7	57.7	NA	NA
Al_2O_3, wt%		11.3	31.2	26.6	27.5	NA	NA
Fe_2O_3, wt%		2.8	10.2	6.1	5.9	NA	NA
Sum, %	Min 70%	68.8	126.0	92.4	91.1	0	0%
CaO, wt%	Class F <10%	0.39	1.21	0.84	0.85	0	0%
SO_3, wt%	Max 5%	0.03	0.09	0.05	0.05	0	0%
Cl, wt%	NA	0.001	0.006	0.002	0.002	NA	NA

Table TM2-11 (cont.): Statistical Summary of Selected Ash Characteristics for Bremo North Ash Pond

Parameter	ASTM C618 or ASTM C40 Criteria	Min	Max	Avg	Median	Samples Failing ASTM C618 Number	Samples Failing ASTM C618 Percent
Moisture, wt% as received	Max 3%	15.22	49.12	32.61	32.69	17	100%
Moisture, wt% further processing	Max 30%[1]	15.22	49.12	32.61	32.69	10	59%
Moisture, wt% dried	Max 3%	0.13	0.75	0.36	0.29	0	0%
LOI, wt%	Max 6%	5.9	22.6	12.6	11.6	16	94%
Physical							
Specific gravity	NA	2.08	2.64	2.23	2.19	NA	NA
Soundness	Max ±0.8%	–0.03	0.02	–0.01	–0.01	0	0%
% retained on #325 mesh	Max 34%	7.0	76.6	37.4	32.0	8	47%
Water required, %	Max 105%	103	116	107	106	9	53%
7-day control, PSI	NA	4,510	5,040	4,613	4,550	NA	NA
7-day sample, PSI	NA	370	4,330	3,307	3,630	NA	NA
7-day SAI, %	Min 75%	54	92	76	80	6	35%
28-day control, PSI	NA	5,680	6,150	5,854	5,950	NA	NA
28-day sample, PSI	NA	3,260	5,960	4,754	5,000	NA	NA
28-day SAI, %	Min 75%	56	105	81	84	5	29%
Organic impurities (Color Plate #)	Max #3	1	5	2	1	2	12%

Number of borings: 94
Number of samples analyzed: 17
[1] The upper moisture limit of CCR feed for selected beneficiation technologies is 20 to 30%.
ASTM = ASTM International; LOI = loss on ignition; PSI = pounds per square inch; SAI = strength activity index test ; wt% = weight percent; NA = not applicable; SiO_2 = silicon dioxide; Al_2O_3 = aluminum oxide; Fe_2O_3 = iron oxide; CaO = calcium oxide; SO_3 = sulfur trioxide; Cl = chlorine

Exhibit TM2-1 shows individual sample results for selected ASTM C618 parameters relative to the acceptance criteria. The depth range for each sample and the boring location and boring log material notation are provided. Depth ranges for samples within the borings varied from 0 to 80 feet. Boring log notations indicate that most samples taken from various layers within each boring were composed of fly ash material. Samples that failed the #325 mesh fineness criterion also failed the 28-day SAI and water required criterion. These samples were from the 40- to 60-foot depths of the Boring 01 location and all depths of the Boring 04 location and were often noted as having significant quantities of bottom ash material, limestone fill, or clay. The samples with the highest 28-day strength also had the lowest percent retained on the #325 mesh (e.g., Boring 03, 60- to 66-foot depth). Boring locations 01 and 02 showed the highest LOI at the deeper boring depths; whereas Boring location 03 exhibited the opposite trend. The one sample with an LOI below 6% by weight was from the Boring 04 (0- to 10-foot depth), which was noted in the boring log as being composed of only limestone fill and clay; the material was very coarse (nearly 80% retained on the #325 mesh) and exhibited an SAI value that was below 60%; therefore, material from this region of the station may not be suitable for use in concrete because the material does not contain fly ash. Two of the 17 samples exceeded the color test criterion. Both samples were at the upper end of the color scale and were from Boring 05 from the 0- to 10-foot (limestone fill/clay material) and the 10- to 30-foot (ash material) depths.

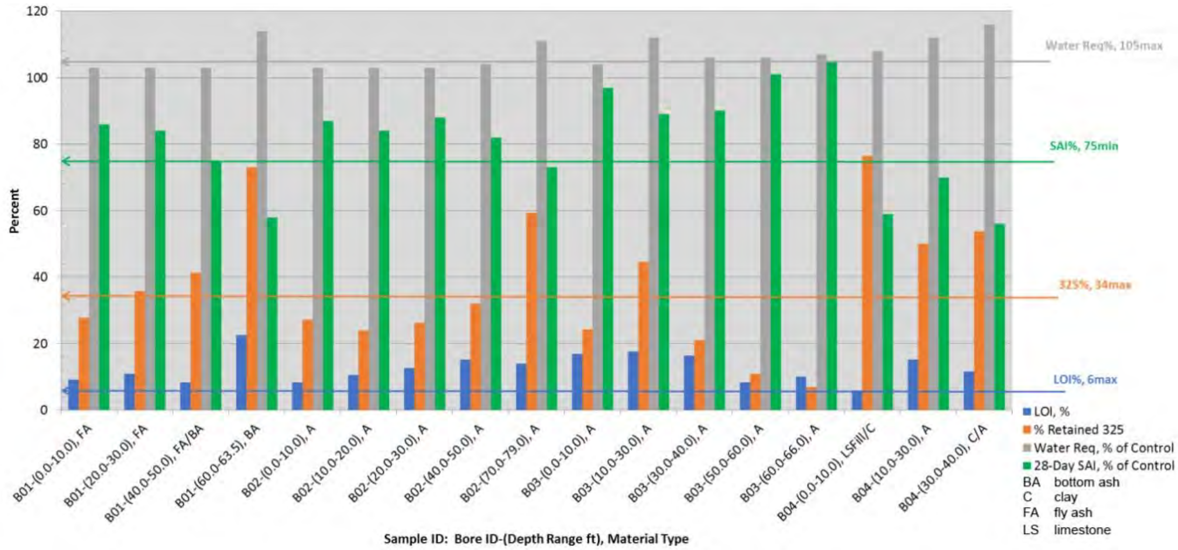

Exhibit TM2-1: ASTM C618 Parameters for Bremo North Ash Pond Boring Samples

4.1.2 Chesterfield Power Station

4.1.2.1 Lower Ash Pond

Table TM2-12 summarizes sample data for key parameters identified at Lower Ash Pond at the Chesterfield Power Station. Ten samples from four boring locations were analyzed. Other than LOI and as-received moisture, the ASTM C618 chemical parameter data were well within the acceptance criteria for all samples. All but two samples had LOI values that were above the 6% weight criterion, with values in the range of 3.3% to 17.3% by weight. Values are well within the range of acceptable LOI in the CCR feed for one or more of the beneficiation technologies. As-received moisture content exceeded 30% by weight for 6 of 10 samples (60%), with moisture content as high as 47% by weight in some samples. Drying of some material before beneficiation may be required. Moisture values tended to be lowest for the 0 to 10-foot depth at each boring location, but were more variable at other depths at the site. Only 2 of 10 samples met the acceptance criteria for all physical parameters. Material from this site was coarse; 70% of samples had percent retained on #325 mesh values that were well above the 34% criterion (often 40% to 50%, with values as high as 77%), resulting in 60% of samples failing the 28-day SAI criterion. Processing of the material from many locations within this site may be required to increase the fineness of the material.

Exhibit TM2-2 shows individual sample results for selected ASTM C618 parameters relative to the acceptance criteria. The depth range for each sample and the boring location and the boring log material notation are provided. Depth ranges for samples within the borings varied from 0 to 40 feet. Boring log notations indicate most samples taken from various layers within each boring were composed of fly ash or fly ash and bottom ash. The two samples that meet all physical parameter criteria were taken from the 0 to 10-foot depth of boring location 2 and the 30- to 38-foot depth of location 4. Although the location 2 sample was noted as containing more coarse bottom ash material, the quantity was relatively small based

Table TM2-12: Statistical Summary of Selected Ash Characteristics for Chesterfield Lower Ash Pond

Parameter	ASTM C618 or ASTM C40 Criteria	Min	Max	Avg	Median	Samples Failing ASTM C618	
						No.	%
Chemical							
SiO_2, wt%		52.0	76.8	60.0	55.6	NA	NA
Al_2O_3, wt%		9.3	29.1	23.7	26.0	NA	NA
Fe_2O_3, wt%		5.7	10.9	8.2	8.5	NA	NA
Sum, %	Min 70%	67.0	116.8	91.9	90.1	0	0%
CaO, wt%	Class F <10%	0.61	1.90	1.12	1.06	0	0%
SO_3, wt%	Max 5%	0.03	0.14	0.09	0.09	0	0%
Cl, wt%	NA	0.001	0.019	0.005	0.001	NA	NA
Moisture, wt% as received	Max 3%	21.39	46.93	32.70	33.40	10	100%
Moisture, wt% further processing	Max 30%[1]	21.39	46.93	32.70	33.40	6	60%
Moisture, wt% dried	Max 3%	0.16	0.65	0.42	0.43	0	0%
LOI, wt%	Max 6%	3.3	17.3	10.2	10.5	8	80%
Physical							
Specific gravity	NA	2.12	2.69	2.31	2.27	NA	NA
Soundness	Max ±0.8%	–0.03	0.00	–0.01	–0.02	0	0%
% retained on #325 mesh	Max 34%	28.3	76.7	48.0	48.8	7	70%
Water required, %	Max 105%	103	110	107	107	6	60%
7-day control, PSI	NA	5,050	5,050	5,050	5,050	NA	NA
7-day sample, PSI	NA	2,930	3,930	3,524	3,550	NA	NA
7-day SAI, %	Min 75%	58	79	70	71	8	80%
28-day control, PSI	NA	6,430	6,430	6,430	6,430	NA	NA
28-day sample, PSI	NA	4,020	5,340	4,609	4,540	NA	NA
28-day SAI, %	Min 75%	63	83	72	71	6	60%
Organic impurities (Color Plate #)	Max #3	1	3	2	2	0	0%

Number of borings: 4

Number of samples analyzed: 10

[1] The upper moisture limit of CCR feed for selected beneficiation technologies is 20 to 30%.

Al2O3 = aluminum oxide; ASTM = ASTM International; CaO = calcium oxide; Cl = chlorine; Fe2O3 = iron oxide; LOI = loss on ignition; NA = not applicable; PSI = pounds per square inch; SiO2 = silicon dioxide; SAI = strength activity index; SO3 = sulfur trioxide; wt% = weight percent

on the boring log notations (approximately <10% bottom ash); the location 4 sample was fly ash only. LOI values tended to decrease with increasing boring depth at all boring locations, with the highest values (10% to 17%) for the 0 to 10-foot boring depth. The two samples with LOI values that were less than the 6% weight criterion were from the deepest boring depths at locations 1 (3.3%) and 3 (5.3%); therefore, minimal beneficiation to reduce LOI may be required for material in these regions of the ash pond, depending on the specific target LOI specification of the end user. None of the samples exceeded the color test criterion.

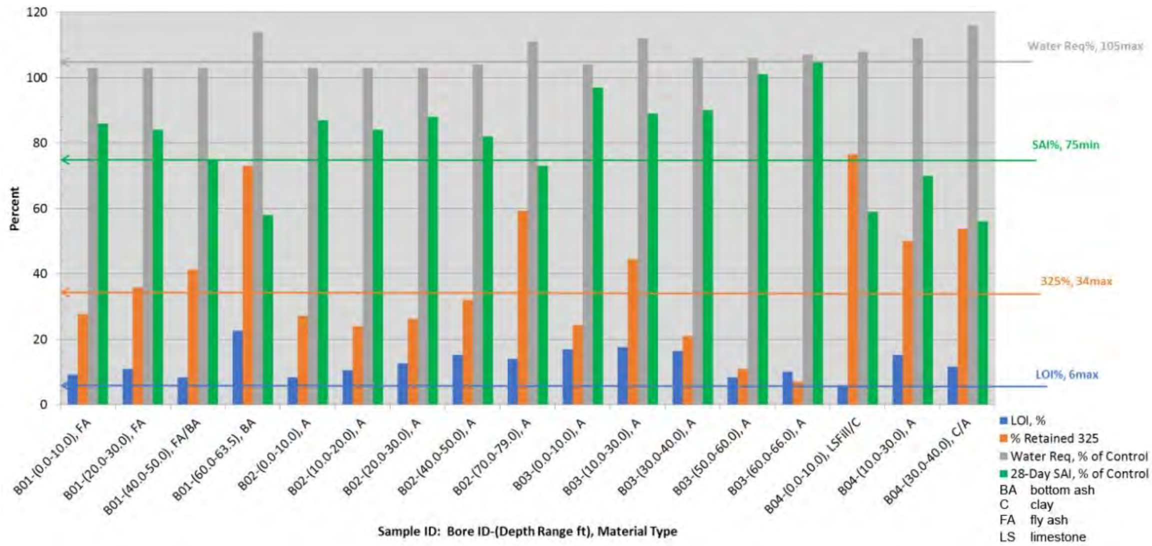

Exhibit TM2-2: ASTM C618 Parameters for Chesterfield Lower Ash Pond Boring Samples

Table TM2-13 summarizes sample data for key parameters identified at the Upper Ash Pond at Chesterfield Power Station. Thirty-seven samples from five boring locations were analyzed. Other than LOI and as-received moisture, the other ASTM C618 chemical parameter data were within the acceptance criteria for all samples. All but one sample had an LOI above the 6% by weight criterion, with values in the range of 5.9% to 17.6% by weight. Values are well within the range of acceptable LOI in the CCR feed for one or more of the beneficiation technologies. As-received moisture content exceeded 30% by weight for 13 of 37 samples (35%), with moisture content as high as 50% by weight in some samples. Drying of some material before beneficiation may be required. For most boring locations, moisture generally increased with increasing boring depth. Ten of the 37 samples met the acceptance criteria for all physical parameters. These samples were associated with boring locations 3, 4, and 5.

Exhibits TM2-3 and TM2-4 show individual sample results for selected ASTM C618 parameters relative to the acceptance criteria. The depth range for each sample and the boring location and the boring log material notation are provided. Depth ranges for samples within the borings varied from 0 to 90 feet. Boring log notations indicate most samples taken from various layers within each boring were composed of fly ash material. Samples that failed both the #325 mesh fineness criterion and the 28-day strength criterion were often from the deeper boring depths and were also noted as having significant quantities of bottom ash or clay: 1-(20- to 30-foot depth), 2-(80- to 90-foot depth), 4-(60- to 70-foot depth), 4-(40- to 50-foot depth), 5-(60- to 70-foot depth), and 5-(80- to 85-foot depth). Samples from boring locations 1 and 2 showed the highest LOI values; however, no obvious trends in LOI are observed with respect to boring depth or material type. None of the samples exceeded the color test criterion.

Table TM2-13: Statistical Summary of Selected Ash Characteristics for Chesterfield Upper Ash Pond

Parameter	ASTM C618 or ASTM C40 Criteria	Min	Max	Avg	Median	Samples Failing ASTM C618 No.	Samples Failing ASTM C618 %
Chemical							
SiO_2, wt%	NA	46.3	59.8	52.7	52.8	NA	NA
Al_2O_3, wt%	NA	23.2	31.3	27.8	28.1	NA	NA
Fe_2O_3, wt%	NA	5.7	12.4	9.2	9.1	NA	NA
Sum, %	Min 70%	75.2	103.5	89.7	90.0	0	0%
CaO, wt%	Class F <10%	0.98	8.02	1.78	1.32	0	0%
SO_3, wt%	Max 5%	0.04	4.76	0.40	0.09	0	0%
Cl, wt%	NA	0.001	0.06	0.005	0.001	NA	NA
Moisture, wt% as received	Max 3%	18.34	50.79	27.63	25.78	37	100%
Moisture, wt% further processing	Max 30%(1)	18.34	50.79	27.63	25.78	13	35%
Moisture, wt% dried	Max 3%	0.07	0.67	0.31	0.32	0	0%
LOI, wt%	Max 6%	10.3	24.4	15.1	14.4	37	100%
Physical							
Specific gravity	NA	2.08	2.36	2.21	2.22	NA	NA
Soundness	Max ±0.8%	–0.05	0.05	–0.02	–0.03	0	0%
% retained on #325 mesh	Max 34%	9.3	58.7	35.3	35.2	19	51%
Water required, %	Max 105%	103	114	107	107	23	62%
7-day control, PSI	NA	4720	5440	5053	5040	NA	NA
7-day sample, PSI	NA	2790	4330	3621	3640	NA	NA
7-day SAI, %	Min 75%	59	88	72	72	23	62%
28-day control, PSI	NA	6000	6390	6175	6150	NA	NA
28-day sample, PSI	NA	3820	5830	4806	4810	NA	NA
28-day SAI, %	Min 75%	64	91	78	79	12	32%
Organic impurities (Color Plate #)	Max #3	1	2	1	1	0	0%

Number of borings: 5
Number of samples analyzed: 37
(1) The upper moisture limit of CCR feed for selected beneficiation technologies is 20 to 30%.

ASTM = ASTM International; LOI = loss on ignition; PSI = pounds per square inch; SAI = strength activity index test; wt% = weight percent; NA = not applicable; SiO_2 = silicon dioxide; Al_2O_3 = aluminum oxide; Fe_2O_3 = iron oxide; CaO = calcium oxide; SO_3 = sulfur trioxide; Cl = chlorine

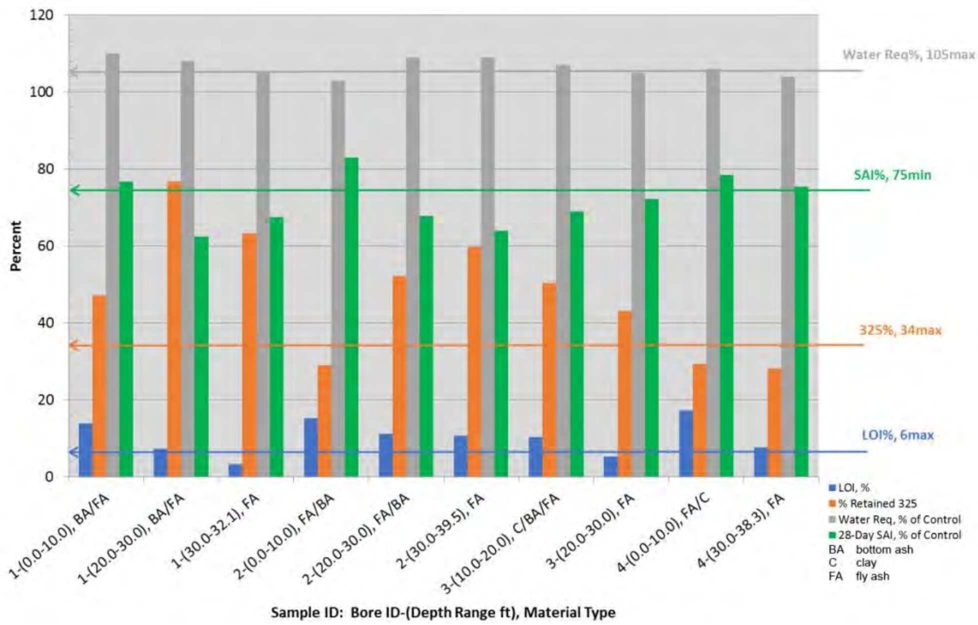

Exhibit TM2-3: ASTM C618 Parameters for Chesterfield Upper Ash Pond Boring Location 1 to 3 Samples

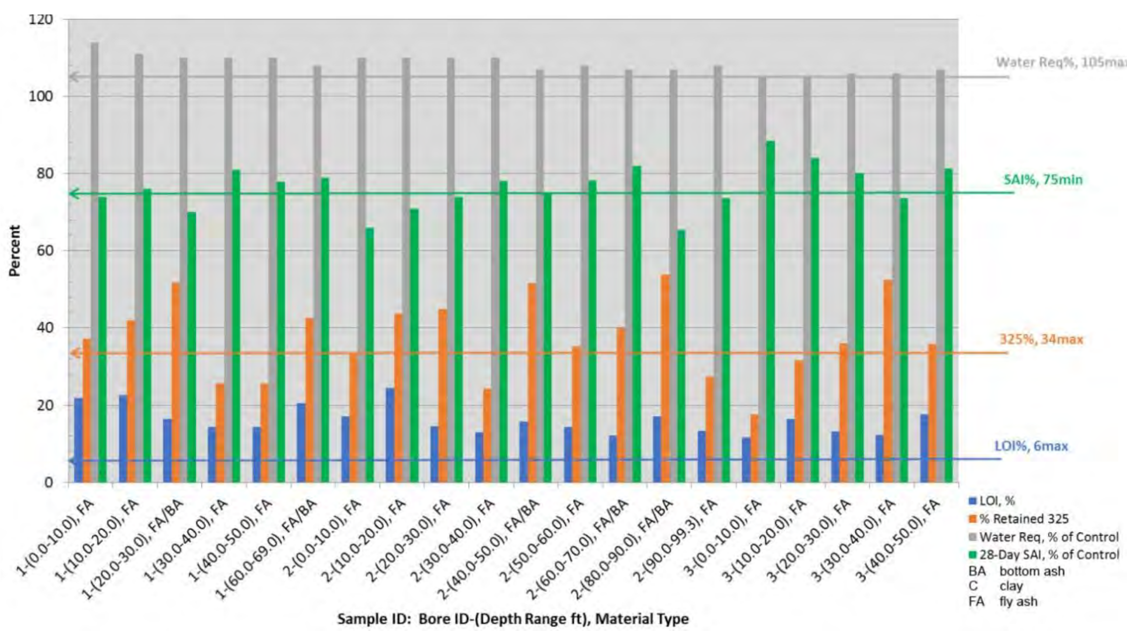

Exhibit TM2-4: ASTM C618 Parameters for Chesterfield Upper Ash Pond Boring Location 3 to 5 Samples

4.1.3 Possum Point Power Station

4.1.3.1 Ash Pond D at Possum Point Power Station

Table TM2-14 summarizes sample data for key parameters identified at Ash Pond D at the Possum Point Power Station. Eight samples from five boring locations were submitted for analysis. Other than LOI and “as-received” moisture, the other ASTM C618 chemical parameter data were well within the acceptance

Table TM2-14: Statistical Summary of Selected Ash Characteristics for Possum Point Ash Pond D

Parameter	ASTM C618 or C40 Criteria	Min	Max	Avg	Median	Samples Failing ASTM C618 No.	Samples Failing ASTM C618 %
Chemical							
SiO_2, wt%		59.0	70.6	66.0	67.5	NA	NA
Al_2O_3, wt%		15.9	26.4	20.1	19.3	NA	NA
Fe_2O_3, wt%		6.0	6.9	6.5	6.5	NA	NA
Sum, %	Min 70%	91.4	94.4	92.6	92.5	0	0%
CaO, wt%	Class F <10%	0.59	1.19	0.82	0.82	0	0%
SO_3, wt%	Max 5%	0.06	0.16	0.09	0.09	0	0%
Cl, wt%	NA	0.00	0.012	0.0043	0.0035	NA	NA
Moisture, wt% as-received	Max 3%	17.3	23.9	19.4	18.6	8	100%
Moisture, wt% further processing	Max 30%[(1)]	17.3	23.9	19.4	18.6	0	0%
Moisture, wt% dried	Max 3%	0.59	1.50	0.90	0.85	0	0%
LOI, wt%	Max 6%	6.9	10.6	8.7	8.6	8	100%
Physical							
Specific gravity	NA	2.25	2.55	2.39	2.41	NA	NA
Soundness	Max ±0.8%	–0.08	0.01	–0.01	–0.01	0	0%
% retained on #325 mesh	Max 34%	26.2	53.5	41.6	41.0	7	88%
Water required, %	Max 105%	107	110	108	107	8	100%
7-day control, PSI	NA	4740	5220	4860	4740	NA	NA
7-day sample, PSI	NA	3250	3720	3460	3465	NA	NA
7-day SAI, %	Min 75%	62	79	72	74	4	50%
28-day control, PSI	NA	5,600	5,750	5,713	5,750	NA	NA
28-day sample, PSI	NA	4,090	4,950	4,424	4,435	NA	NA
28-day SAI, %	Min 75%	73	86	78	78	1	13%
Organic impurities (Color Plate #)	Max #3	1	4	3	3	3	38%

Number of borings: 5
Number of samples analyzed: 8
(1) The upper moisture limit of CCR feed for selected beneficiation technologies is 20 to 30%.
Al_2O_3 = aluminum oxide; ASTM = ASTM International; CaO = calcium oxide; Cl = chlorine; Fe_2O_3 = iron oxide; LOI = loss on ignition; NA = not applicable; PSI = pounds per square inch; SAI = strength activity index test; SiO2 = silicon dioxide; SO_3 = sulfur trioxide; wt% = weight percent

criteria for all samples. All samples had LOI above the 6% by weight criterion, with values in the range of 6.9% to 10.6% by weight. Although these values exceeded the ASTM C618 criterion, they are well within the range of acceptable LOI in the CCR feed for one or more of the beneficiation technologies capable of reducing carbon content listed in Table TM2-3. As-received moisture content is also within the limits of the two non-electrostatic technologies; the STI technology requires a low moisture feed since it is an electrostatic process. All samples exceeded one or more of the acceptance criteria for physical parameters.

Exhibit TM2-5 shows sample results for selected ASTM C618 parameters relative to the acceptance criteria: LOI, percent retained on #325 mesh, water requirement, and 28-day SAI. Sample data are ordered by boring location ID and depth. The depth range for each sample and the boring location and boring log material notation are provided (A = ash, C = clay). For example, the first sample shown in Exhibit TM2-5 was from boring location 01 for material in the 0 to 10-foot depth, and the boring logs noted the material as ash. Depth ranges for samples within the borings varied from 0 to 20 feet. Boring log notations indicate most samples taken from various layers within each boring were composed of ash plus clay or silty clay material layers.

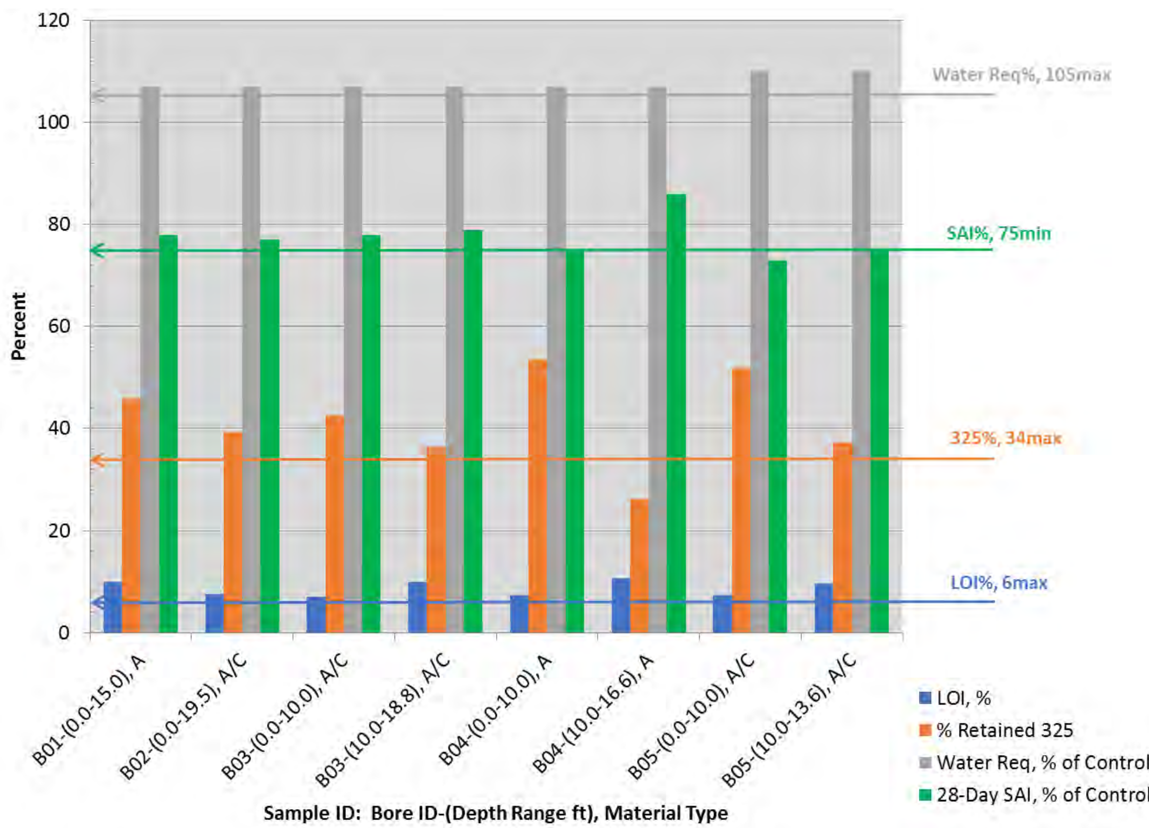

Exhibit TM2-5: ASTM C618 Parameters for Possum Point Ash Pond D Boring Samples

Only one sample passed the #325 mesh particle size criterion (Boring 04, 10 to 16.6 feet) with 26.5% retained. This sample exhibited the lowest percent retained on #325 mesh (i.e., the finest material) and the highest 28-day SAI%, but had the highest measured LOI at 10.9%. For the Boring 03, 04, and 05 locations, finer material appears to be present deeper in the ash pond. Increasing the fineness of the ash (i.e., lowering the percent retained at #325 mesh) is known to improve ash reactivity and rate of pozzolanic activity, and lowering the LOI can reduce the water requirement and reduce the negative impact of carbon on air entrainment admixtures (AEAs) (US DOT, 2003). Thirty-eight percent (38%) of samples also exceeded the ASTM C30-16 organic impurities color test. Although not shown on Exhibit TM2-5, samples that exceeded the color criterion were typically associated with the 0 to 10 foot depths of boring locations 03, 04, and 05, where as much as 50% of the depth on the boring logs for any given sample was noted as clay or silty clay material. The high clay content or organic matter associated with the clay material at Ash Pond D at Possum Point Power Station is one possible explanation for the exceedance of the color criterion for these samples. Although pure clay minerals themselves do not contain organic matter, natural clay may contain trace levels of organic matter and/or color impurities.

4.2 Test Results for ASTM Methods D6913/1921

In addition to the particle size information obtained from the ASTM C618 #325 mesh analyses, more detailed PSD data were generated for each sample using ASTM D6913 and D1921 methods to provide additional grain size distribution information. Detailed PSD results are tabulated in Appendix B. The major differences between the two techniques are as follows:

- ASTM C618 is a wet sieve method, whereas ASTM D6913/1921 are dry sieve methods.
- ASTM C618 specifies 1 gram of sample for analysis compared to 250 g of sample for ASTM D6913/1921 (200 g for ASTM D6913 and then 50 g for ASTM D1921).
- ASTM C618 uses a single #325 mesh screen, whereas ASTM D6918 uses eight sizes that range from ⅜ inch to #200 mesh and D1921 uses seven sizes that range from #230 mesh to #635 mesh.

Detailed ASTM D6913 and D1921 PSD results for each sample are tabulated in Appendix B.
Table TM2-15 provides a comparison of minimum and maximum values for percent retained on the #325 mesh for the two methods. Data from the ASTM D6913 and ASTM D1921 PSD dry sieve analyses were combined to obtain a complete PSD profile for the samples and then used to calculate the percent of total sample mass retained on the #325 mesh to allow comparison to the ASTM C618 results.

Table TM2-15: Comparison of Data for Percent Retained on #325 Mesh

	Possum Point Ash Pond D		Bremo North Ash Pond		Chesterfield Lower Ash Pond		Chesterfield Upper Ash Pond	
Method	Min	Max	Min	Min	Min	Max	Min	Max
ASTM C618	26%	54%	28%	9.3%	9.3%	59%	28%	77%
D6913/1921	58%	94%	32%	10%	10%	64%	32%	94%

Trends across samples at a given site were consistent, as illustrated in Exhibit TM2-6 for the eight samples analyzed at Ash Pond D at Possum Point Power Station. The ASTM 6913/1921 results were consistently higher than the ASTM C618 results at all other sites as well; however, the difference between the two methods was most pronounced at Ash Pond D, where significant amounts of clay material were noted in boring logs for most samples. The best agreement between the methods was observed for the samples from the Upper Ash Pond at the Chesterfield Power Station, where minimal amounts of clay were noted in the boring logs. The differences in results for the two methods may be related to the clay content of the samples, differences in sample size required for each method, or use of wet-sieving versus dry-sieving techniques. Regardless, the basic conclusions from the two data sets are the same; most material from all four sites will likely require some kind of size classification processing to improve the particle size characteristics so that the material can be used in concrete applications. Current information also points to a possible bias in the ASTM D6913/1921 dry sieve PSD data when the method is applied to samples with high clay content. Therefore, the ASTM D6913/1921 data should be viewed with caution if used in any detailed evaluation of beneficiation options, especially for the Ash Pond D at the Possum Point Power Station.

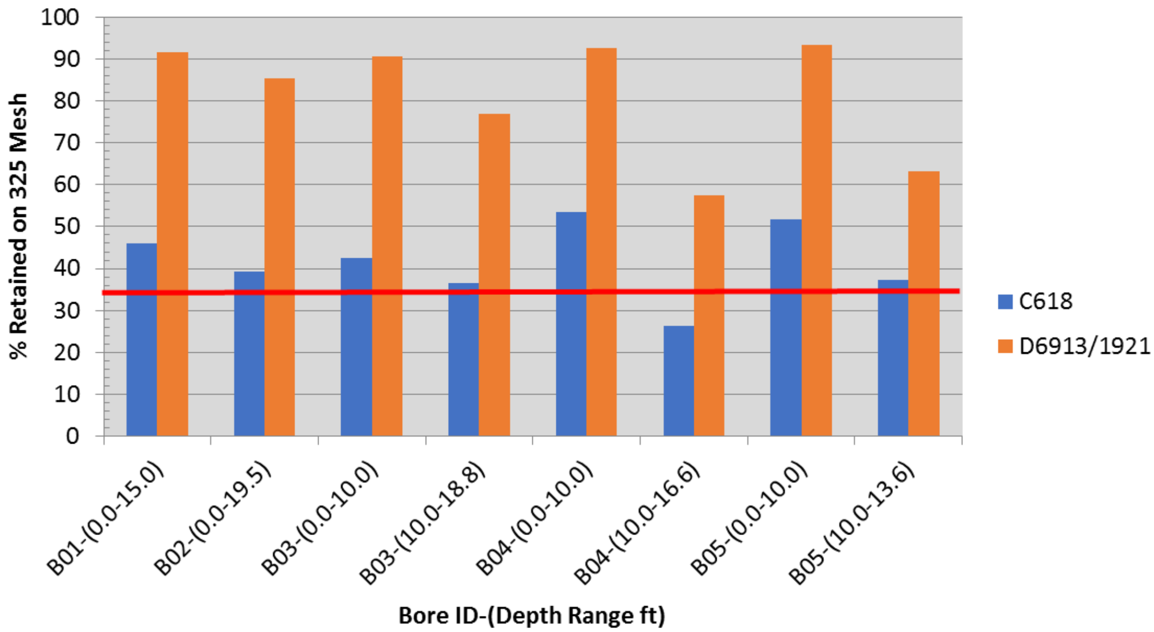

Exhibit TM2-6: Comparison of Particle Size Data for Possum Point Ash Pond D; Percent Retained on #325 Mesh

4.3 Additional Considerations

Power plant air pollution control technologies such as the use of ammonia in selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) for nitrogen oxides (NO_X) control can also impact the CCR ash characteristics and require evaluation with respect to beneficial use of the CCR material. Where SCR technologies were historically used at the Chesterfield Power Station, it would be important to determine where in the pond this ash was deposited and make sure it is tested and meets requirements for beneficial use. Such an evaluation was beyond the scope of the current effort.

Injection of alkali reagents via dry sorbent injection (DSI) into the flue gas to control emissions of acid gases such as hydrogen chloride and sulfur trioxide results in increased levels of chloride and sulfate in the fly ash. Chloride in concrete can create issues with corrosion of rebar used in steel-reinforced concrete applications. Although ASTM C618 does not address chloride levels in fly ash used for concrete, AECOM is aware of utilities that must meet fly ash chloride limits specified by concrete manufacturers in states such as California and Florida. The Florida Department of Transportation has established chloride limits in Portland cement concrete (Florida DOT, 2016). AECOM is aware that some concrete manufacturers have subsequently set chloride limits for fly ash. The current set of ash characterization samples from these four Dominion stations generally exhibited chloride levels in the range of <10 to 150 ppmw. Two samples from the 49- to 50-foot and 60- to 69-foot depths of Boring 01 at the Upper Ash Pond at the Chesterfield Power Station had the highest concentrations at 420 ppmw (0.042% by weight) and 590 ppmw (0.059% by weight), respectively. Increased sulfate levels in the ash as a result of DSI can potentially result in exceedance of the ASTM C618 SO_3 limit of 5% by weight; however, none of the samples analyzed as part of this study exceeded the limit. Values for most samples were one to two orders of magnitude below the limit, with the exception of one sample from Boring 02 (40- to 50-foot depth) at the Upper Ash Pond, which had a measured SO_3 value of 4.8% by weight.

The use of ammonia in SCR and SNCR technologies or for control of SO_3 emissions can result in ammonia contamination of the ash. Excess ammonia in the flue gas reacts with the ash to form ammonium salts on the ash particles, which can subsequently be released as ammonia gas during concrete production (ACI, 2003; Bittner et al., 2001). Ammonia levels in the ash were not measured as part of the test program at these sites.

5. References

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6. Abbreviations

µm	micrometer(s)
ACAA	American Coal Ash Association
ACI	American Concrete Institute
AEA	air entrainment admixtures
Al_2O_3	aluminum oxide
ASTM	American Society for Testing and Materials International
CaO	calcium oxide
CCR	coal combustion residuals
CFR	Code of Federal Regulations
CY	cubic yard
DOT	Department of Transportation
DPT	direct push technology
DSI	dry sorbent injection
Fe_2O_3	iron oxide
ID	identifier
LEED	Leadership in Engineering and Environmental Design
LOI	loss on ignition
MgO	magnesium oxide
NOx	nitrogen oxides
PMI	PMI Ash Technologies
ppmw	parts per million weight
PSD	particle size distribution
PSI	pounds per square inch
SAI	strength activity index
SB 1398	Senate Bill 1398
SCR	selective catalytic reduction
SiO_2	silicon dioxide
SNCR	selective non-catalytic reduction
SO_3	sulfur trioxide
STAR	Staged Turbulent Air Reactor
STI	Separation Technology Inc.
wt%	weight percent

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Figures

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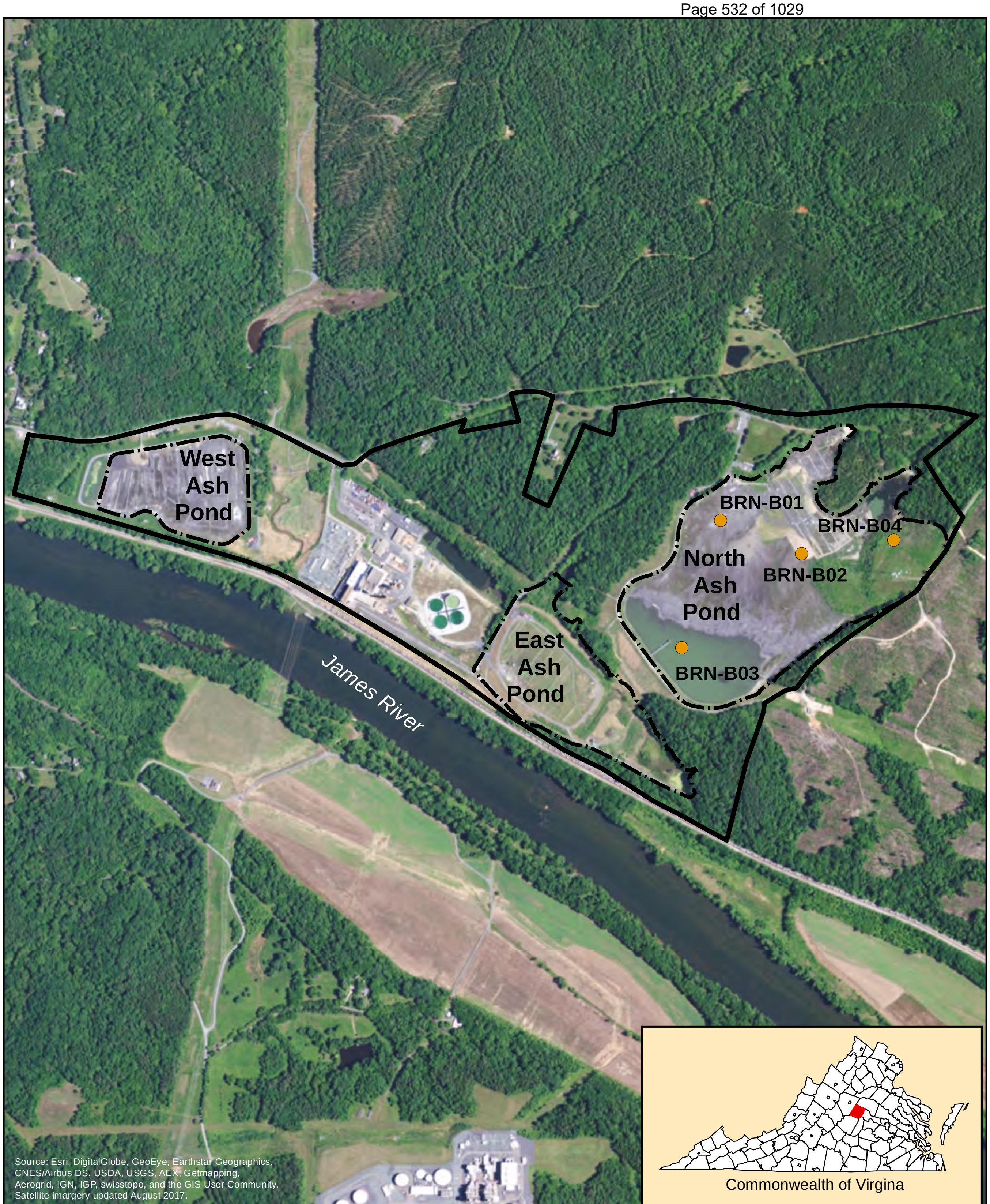

LEGEND

Approximate Property Boundary

Approximate Pond Boundary

Boring Location

N

0 550 1,100 2,200
Feet

AECOM

Figure TM2-1
Boring Locations

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Bremo Power Station

DATE:	DEPT:
10/25/2017	Environment

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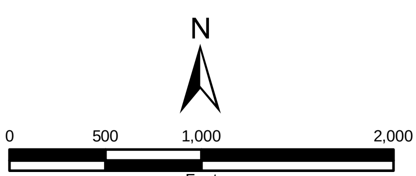
LEGEND

Approximate Property Boundary

Approximate Pond Boundary

Boring Location



AECOM

Figure TM2-2
Boring Locations

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Chesterfield Power Station

DATE:	DEPT:
10/25/2017	Environment

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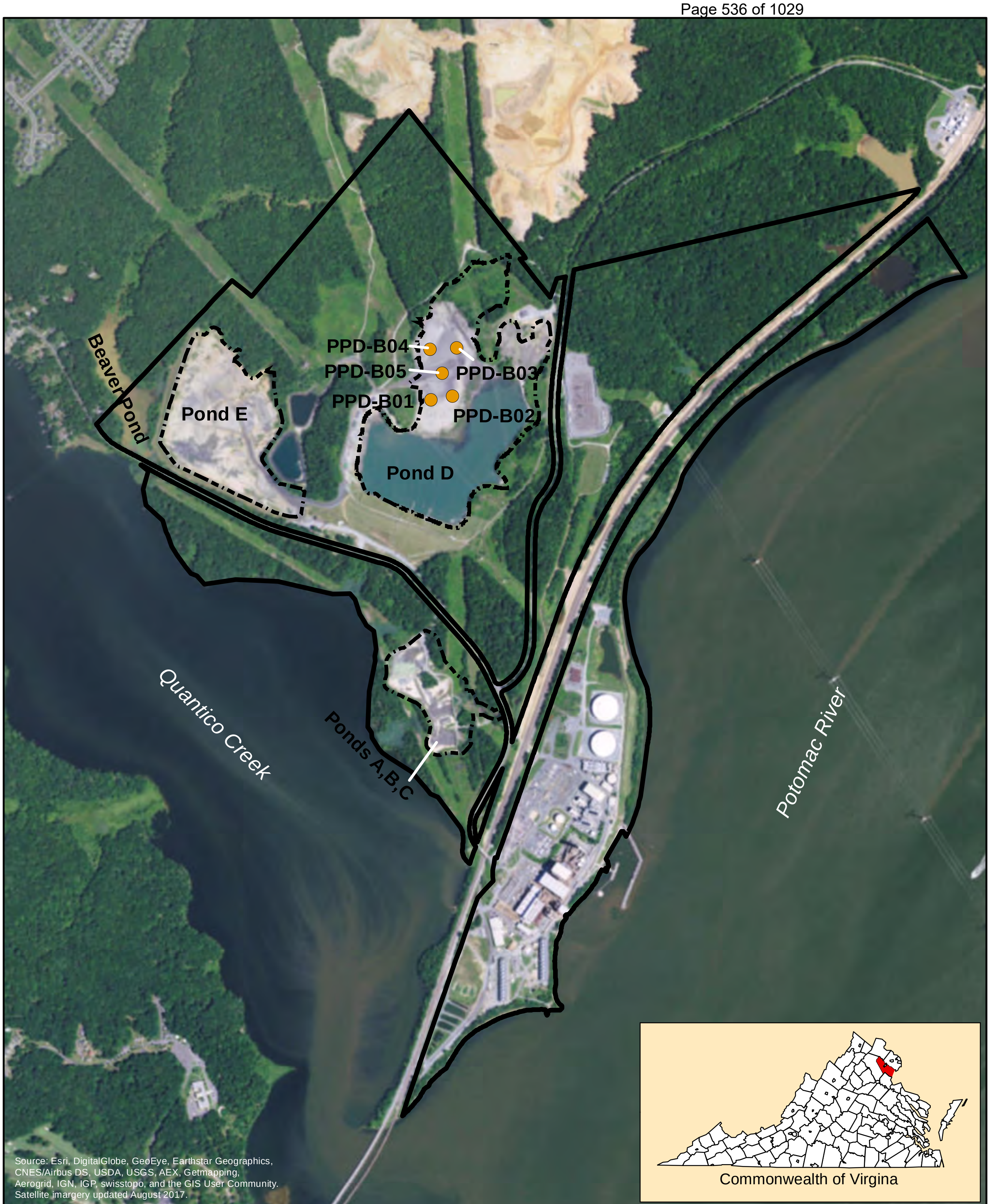

LEGEND

Approximate Property Boundary

Approximate Pond Boundary

Boring Location

N

0 750 1,500 3,000

Feet

AECOM

Figure TM2-3
Boring Locations

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/25/2017	Environment

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Appendix A
CCR Boring Logs

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Project: Dominion CCR Ash Study
Project Location: Possum Point Power Station, Ash Pond D
Project Number: 60545438

Log of PPD-B01

Sheet 1 of 1

Date(s) Drilled	7/31/17	Logged By	Ethan House	Checked By	CS/EH
Drilling Method	Direct Push	Drill Bit Size/Type	2.25" direct push bit	Total Depth of Borehole	10.0ft bgs
Drill Rig Type	Geoprobe 6620DT	Drilling Contractor	Cascade Drilling		
Borehole Backfill	Bentonite chips, hydrated	Sampling Method(s)	Macrocore ™ with Acetate liners		
Coordinate Location	N 11830681.1 E 6886309.2	Groundwater Level(s)	Dry		

Elevation, feet	Depth, feet	SAMPLES Type	Num er	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pen., TSF	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	0		DPT 1		100	0.75		Black (2.5Y 2.5/1), ASH, trace organic matter, fine grained, loose, dry,		
	5		DPT 2		10	NA				
	10							@ 10.0' bgs refusal		*Abandoned with bentonite chips*

End of Boring at 10´ bgs

The cause of DPT refusal is unknown.

Project: Dominion CCR Ash Study **Project Location: Possum Point Power Station, Ash Pond D** **Project Number: 60545438**	**Log of PPD-B02** Sheet 1 of 1

Date(s) Drilled	8/1/17	Logged By	Ethan House	Checked By	CS/EH
Drilling Method	Direct Push	Drill Bit Size/Type	2.25" direct push bit	Total Depth of Borehole	19.5ft bgs
Drill Rig Type	Geoprobe 6620DT	Drilling Contractor	Cascade Drilling		
Borehole Backfill	Bentonite chips, hydrated	Sampling Method(s)	Macrocore ™ with Acetate liners		
Coordinate Location	N 11830914.6 E 6886345.5	Groundwater Level(s)	Dry		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES Recovery, %	SAMPLES Pocket Pen., TSF	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	0							No recovery.		
			DPT 1		55	2.5		FILL materials with ash.		
								Olive Brown (2.5Y 4/4), CLAY, trace fine grains, moderate plasticity, firm, dry.		
	5							Dark Gray (2.5Y 4/1), ASH, fine grained, firm.		
			DPT 2		40	0.75				
								@ 8.8-9.6' bgs trace of silty clay		
	10							Black (2.5Y 2.5/1), ASH, firm, crumbly, fine grained, dry.		
			DPT 3		100	2.5				
	15									
			DPT 4		52	2.25		Olive Brown (2.5Y 4/4), silty CLAY, low plasticity, firm, damp.		
								@ 19.5' bgs refusal		*Abandoned with bentonite chips*
								End of Boring at 19.5´ bgs The cause of DPT refusal is unknown.		

AECOM

Project: Dominion CCR Ash Study
Project Location: Possum Point Power Station, Ash Pond D
Project Number: 60545438

Log of PPD-B03

Sheet 1 of 1

Date(s) Drilled	8/1/17	Logged By	Ethan House	Checked By	CS/EH
Drilling Method	Direct Push	Drill Bit Size/Type	2.25" direct push bit	Total Depth of Borehole	18.8ft bgs
Drill Rig Type	Geoprobe 6620DT	Drilling Contractor	Cascade Drilling		
Borehole Backfill	Bentonite chips, hydrated	Sampling Method(s)	Macrocore ™ with Acetate liners		
Coordinate Location	N 11830956.7 E 6886862.1	Groundwater Level(s)	Dry		

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist. Blows/6" OR CORE% RQD	SAMPLES: Recovery, %	SAMPLES: Pocket Pen., TSF	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	0		DPT 1		100	0.5		Black (2.5Y 2.5/1), ASH, trace organic matter, fine grained, dry.	
	5		DPT 2		100	2.75		Black (2.5Y 2.5/1), silty CLAY.	
								Black (2.5Y 2.5/1), ASH, firm, fine grained, low plasticity, dry.	
	10		DPT 3		100	1.25		Black (2.5Y 2.5/1), ASH, fine grained, soft, dry.	
	15		DPT 4		80	1.5		Very Dark Gray (2.5Y 3/1), silty CLAY, firm, fine grained, low plasticity, dry.	
								Black (2.5Y 2.5/1), ASH, stiff, fine grained, dry. @ 18.8' bgs refusal	*Abandoned with bentonite chips*

End of Boring at 18.8´ bgs

The cause of DPT refusal is unknown.

Project: Dominion CCR Ash Study
Project Location: Possum Point Power Station, Ash Pond D
Project Number: 60545438

Log of PPD-B04

Sheet 1 of 1

Date(s) Drilled	8/1/17	Logged By	Ethan House	Checked By	CS/EH
Drilling Method	Direct Push	Drill Bit Size/Type	2.25" direct push bit	Total Depth of Borehole	16.6ft bgs
Drill Rig Type	Geoprobe 6620DT	Drilling Contractor	Cascade Drilling		
Borehole Backfill	Bentonite chips, hydrated	Sampling Method(s)	Macrocore ™ with Acetate liners		
Coordinate Location	N 11830675.6 E 6886847.5	Groundwater Level(s)	Dry		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pen., TSF	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	0		DPT 1		100	2.25		Black (2.5Y 2.5/1), ASH, trace organic matter, trace sandy clay 4.3-4.6', fine grained, loose, dry.		
	5		DPT 2		100	4.0		Dark Gray (2.5Y 4/1), ASH, small quartz and gravel at 7.6' and 8.6', trace sandy clay 6.7-8.5', fine grained, firm, dry.		
	10		DPT 3		95	1.0		Black (2.5Y 2.5/1), ASH, loose, dry.		
	15		DPT 4		100	2.5		Very Dark Gray (2.5Y 3/1), clayey SILT, fine grained, low plasticity, dry.		*Abandoned with bentonite chips*
								Black (2.5Y 2.5/1), ASH, fine grained, loose, slightly damp. Refusal at 16.6'.		

End of Boring at 16.6´ bgs

The cause of DPT refusal is unknown.

AECOM

Project: Dominion CCR Ash Study **Project Location: Possum Point Power Station, Ash Pond D** **Project Number: 60545438**	**Log of PPD-B05** Sheet 1 of 1

Date(s) Drilled	8/1/17	Logged By	Ethan House	Checked By	CS/EH
Drilling Method	Direct Push	Drill Bit Size/Type	2.25" direct push bit	Total Depth of Borehole	13.6ft bgs
Drill Rig Type	Geoprobe 6620DT	Drilling Contractor	Cascade Drilling		
Borehole Backfill	Bentonite chips, hydrated	Sampling Method(s)	Macrocore ™ with Acetate liners		
Coordinate Location	N 11830803.3 E 6886591.1	Groundwater Level(s)	Dry		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Sampling Resist. Blows/6" OR CORE% RQD	Recovery, %	Pocket Pen., TSF	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	0		DPT 1		100	1.0		Black (2.5Y 2.5/1), ASH, trace silty clay 3.6-5', fine grained, loose, dry.		
	5		DPT 2		100	1.0		Very Dark Gray (2.5Y 3/1), silty CLAY, trace organic matter and ash, fine grained, low plasticiity, dry.		
	10		DPT 3		100	NA		Black (2.5Y 2.5/1), ASH, firm, crumbly, fine grained, dry.		
								Silty CLAY, trace gravel, crumbly, dry. Refusal at 13.6'.		*Abandoned with bentonite chips*

End of Boring at 13.6´ bgs

The cause of DPT refusal is unknown.

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Appendix B
Detailed Chemical and Physical Parameter Analytical Results

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Chemical Parameters - Bremo Power Station NAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		BRN-B01 (0.0-10.0)	BRN-B01 (20.0-30.0)	BRN-B01 (40.0-50.0)	BRN-B01-(60.0-63.5)	BRN-B02 (0.0-10.0)	BRN-B02 (10.0-20.0)	BRN-B02 (20.0-30.0)	BRN-B02 (40.0-50.0)
TEC ID				17-824-1	17-824-2	17-824-3	17-828-1	17-824-4	17-824-5	17-824-6	17-824-7
Impoundment				c	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP
Bore				B01	B01	B01	B01	B02	B02	B02	B02
Depth				0-10 ft	20-30 ft	40-50 ft	60-63.5 ft	0-10 ft	10-20 ft	20-30 ft	40-50 ft
Bore Log Material Description*				FA	FA	FA/BA	BA	A	A	A	A
SiO_2	wt%			59.90	57.70	58.82	55.12	58.40	57.77	56.95	55.84
Al_2O_3	wt%			26.18	27.54	27.90	26.13	26.85	27.35	29.13	30.29
Fe_2O_3	wt%			6.34	6.61	8.00	10.15	6.14	5.86	6.08	5.57
Sum	wt%	min	70	92.42	91.85	94.73	91.41	91.39	90.98	92.16	91.70
CaO	wt%	max	10	0.87	0.78	0.70	0.80	0.91	0.82	0.76	0.91
MgO	wt%			1.08	0.99	0.98	0.94	1.05	1.04	0.99	0.92
Na_2O	wt%			0.44	0.35	0.31	0.28	0.38	0.40	0.31	0.28
K_2O	wt%			2.60	2.48	2.44	2.38	2.56	2.57	2.58	2.26
Total Na_2O	wt%			2.15	1.98	1.92	1.85	2.07	2.10	2.00	1.77
TiO_2	wt%			1.55	1.56	1.55	1.31	1.59	1.58	1.59	1.65
MnO_2	wt%			0.07	0.04	0.04	0.04	0.06	0.06	0.03	0.03
P_2O_5	wt%			0.19	0.14	0.12	0.09	0.17	0.16	0.13	0.14
SrO	wt%			0.08	0.08	0.09	0.06	0.08	0.08	0.08	0.10
BaO	wt%			0.14	0.16	0.13	0.10	0.14	0.14	0.15	0.12
SO_3	wt%	max	5	0.05	0.07	0.04	0.09	0.06	0.05	0.05	0.07
Cl	wt%			<0.001	<0.001	0.001	<0.001	0.002	<0.001	0.003	<0.001
Moisture (as received)	wt%	max	3	21.2	24.7	32.7	34.4	23.7	22.8	29.4	42.8
Moisture (after lab preparation)	wt%	max	3	0.22	0.30	0.27	0.18	0.60	0.29	0.34	0.28
LOI**	%	max	6	9.13	10.98	8.38	22.62	8.38	10.54	12.65	15.17
Available Alkalies Test:											
Na_2O as Available Alkalies	wt%			0.25	0.16	0.16	0.17	0.22	0.22	0.16	0.11
K_2O as Available Alkalies	wt%			1.62	1.36	1.38	1.5	1.53	1.64	1.37	1.14
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			1.32	1.05	1.07	1.16	1.23	1.30	1.06	0.86

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill

** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.

Shading = parameters outside of ASTM C618 standards

Chemical Parameters - Bremo Power Station NAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		BRN-B02 (70.0-79.0)	BRN-B03 (0.0-10.0)	BRN-B03 (10.0-30.0)	BRN-B03 (30.0-40.0)	BRN-B03 (50.0-60.0)	BRN-B03 (60.0-66.0)	BRN-B04 (0.0-10.0)	BRN-B04 (10.0-30.0)	BRN-B04 (30.0-40.0)
TEC ID				17-824-8	17-824-9	17-824-10	17-824-11	17-824-12	17-824-13	17-824-14	17-824-15	17-824-16
Impoundment				Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP
Bore				B02	B03	B03	B03	B03	B03	B04	B04	B04
Depth				70-79 ft	0-10 ft	10-30 ft	30-40 ft	50-60 ft	60-66 ft	0-10 ft	10-30 ft	30-40 ft
Bore Log Material Description*				A/C	A	A	A	A	A	LS Fill/C	A	C/A
SiO_2	wt%			61.00	56.03	55.76	55.66	54.72	55.44	84.63	64.03	67.05
Al_2O_3	wt%			23.22	30.40	29.43	30.88	31.17	30.62	11.27	21.59	22.32
Fe_2O_3	wt%			6.44	5.04	5.90	5.54	5.73	5.42	2.76	6.95	5.52
Sum	wt%	min	70	90.65	91.47	91.09	92.09	91.62	91.48	98.66	92.58	94.89
CaO	wt%	max	10	1.21	0.86	0.76	0.88	1.01	1.01	0.71	0.85	0.39
MgO	wt%			1.19	1.00	1.00	1.00	1.12	1.07	0.39	0.82	0.75
Na_2O	wt%			0.96	0.31	0.30	0.31	0.40	0.39	0.60	0.76	0.19
K_2O	wt%			1.89	2.53	2.52	2.46	2.40	2.44	0.60	1.73	1.40
Total Na_2O	wt%			2.20	1.98	1.96	1.93	1.98	2.00	0.99	1.90	1.12
TiO_2	wt%			0.99	1.64	1.58	1.67	1.54	1.64	0.36	1.04	0.80
MnO_2	wt%			0.05	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.03
P_2O_5	wt%			0.09	0.14	0.13	0.14	0.15	0.18	0.04	0.09	0.05
SrO	wt%			0.06	0.08	0.08	0.10	0.10	0.11	0.01	0.06	0.04
BaO	wt%			0.11	0.14	0.13	0.14	0.14	0.14	0.04	0.09	0.07
SO_3	wt%	max	5	0.06	0.03	0.04	0.07	0.03	0.04	0.03	0.05	0.03
Cl	wt%			<0.001	0.002	0.006	0.002	<0.001	0.002	0.002	0.002	0.002
Moisture (as received)	wt%	max	3	49.1	45.8	47.1	40.8	33.7	36.7	15.2	30.4	23.8
Moisture (after lab preparation)	wt%	max	3	0.73	0.75	0.54	0.24	0.30	0.19	0.13	0.49	0.19
LOI**	%	max	6	14.08	16.92	17.56	16.34	8.34	10.02	5.93	15.28	11.59
Available Alkalies Test:												
Na_2O as Available Alkalies	wt%			0.69	0.15	0.13	0.13	0.19	0.19	0.35	0.46	0.11
K_2O as Available Alkalies	wt%			1.17	1.25	1.28	1.23	1.21	1.23	0.36	1.21	0.76
Available Alkalies as Na_2O equivalent ($Na_2O + 0.658K_2O$)	wt%			1.46	0.97	0.97	0.94	0.99	1.00	0.59	1.26	0.61

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.
Shading = parameters outside of ASTM C618 standards

Chemical Parameters - Bremo Power Station NAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		Bremo Summary						
TEC ID				Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment										
Bore										
Depth										
Bore Log Material Description*										
SiO_2	wt%			17	54.72	84.63	59.70	57.70	-	-
Al_2O_3	wt%			17	11.27	31.17	26.60	27.54	-	-
Fe_2O_3	wt%			17	2.76	10.15	6.12	5.90	-	-
Sum	wt%	min	70	17	90.65	98.66	92.42	91.70	0	0.0%
CaO	wt%	max	10	17	0.39	1.21	0.84	0.85	0	0.0%
MgO	wt%			17	0.39	1.19	0.96	1.00	-	-
Na_2O	wt%			17	0.19	0.96	0.41	0.35	-	-
K_2O	wt%			17	0.60	2.60	2.23	2.44	-	-
Total Na_2O	wt%			17	0.99	2.20	1.87	1.98	-	-
TiO_2	wt%			17	0.36	1.67	1.39	1.56	-	-
MnO_2	wt%			17	0.03	0.07	0.04	0.04	-	-
P_2O_5	wt%			17	0.04	0.19	0.13	0.14	-	-
SrO	wt%			17	0.01	0.11	0.08	0.08	-	-
BaO	wt%			17	0.04	0.16	0.12	0.14	-	-
SO_3	wt%	max	5	17	0.03	0.09	0.05	0.05	0	0.0%
Cl	wt%			17	0.001	0.006	0.002	0.002	-	-
Moisture (as received)	wt%	max	3	17	15.22	49.12	32.61	32.69	17	100%
Moisture (after lab preparation)	wt%	max	3	17	0.13	0.75	0.36	0.29	0	0.0%
LOI**	%	max	6	17	5.93	22.62	12.58	11.59	16	94.1%
Available Alkalies Test:										
Na_2O as Available Alkalies	wt%			17	0.11	0.69	0.23	0.17	-	-
K_2O as Available Alkalies	wt%			17	0.36	1.64	1.25	1.25	-	-
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			17	0.59	1.46	1.05	1.05	-	-

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill

** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.

Shading = parameters outside of ASTM C618 standards

Client ID	ASTM C618 Class F Criteria		BRN-B01 (0.0-10.0)	BRN-B01 (20.0-30.0)	BRN-B01 (40.0-50.0)	BRN-B01-(60.0-63.5)	BRN-B02 (0.0-10.0)	BRN-B02 (10.0-20.0)	BRN-B02 (20.0-30.0)	BRN-B02 (40.0-50.0)	BRN-B02 (70.0-79.0)
TEC ID			17-824-1	17-824-2	17-824-3	17-828-1	17-824-4	17-824-5	17-824-6	17-824-7	17-824-8
Impoundment			Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP
Bore			B01	B01	B01	B01	B02	B02	B02	B02	B02
Depth			0-10 ft	20-30 ft	40-50 ft	60-63.5 ft	0-10 ft	10-20 ft	20-30 ft	40-50 ft	70-79 ft
Bore Log Description*			FA	FA	FA/BA	BA	A	A	A	A	A/C
Specific Gravity			2.29	2.19	2.18	2.08	2.25	2.15	2.15	2.14	2.32
Soundness %	max	±0.8	-0.01	-0.01	-0.01	-0.01	-0.02	-0.03	-0.02	-0.01	0.01
Retained on #325 Mesh %	max	34	27.71	35.79	41.38	73.15	27.25	24.04	26.12	32.02	59.26
Water Req %	max	105	103	103	103	114	103	103	103	104	111
7 Day Control (PSI)			4550	4550	4550	5040	4550	4550	4550	4550	4550
7 Day (PSI)			3840	3690	3290	2740	3950	3630	3710	3630	2960
7-Day SAI, % of control	min	75	84	81	72	54	87	80	82	80	65
28 Day Control (PSI)			5950	5950	5950	6150	5950	5950	5950	5950	5950
28 Day (PSI)			5110	5000	4450	3550	5150	4970	5240	4880	4320
28-Day SAI, % of control	min	75	86	84	75	58	87	84	88	82	73
Organic Impurities (Color Plate #)	max	3	2	1	1	1	2	3	2	1	1

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			169.9	169.8	186.1	199.2	161.5	185.1	161.2	138.6	221.7
3/8"			0.1%	0.0%	0.0%	0.0%	1.5%	0.6%	0.0%	0.0%	0.0%
#4			3.1%	1.5%	0.3%	0.3%	3.3%	2.1%	0.0%	0.0%	0.7%
#8			6.1%	2.4%	0.3%	1.0%	6.7%	2.6%	0.4%	0.1%	4.0%
#16			5.0%	2.5%	1.2%	3.3%	5.4%	2.6%	0.7%	0.1%	5.1%
#30			4.3%	5.2%	2.4%	9.1%	3.8%	2.5%	0.7%	0.1%	6.0%
#50			3.5%	3.0%	3.2%	21.4%	3.0%	2.4%	1.1%	0.2%	8.1%
#100			4.4%	5.2%	5.1%	14.2%	3.5%	3.7%	2.6%	2.2%	13.8%
#200			10.5%	16.0%	18.1%	21.3%	8.2%	10.5%	10.9%	14.8%	22.5%
Pan			62.9%	64.2%	69.4%	29.4%	64.3%	72.3%	83.3%	82.0%	39.8%

ASTM D1921 (Percent Retained)

Sample Weight (g)			50.7	52.9	53.9	57	51.9	50.4	51.8	52.2	51.6
#230			2.8%	5.1%	6.9%	11.9%	2.9%	4.0%	3.9%	5.9%	9.9%
#270			4.7%	7.6%	8.7%	13.3%	4.6%	5.0%	5.8%	8.6%	11.8%
#325			6.3%	7.8%	8.5%	11.1%	5.2%	5.8%	6.6%	8.6%	10.5%
#400			6.7%	7.9%	8.9%	10.7%	6.2%	6.3%	7.3%	8.8%	10.1%
#450			66.1%	64.5%	50.8%	43.0%	75.9%	72.2%	72.4%	54.0%	7.0%
#500			6.1%	2.1%	1.3%	0.5%	1.0%	1.6%	1.0%	2.7%	10.5%
#635			2.0%	2.1%	2.6%	1.6%	1.3%	2.4%	0.8%	3.4%	15.9%
Pan			3.7%	2.5%	12.2%	7.9%	2.9%	2.6%	2.1%	6.9%	24.2%

Combined

Sample Weight (g) - Percent retained per fraction			169.9	169.8	186.1	199.2	161.5	185.1	161.2	138.6	221.7
3/8" (9510 micron)			0.1%	0.0%	0.0%	0.0%	1.5%	0.6%	0.0%	0.0%	0.0%
#4 (4760 micron)			3.1%	1.5%	0.3%	0.3%	3.3%	2.1%	0.0%	0.0%	0.7%
#8 (2380 micron)			6.1%	2.4%	0.3%	1.0%	6.7%	2.6%	0.4%	0.1%	4.0%
#16 (1190 micron)			5.0%	2.5%	1.2%	3.3%	5.4%	2.6%	0.7%	0.1%	5.1%
#30 (595 micron)			4.3%	5.2%	2.4%	9.1%	3.8%	2.5%	0.7%	0.1%	6.0%
#50 (297 micron)			3.5%	3.0%	3.2%	21.4%	3.0%	2.4%	1.1%	0.2%	8.1%
#100 (149 micron)			4.4%	5.2%	5.1%	14.2%	3.5%	3.7%	2.6%	2.2%	13.8%
#200 (74 micron)			10.5%	16.0%	18.1%	21.3%	8.2%	10.5%	10.9%	14.8%	22.5%
#230 (63 micron)			1.7%	3.3%	4.8%	3.5%	1.9%	2.9%	3.2%	4.9%	3.9%
#270 (53 icron)			3.0%	4.9%	6.0%	3.9%	3.0%	3.6%	4.8%	7.1%	4.7%
#325 (44 micron)			4.0%	5.0%	5.9%	3.2%	3.3%	4.2%	5.5%	7.1%	4.2%
#400 (37 micron)			4.2%	5.1%	6.2%	3.1%	4.0%	4.6%	6.1%	7.2%	4.0%
#450 (32 micron)			41.5%	41.4%	35.3%	12.6%	48.8%	52.2%	60.3%	44.3%	2.8%
#500 (28 micron)			3.8%	1.3%	0.9%	0.2%	0.6%	1.1%	0.8%	2.2%	4.2%
#635 (22 micron)			1.2%	1.3%	1.8%	0.5%	0.9%	1.7%	0.6%	2.8%	6.3%
Pan			2.4%	1.6%	8.5%	2.3%	1.9%	1.9%	1.8%	5.7%	9.6%
Sum			98.9%	99.6%	99.9%	100.0%	99.8%	99.3%	99.5%	98.9%	99.9%
Percent retained #325 Mesh			45.7%	48.9%	47.3%	81.3%	43.7%	37.7%	29.9%	36.7%	73.0%

Client ID	ASTM C618 Class F Criteria		BRN-B03 (0.0-10.0)	BRN-B03 (10.0-30.0)	BRN-B03 (30.0-40.0)	BRN-B03 (50.0-60.0)	BRN-B03 (60.0-66.0)	BRN-B04 (0.0-10.0)	BRN-B04 (10.0-30.0)	BRN-B04 (30.0-40.0)
TEC ID			17-824-9	17-824-10	17-824-11	17-824-12	17-824-13	17-824-14	17-824-15	17-824-16
Impoundment			Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP	Bremo NAP
Bore			B03	B03	B03	B03	B03	B04	B04	B04
Depth			0-10 ft	10-30 ft	30-40 ft	50-60 ft	60-66 ft	0-10 ft	10-30 ft	30-40 ft
Bore Log Description*			A	A	A	A	A	LS Fill/C	A	C/A
Specific Gravity			2.12	2.11	2.14	2.23	2.25	2.64	2.28	2.43
Soundness %	max	±0.8	0	0	-0.01	-0.02	-0.03	0.01	0.02	0.01
Retained on #325 Mesh %	max	34	24.32	44.54	21.11	10.85	7.02	76.55	50.01	53.85
Water Req %	max	105	104	112	106	106	107	108	112	116
7 Day Control (PSI)			4690	4690	4690	4690	4690	4510	4510	4510
7 Day (PSI)			3920	3610	370	4130	4330	2660	3230	2530
7-Day SAI, % of control	min	75	84	77	80	88	92	59	72	56
28 Day Control (PSI)			5680	5680	5680	5680	5680	5790	5790	5790
28 Day (PSI)			5500	5040	5130	5750	5960	3440	4060	3260
28-Day SAI, % of control	min	75	97	89	90	101	105	59	70	56
Organic Impurities (Color Plate #)	max	3	1	1	1	1	1	5	5	1

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			151.5	140.1	145.4	150.4	149	198.4	182.5	189.7
3/8"			0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%
#4			0.0%	0.0%	0.0%	1.3%	2.2%	16.3%	1.0%	11.1%
#8			0.1%	0.0%	0.0%	3.4%	3.1%	11.1%	7.0%	11.1%
#16			0.2%	0.0%	0.0%	3.2%	2.2%	9.3%	11.3%	10.6%
#30			0.2%	0.1%	0.0%	2.5%	1.5%	9.7%	12.8%	9.6%
#50			0.5%	0.2%	0.2%	1.9%	1.2%	13.4%	15.6%	9.8%
#100			1.9%	4.4%	1.7%	1.7%	1.5%	16.0%	16.7%	10.9%
#200			10.6%	25.8%	13.8%	2.7%	2.6%	10.6%	12.1%	11.9%
Pan			86.3%	69.2%	84.0%	83.0%	85.2%	8.4%	23.5%	24.9%

ASTM D1921 (Percent Retained)

Sample Weight (g)			50.6	51.6	51.5	50.2	51.7	16.7	42.2	47.3
#230			5.1%	9.7%	5.2%	0.8%	1.4%	18.0%	8.8%	8.7%
#270			5.9%	11.4%	6.8%	1.6%	2.1%	15.6%	10.0%	10.6%
#325			7.3%	9.7%	6.8%	2.6%	2.7%	13.2%	9.5%	9.5%
#400			7.9%	9.3%	7.6%	3.6%	4.1%	12.6%	9.7%	10.4%
#450			65.4%	46.7%	63.1%	81.5%	79.3%	16.2%	58.1%	57.7%
#500			1.4%	2.5%	2.5%	4.4%	2.1%	7.8%	0.7%	0.2%
#635			1.6%	2.3%	1.9%	1.4%	2.1%	6.6%	0.9%	0.6%
Pan			5.3%	8.1%	6.0%	4.0%	5.6%	9.6%	2.4%	1.5%

Combined

Sample Weight (g) - Percent retained per fraction			151.5	140.1	145.4	150.4	149.0	198.4	182.5	189.7
3/8" (9510 micron)			0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%
#4 (4760 micron)			0.0%	0.0%	0.0%	1.3%	2.2%	16.3%	1.0%	11.1%
#8 (2380 micron)			0.1%	0.0%	0.0%	3.4%	3.1%	11.1%	7.0%	11.1%
#16 (1190 micron)			0.2%	0.0%	0.0%	3.2%	2.2%	9.3%	11.3%	10.6%
#30 (595 micron)			0.2%	0.1%	0.0%	2.5%	1.5%	9.7%	12.8%	9.6%
#50 (297 micron)			0.5%	0.2%	0.2%	1.9%	1.2%	13.4%	15.6%	9.8%
#100 (149 micron)			1.9%	4.4%	1.7%	1.7%	1.5%	16.0%	16.7%	10.9%
#200 (74 micron)			10.6%	25.8%	13.8%	2.7%	2.6%	10.6%	12.1%	11.9%
#230 (63 micron)			4.4%	6.7%	4.4%	0.7%	1.2%	1.5%	2.1%	2.2%
#270 (53 icron)			5.1%	7.9%	5.7%	1.3%	1.8%	1.3%	2.3%	2.6%
#325 (44 micron)			6.3%	6.7%	5.7%	2.2%	2.3%	1.1%	2.2%	2.4%
#400 (37 micron)			6.8%	6.4%	6.4%	3.0%	3.5%	1.1%	2.3%	2.6%
#450 (32 micron)			56.4%	32.3%	53.0%	67.7%	67.5%	1.4%	13.6%	14.4%
#500 (28 micron)			1.2%	1.7%	2.1%	3.6%	1.8%	0.7%	0.2%	0.1%
#635 (22 micron)			1.4%	1.6%	1.6%	1.2%	1.8%	0.6%	0.2%	0.2%
Pan			4.6%	5.6%	5.1%	3.3%	4.8%	0.8%	0.6%	0.4%
Sum			99.9%	99.4%	99.7%	99.6%	99.0%	99.8%	99.9%	99.6%
Percent retained #325 Mesh			29.5%	51.7%	31.5%	20.8%	19.6%	95.4%	83.1%	82.0%

Physical Parameters - Bremo Power Station NAP

Client ID	ASTM C618 Class F Criteria		Bremo Summary						
TEC ID			Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment									
Bore									
Depth									
Bore Log Description*									
Specific Gravity			17	2.08	2.64	2.23	2.19	-	-
Soundness %	**max**	**±0.8**	17	-0.03	0.02	-0.01	-0.01	0	0.0%
Retained on #325 Mesh %	**max**	**34**	17	7.02	76.55	37.35	32.02	8	47.1%
Water Req %	**max**	**105**	17	103	116	107	106	9	52.9%
7 Day Control (PSI)			17	4510	5040	4613	4550	-	-
7 Day (PSI)			17	370	4330	3307	3630	-	-
7-Day SAI, % of control	**min**	**75**	17	54	92	76	80	6	35.3%
28 Day Control (PSI)			17	5680	6150	5854	5950	-	-
28 Day (PSI)			17	3260	5960	4754	5000	-	-
28-Day SAI, % of control	**min**	**75**	17	56	105	81	84	5	29.4%
Organic Impurities (Color Plate #)	**max**	**3**	17	1	5	2	1	2	11.8%

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)							
Sample Weight (g)			17	138.6	221.7	170.6	169.8
3/8"			17	0.0%	5.0%	0.4%	0.0%
#4			17	0.0%	16.3%	2.5%	1.0%
#8			17	0.0%	11.1%	3.5%	2.6%
#16			17	0.0%	11.3%	3.7%	2.6%
#30			17	0.0%	12.8%	4.2%	2.5%
#50			17	0.2%	21.4%	5.2%	3.0%
#100			17	1.5%	16.7%	6.4%	4.4%
#200			17	2.6%	25.8%	13.1%	11.9%
Pan			17	8.4%	86.3%	60.7%	69.2%
ASTM D1921 (Percent Retained)							
Sample Weight (g)			17	16.7	57.0	49.1	51.6
#230			17	0.8%	18.0%	6.5%	5.2%
#270			17	1.6%	15.6%	7.9%	7.6%
#325			17	2.6%	13.2%	7.7%	7.8%
#400			17	3.6%	12.6%	8.1%	7.9%
#450			17	7.0%	81.5%	57.3%	63.1%
#500			17	0.2%	10.5%	2.8%	2.1%
#635			17	0.6%	15.9%	2.9%	2.0%
Pan			17	1.5%	24.2%	6.3%	5.3%
Combined							
Sample Weight (g) - Percent retained per fraction			17	138.6	221.7	170.6	169.8
3/8" (9510 micron)			17	0.0%	5.0%	0.4%	0.0%
#4 (4760 micron)			17	0.0%	16.3%	2.5%	1.0%
#8 (2380 micron)			17	0.0%	11.1%	3.5%	2.6%
#16 (1190 micron)			17	0.0%	11.3%	3.7%	2.6%
#30 (595 micron)			17	0.0%	12.8%	4.2%	2.5%
#50 (297 micron)			17	0.2%	21.4%	5.2%	3.0%
#100 (149 micron)			17	1.5%	16.7%	6.4%	4.4%
#200 (74 micron)			17	2.6%	25.8%	13.1%	11.9%
#230 (63 micron)			17	0.7%	6.7%	3.1%	3.2%
#270 (53 icron)			17	1.3%	7.9%	4.1%	3.9%
#325 (44 micron)			17	1.1%	7.1%	4.2%	4.2%
#400 (37 micron)			17	1.1%	7.2%	4.5%	4.2%
#450 (32 micron)			17	1.4%	67.7%	38.0%	41.5%
#500 (28 micron)			17	0.1%	4.2%	1.6%	1.2%
#635 (22 micron)			17	0.2%	6.3%	1.5%	1.3%
Pan			17	0.4%	9.6%	3.6%	2.4%
Sum			17	98.9%	100.0%	99.6%	99.6%
Percent retained #325 Mesh			17	19.6%	95.4%	50.5%	45.7%

Chemical Parameters - Chesterfield Power Station LAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		LAPPB-1-(0.0-10.0)	LAPPB-1-(20.0-30.0)	LAPPB-1-(30.0-32.1)	LAPPB-2-(0.0-10.0)	LAPPB-2-(20.0-30.0)	LAPPB-2-(30.0-39.5)	LAPPB-3-(10.0-20.0)
TEC ID				17-850-3	17-850-4	17-850-5	17-850-6	17-850-7	17-850-8	17-850-9
Impoundment				Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP
Bore				1	1	1	2	2	2	3
Depth				0-10 ft	20-30 ft	30-32.1 ft	0-10 ft	20-30 ft	30-39.5 ft	10-20 ft
Bore Log Material Description*				BA/FA	BA/FA	FA	FA/BA	FA/BA	FA	C/FA/BA
SiO_2	wt%			54.11	70.92	76.83	53.04	52.2	56.76	54.34
Al_2O_3	wt%			27.85	16.99	9.29	29.13	29.02	24.15	27.96
Fe_2O_3	wt%			8.74	5.82	5.67	8.28	10.61	10.9	9.26
Sum	wt%	min	70	90.69	93.73	91.79	90.44	91.84	91.81	91.56
CaO	wt%	max	10	1.45	1.04	0.61	1.25	1.08	0.98	1.03
MgO	wt%			0.99	0.67	0.68	1.11	0.94	1.04	1.01
Na_2O	wt%			0.41	0.56	0.6	0.45	0.36	0.38	0.40
K_2O	wt%			2.3	1.97	1.92	2.54	2.15	2.2	2.34
Total Na_2O	wt%			1.927	1.852	1.861	2.123	1.781	1.828	1.936
TiO_2	wt%			1.51	1.83	1.3	1.57	1.6	1.45	1.56
MnO_2	wt%			0.04	0.06	0.08	0.03	0.03	0.05	0.03
P_2O_5	wt%			0.16	0.11	0.13	0.2	0.17	0.17	0.14
SrO	wt%			0.12	0.08	0.02	0.14	0.14	0.1	0.13
BaO	wt%			0.15	0.13	0.07	0.18	0.18	0.15	0.16
SO_3	wt%	max	5	0.14	0.09	0.03	0.11	0.06	0.09	0.04
Cl	wt%			0.017	0.001	<0.001	0.015	<0.001	<0.001	<0.001
Moisture (as received)	wt%	max	3	23.2	26.2	21.4	28.7	46.9	37.3	36.6
Moisture (after lab preparation)	wt%	max	3	0.65	0.30	0.16	0.56	0.30	0.42	0.48
LOI**	%	max	6	13.88	7.35	3.27	15.20	11.22	10.67	10.37
Available Alkalies Test:										
Na_2O as Available Alkalies	wt%			0.19	0.36	0.48	0.2	0.18	0.26	0.21
K_2O as Available Alkalies	wt%			1.25	1.26	1.58	1.38	1.27	1.66	1.37
Available Alkalies as Na_2O equivalent ($Na_2O + 0.658K_2O$)	wt%			1.01	1.19	1.52	1.11	1.02	1.35	1.11

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.
Shading = parameters outside of ASTM C618 standards

Chemical Parameters - Chesterfield Power Station LAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		LAPPB-3-(20.0-30.0)	LAPPB-4-(0.0-10.0)	LAPPB-4-(30.0-38.3)	Lower Chesterfield Summary						
TEC ID				17-850-10	17-850-11	17-850-12	Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment				Chesterfield LAP	Chesterfield LAP	Chesterfield LAP							
Bore				3	4	4							
Depth				20-30 ft	0-10 ft	30-38.3 ft							
Bore Log Material Description*				FA	FA/C	FA							
SiO_2	wt%			69.31	52.02	60.31	10	52.02	76.83	59.98	55.55	-	-
Al_2O_3	wt%			19.79	28.71	23.78	10	9.29	29.13	23.67	26	-	-
Fe_2O_3	wt%			5.73	9.27	7.48	10	5.67	10.90	8.18	8.51	-	-
Sum	wt%	min	70	94.83	90	91.57	10	90.00	94.83	91.83	91.68	0	0.0%
CaO	wt%	max	10	0.7	1.9	1.15	10	0.61	1.90	1.12	1.06	0	0.0%
MgO	wt%			0.8	0.98	1.06	10	0.67	1.11	0.93	0.99	-	-
Na_2O	wt%			0.44	0.42	0.52	10	0.36	0.60	0.45	0.43	-	-
K_2O	wt%			2.07	2.39	2.32	10	1.92	2.54	2.22	2.25	-	-
Total Na_2O	wt%			1.806	1.993	2.041	10	1.78	2.12	1.91	1.894	-	-
TiO_2	wt%			1.46	1.52	1.54	10	1.30	1.83	1.53	1.53	-	-
MnO_2	wt%			0.04	0.03	0.06	10	0.03	0.08	0.05	0.04	-	-
P_2O_5	wt%			0.11	0.18	0.19	10	0.11	0.20	0.16	0.17	-	-
SrO	wt%			0.08	0.11	0.1	10	0.02	0.14	0.10	0.11	-	-
BaO	wt%			0.13	0.15	0.14	10	0.07	0.18	0.14	0.15	-	-
SO_3	wt%	max	5	0.04	0.14	0.11	10	0.03	0.14	0.09	0.09	0	0.0%
Cl	wt%			<0.001	0.007	0.002	10	0.001	0.017	0.005	0.001	-	-
Moisture (as received)	wt%	max	3	37.7	30.2	38.7	10	21.39	46.93	32.70	33.4	10	100.0%
Moisture (after lab preparation)	wt%	max	3	0.45	0.40	0.45	10	0.16	0.65	0.42	0.43	0	0.0%
LOI**	%	max	6	5.43	17.29	7.70	10	3.27	17.29	10.24	10.52	8	80.0%
Available Alkalies Test:													
Na_2O as Available Alkalies	wt%			0.28	0.16	0.3	10	0.16	0.48	0.26	0.235	-	-
K_2O as Available Alkalies	wt%			1.5	1.21	1.55	10	1.21	1.66	1.40	1.375	-	-
Available Alkalies as Na_2O equivalent ($Na_2O + 0.658K_2O$)	wt%			1.27	0.96	1.32	10	0.96	1.52	1.19	1.15027	-	-

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.
Shading = parameters outside of ASTM C618 standards

Client ID	ASTM C618 Class F Criteria		LAPPB-1-(0.0-10.0)	LAPPB-1-(20.0-30.0)	LAPPB-1-(30.0-32.1)	LAPPB-2-(0.0-10.0)	LAPPB-2-(20.0-30.0)	LAPPB-2-(30.0-39.5)	LAPPB-3-(10.0-20.0)	LAPPB-3-(20.0-30.0)	LAPPB-4-(0.0-10.0)	LAPPB-4-(30.0-38.3)
TEC ID			17-850-3	17-850-4	17-850-5	17-850-6	17-850-7	17-850-8	17-850-9	17-850-10	17-850-11	17-850-12
Impoundment			Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP	Chesterfield LAP
Bore			1	1	1	2	2	2	3	3	4	4
Depth			0-10 ft	20-30 ft	30-32.1 ft	0-10 ft	20-30 ft	30-39.5 ft	10-20 ft	20-30 ft	0-10 ft	30-38.3 ft
Bore Log Description*			BA/FA	BA/FA	FA	FA/BA	FA/BA	FA	C/FA/BA	FA	FA/C	FA
Specific Gravity			2.17	2.34	2.69	2.12	2.16	2.3	2.17	2.44	2.24	2.42
Soundness %	max	±0.8	0	-0.01	0	0	-0.02	-0.03	-0.02	0	-0.03	-0.02
Retained on #325 Mesh %	max	34	47.2	76.7	63.25	29.13	52.25	59.82	50.43	43.23	29.43	28.28
Water Req %	max	105	110	108	105	103	109	109	107	105	106	104
7 Day Control (PSI)			5050	5050	5050	5050	5050	5050	5050	5050	5050	5050
7 Day (PSI)			3580	2930	3730	3910	3470	3040	3510	3520	3930	3620
7-Day SAI, % of control	min	75	71	58	74	77	69	60	70	70	79	72
28 Day Control (PSI)			6430	6430	6430	6430	6430	6430	6430	6430	6430	6430
28 Day (PSI)			4940	4020	4340	5340	4360	4120	4440	4640	5040	4850
28-Day SAI, % of control	min	75	77	63	67	83	68	64	69	72	78	75
Organic Impurities (Color Plate #)	max	3	2	2	3	1	1	2	1	3	1	3

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			291.3	400.5	366.4	279.3	310.4	290.3	271.9	303.1	294	283.9
3/8"			1%	1%	3%	1%	0%	1%	0%	1%	0%	3%
#4			2%	2%	1%	1%	2%	4%	0%	2%	0%	0%
#8			3%	3%	4%	1%	3%	10%	2%	4%	0%	6%
#16			4%	4%	13%	2%	3%	12%	2%	13%	0%	9%
#30			5%	5%	11%	2%	3%	11%	3%	15%	1%	10%
#50			7%	21%	18%	2%	5%	13%	5%	12%	3%	10%
#100			10%	31%	25%	5%	9%	15%	10%	12%	7%	13%
#200			13.5%	10.9%	13.1%	11.0%	15.9%	11.4%	17.0%	10.7%	10.0%	13.7%
Pan			53.8%	22.0%	11.8%	74.8%	58.8%	22.5%	60.5%	31.8%	78.0%	35.6%

ASTM D1921 (Percent Retained)

Sample Weight (g)			53.4	51	43.1	54.4	52.7	51.1	53.3	50	52.6	51
#230			5.2%	7.8%	17.6%	3.9%	7.0%	10.4%	6.8%	6.6%	3.4%	7.6%
#270			7.3%	8.0%	15.3%	5.1%	8.2%	10.8%	8.4%	7.6%	4.2%	10.0%
#325			7.9%	7.3%	12.1%	5.9%	7.8%	9.4%	8.3%	7.8%	5.1%	9.6%
#400			9.0%	7.5%	11.4%	7.2%	8.5%	10.0%	9.0%	9.4%	6.3%	10.6%
#450			65.2%	54.1%	6.0%	67.1%	52.2%	10.2%	59.1%	64.6%	68.3%	37.1%
#500			0.6%	2.5%	8.4%	1.1%	2.8%	22.3%	1.5%	1.4%	1.7%	4.1%
#635			1.1%	5.1%	10.2%	2.8%	2.5%	14.5%	1.9%	1.4%	3.6%	8.2%
Pan			3.7%	7.6%	19.0%	6.4%	10.4%	12.3%	5.1%	1.2%	5.9%	12.7%

Combined

Sample Weight (g) - Percent retained per fraction			291.3	400.5	366.4	279.3	310.4	290.3	271.9	303.1	294.0	283.9
3/8" (9510 micron)			0.5%	1.2%	2.6%	1.5%	0.4%	0.7%	0.2%	0.7%	0.0%	2.8%
#4 (4760 micron)			1.9%	2.0%	1.0%	0.9%	2.0%	4.2%	0.5%	1.6%	0.3%	0.3%
#8 (2380 micron)			3.1%	2.9%	4.0%	1.3%	2.6%	10.3%	1.7%	3.6%	0.4%	5.6%
#16 (1190 micron)			4.5%	3.6%	12.7%	1.6%	3.0%	12.3%	2.4%	13.2%	0.4%	8.9%
#30 (595 micron)			5.4%	5.0%	11.5%	1.8%	3.5%	10.9%	2.8%	14.5%	0.6%	9.6%
#50 (297 micron)			7.1%	21.2%	18.0%	2.4%	4.7%	13.2%	4.6%	11.9%	3.2%	10.5%
#100 (149 micron)			10.2%	31.1%	25.2%	4.8%	9.1%	14.5%	10.4%	11.9%	7.0%	13.0%
#200 (74 micron)			13.5%	10.9%	13.1%	11.0%	15.9%	11.4%	17.0%	10.7%	10.0%	13.7%
#230 (63 micron)			2.8%	1.7%	2.1%	2.9%	4.1%	2.3%	4.1%	2.1%	2.7%	2.7%
#270 (53 icron)			3.9%	1.8%	1.8%	3.8%	4.8%	2.4%	5.1%	2.4%	3.3%	3.6%
#325 (44 micron)			4.2%	1.6%	1.4%	4.4%	4.6%	2.1%	5.0%	2.5%	4.0%	3.4%
#400 (37 micron)			4.8%	1.6%	1.3%	5.4%	5.0%	2.2%	5.4%	3.0%	4.9%	3.8%
#450 (32 micron)			35.1%	11.9%	0.7%	50.2%	30.7%	2.3%	35.8%	20.5%	53.2%	13.2%
#500 (28 micron)			0.3%	0.6%	1.0%	0.8%	1.7%	5.0%	0.9%	0.4%	1.3%	1.5%
#635 (22 micron)			0.6%	1.1%	1.2%	2.1%	1.5%	3.3%	1.1%	0.4%	2.8%	2.9%
Pan			2.0%	1.7%	2.3%	4.8%	6.1%	2.8%	3.1%	0.4%	4.6%	4.5%
Sum			100.0%	100.0%	100.0%	99.6%	99.7%	100.0%	100.0%	100.0%	98.8%	100.0%
Percent retained #325 Mesh			57.2%	83.1%	93.5%	36.4%	54.7%	84.4%	53.7%	75.2%	32.0%	74.1%

Physical Parameters - Chesterfield Power Station LAP

Client ID	ASTM C618 Class F Criteria		Lower Chesterfield Summary						
TEC ID			Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment									
Bore									
Depth									
Bore Log Description*									
Specific Gravity			10	2.12	2.69	2.31	2.27	-	-
Soundness %	max	±0.8	10	-0.03	0.00	-0.01	-0.02	0	0.0%
Retained on #325 Mesh %	max	34	10	28.28	76.70	47.97	48.82	7	70.0%
Water Req %	max	105	10	103	110	107	107	6	60.0%
7 Day Control (PSI)			10	5050	5050	5050	5050	-	-
7 Day (PSI)			10	2930	3930	3524	3550	-	-
7-Day SAI, % of control	min	75	10	58	79	70	71	8	80.0%
28 Day Control (PSI)			10	6430	6430	6430	6430	-	-
28 Day (PSI)			10	4020	5340	4609	4540	-	-
28-Day SAI, % of control	min	75	10	63	83	72	71	6	60.0%
Organic Impurities (Color Plate #)	max	3	10	1	3	2	2	0	0.0%

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			10	271.9	400.5	309.1	292.7
3/8"			10	0.0%	2.8%	1.1%	0.7%
#4			10	0.3%	4.2%	1.5%	1.3%
#8			10	0.4%	10.3%	3.6%	3.0%
#16			10	0.4%	13.2%	6.3%	4.1%
#30			10	0.6%	14.5%	6.6%	5.2%
#50			10	2.4%	21.2%	9.7%	8.8%
#100			10	4.8%	31.1%	13.7%	11.1%
#200			10	10.0%	17.0%	12.7%	12.3%
Pan			10	11.8%	78.0%	45.0%	44.7%
ASTM D1921 (Percent Retained)							
Sample Weight (g)			10	43.1	54.4	51.3	51.9
#230			10	3.4%	17.6%	7.6%	6.9%
#270			10	4.2%	15.3%	8.5%	8.1%
#325			10	5.1%	12.1%	8.1%	7.8%
#400			10	6.3%	11.4%	8.9%	9.0%
#450			10	6.0%	68.3%	48.4%	56.6%
#500			10	0.6%	22.3%	4.6%	2.1%
#635			10	1.1%	14.5%	5.1%	3.2%
Pan			10	1.2%	19.0%	8.5%	7.0%
Combined							
Sample Weight (g) - Percent retained per fraction			10	271.9	400.5	309.1	292.7
3/8" (9510 micron)			10	0.0%	2.8%	1.1%	0.7%
#4 (4760 micron)			10	0.3%	4.2%	1.5%	1.3%
#8 (2380 micron)			10	0.4%	10.3%	3.6%	3.0%
#16 (1190 micron)			10	0.4%	13.2%	6.3%	4.1%
#30 (595 micron)			10	0.6%	14.5%	6.6%	5.2%
#50 (297 micron)			10	2.4%	21.2%	9.7%	8.8%
#100 (149 micron)			10	4.8%	31.1%	13.7%	11.1%
#200 (74 micron)			10	10.0%	17.0%	12.7%	12.3%
#230 (63 micron)			10	1.7%	4.1%	2.8%	2.7%
#270 (53 icron)			10	1.8%	5.1%	3.3%	3.4%
#325 (44 micron)			10	1.4%	5.0%	3.3%	3.7%
#400 (37 micron)			10	1.3%	5.4%	3.8%	4.3%
#450 (32 micron)			10	0.7%	53.2%	25.4%	25.6%
#500 (28 micron)			10	0.3%	5.0%	1.4%	0.9%
#635 (22 micron)			10	0.4%	3.3%	1.7%	1.3%
Pan			10	0.4%	6.1%	3.2%	2.9%
Sum			10	98.8%	100.0%	99.8%	100.0%
Percent retained #325 Mesh			10	32.0%	93.5%	64.4%	65.6%

Chemical Parameters - Chesterfield Power Station UAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		UAPPB-1-(0.0-10.0)	UAPPB-1-(10.0-20.0)	UAPPB-1-(20.0-30.0)	UAPPB-1-(30.0-40.0)	UAPPB-1-(40.0-50.0)	UAPPB-1-(60.0-69.0)	UAPPB-2-(0.0-10.0)	UAPPB-2-(10.0-20.0)
TEC ID				17-828-2	17-828-3	17-828-4	17-828-5	17-828-6	17-828-7	17-828-8	17-828-9
Impoundment				Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore				1	1	1	1	1	1	2	2
Depth				0-10 ft	10-20 ft	20-30 ft	30-40 ft	49-50 ft	60-69 ft	0-10 ft	10-20 ft
Bore Log Material Description*				FA	FA	FA/BA	FA	FA	FA/BA	FA	FA
SiO_2	wt%			52.62	51.56	49.42	52.30	53.10	46.66	52.69	53.07
Al_2O_3	wt%			28.23	27.01	26.32	28.45	28.86	24.40	26.48	25.37
Fe_2O_3	wt%			9.14	11.08	10.33	9.03	8.50	8.07	10.91	10.60
Sum	wt%	min	70	89.99	89.66	86.07	89.78	90.46	79.13	90.07	89.04
CaO	wt%	max	10	1.39	1.83	4.01	1.83	1.47	8.02	1.85	1.99
MgO	wt%			0.96	0.99	1.08	1.10	1.06	1.02	1.02	0.96
Na_2O	wt%			0.37	0.37	0.43	0.40	0.39	0.35	0.42	0.39
K_2O	wt%			2.29	2.28	2.30	2.55	2.52	1.98	2.35	2.29
Total Na_2O	wt%			1.87	1.87	1.94	2.08	2.05	1.66	1.96	1.90
TiO_2	wt%			1.54	1.47	1.40	1.51	1.54	1.25	1.44	1.39
MnO_2	wt%			0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
P_2O_5	wt%			0.15	0.17	0.18	0.20	0.19	0.21	0.17	0.17
SrO	wt%			0.10	0.10	0.14	0.13	0.13	0.10	0.11	0.10
BaO	wt%			0.15	0.14	0.18	0.20	0.18	0.13	0.16	0.15
SO_3	wt%	max	5	0.12	0.24	1.54	0.21	0.15	4.41	0.16	0.33
Cl	wt%			<0.001	0.003	<0.001	0.003	0.042	0.059	0.008	0.008
Moisture (as received)	wt%	max	3	21.8	25.1	31.3	34.9	28.2	30.7	21.9	24.7
Moisture (after lab preparation)	wt%	max	3	0.16	0.07	0.49	0.19	0.14	0.34	0.22	0.16
LOI**	%	max	6	21.88	22.50	16.45	14.41	14.44	20.45	17.09	24.42
Available Alkalies Test:											
Na_2O as Available Alkalies	wt%			0.18	0.17	0.14	0.19	0.16	0.18	0.18	0.18
K_2O as Available Alkalies	wt%			1.12	1.08	0.91	1.23	1.24	1.06	1.19	1.22
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			0.92	0.88	0.74	1.00	0.98	0.88	0.96	0.98

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Shading = parameters outside of ASTM C618 standards

Chemical Parameters - Chesterfield Power Station UAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		UAPPB-2-(20.0-30.0)	UAPPB-2-(30.0-40.0)	UAPPB-2-(40.0-50.0)	UAPPB-2-(50.0-60.0)	UAPPB-2-(60.0-70.0)	UAPPB-2-(80.0-90.0)	UAPPB-2-(90.0-99.3)	UAPPB-3-(0.0-10.0)
TEC ID				17-828-10	17-828-11	17-828-12	17-828-13	17-828-14	17-828-15	17-828-16	17-841-1
Impoundment				Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore				2	2	2	2	2	2	2	3
Depth				20-30 ft	30-40 ft	40-50 ft	50-60 ft	60-70 ft	80-90 ft	90-99.3 ft	0-10 ft
Bore Log Material Description*				FA	FA	FA/BA	FA	FA/BA	FA/BA	FA	FA
SiO_2	wt%			52.75	52.75	46.29	53.53	52.66	52.55	51.34	53.37
Al_2O_3	wt%			27.69	28.44	24.04	27.78	29.05	28.40	29.18	29.16
Fe_2O_3	wt%			9.22	9.42	8.87	9.05	9.31	9.62	7.48	8.07
Sum	wt%	min	70	89.66	90.61	79.20	90.36	91.02	90.56	88.00	90.60
CaO	wt%	max	10	2.20	1.53	7.77	1.48	1.11	1.14	1.16	1.21
MgO	wt%			0.99	1.03	1.03	1.03	1.00	1.06	1.18	1.15
Na_2O	wt%			0.33	0.35	0.27	0.36	0.42	0.42	0.39	0.41
K_2O	wt%			2.29	2.47	1.97	2.49	2.42	2.53	2.72	2.69
Total Na_2O	wt%			1.84	1.98	1.57	2.00	2.01	2.09	2.18	2.18
TiO_2	wt%			1.51	1.58	1.28	1.49	1.59	1.53	1.49	1.61
MnO_2	wt%			0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.03
P_2O_5	wt%			0.18	0.21	0.20	0.18	0.18	0.18	0.30	0.20
SrO	wt%			0.12	0.13	0.11	0.11	0.13	0.11	0.12	0.14
BaO	wt%			0.16	0.18	0.14	0.16	0.17	0.17	0.16	0.19
SO_3	wt%	max	5	0.72	0.20	4.76	0.21	0.09	0.11	0.06	0.06
Cl	wt%			0.006	0.013	0.001	<0.001	0.001	<0.001	0.001	0.001
Moisture (as received)	wt%	max	3	24.9	26.3	23.7	26.8	25.8	28.5	37.3	21.3
Moisture (after lab preparation)	wt%	max	3	0.11	0.17	0.67	0.19	0.14	0.17	0.34	0.31
LOI**	%	max	6	14.46	13.00	15.75	14.45	12.22	17.14	13.33	11.72
Available Alkalies Test:											
Na_2O as Available Alkalies	wt%			0.16	0.17	0.13	0.16	0.21	0.19	0.17	0.21
K_2O as Available Alkalies	wt%			1.22	1.24	0.91	1.35	1.33	1.34	1.45	1.4
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			0.96	0.99	0.73	1.05	1.09	1.07	1.12	1.13

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
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Chemical Parameters - Chesterfield Power Station UAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		UAPPB-3-(10.0-20.0)	UAPPB-3-(20.0-30.0)	UAPPB-3-(30.0-40.0)	UAPPB-3-(40.0-50.0)	UAPPB-3-(60.0-70.0)	UAPPB-3-(70.0-80.0)	UAPPB-4-(0.0-10.0)	UAPPB-4-(10.0-20.0)
TEC ID				17-841-2	17-841-3	17-841-4	17-841-5	17-841-6	17-841-7	17-841-8	17-841-9
Impoundment				Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore				3	3	3	3	3	3	4	4
Depth				10-20 ft	20-30 ft	30-40 ft	40-50 ft	60-70 ft	70-80 ft	0-10 ft	10-20 ft
Bore Log Material Description*				FA	FA	FA	FA	FA/BA	FA	FA	FA
SiO_2	wt%			53.34	54.24	53.71	52.55	52.67	56.41	51.84	52.24
Al_2O_3	wt%			27.92	27.47	25.12	29.51	29.63	26.54	28.25	28.07
Fe_2O_3	wt%			8.93	9.35	12.35	7.87	8.35	7.77	9.6	10.03
Sum	wt%	min	70	90.19	91.07	91.18	89.93	90.65	90.72	89.69	90.33
CaO	wt%	max	10	1.11	1.09	1.32	1.22	1.12	1.12	1.34	1.33
MgO	wt%			1.10	1.06	1.02	1.16	1.01	1	1.18	1.17
Na_2O	wt%			0.38	0.39	0.36	0.48	0.38	0.56	0.42	0.42
K_2O	wt%			2.51	2.53	2.32	2.65	2.4	2.93	2.63	2.65
Total Na_2O	wt%			2.03	2.05	1.89	2.22	1.964	2.486	2.149	2.161
TiO_2	wt%			1.56	1.52	1.39	1.59	1.56	1.34	1.48	1.49
MnO_2	wt%			0.04	0.04	0.05	0.03	0.03	0.04	0.04	0.04
P_2O_5	wt%			0.19	0.17	0.16	0.23	0.18	0.18	0.3	0.28
SrO	wt%			0.13	0.12	0.11	0.13	0.13	0.12	0.16	0.16
BaO	wt%			0.18	0.17	0.17	0.19	0.17	0.18	0.19	0.19
SO_3	wt%	max	5	0.05	0.07	0.15	0.07	0.07	0.12	0.07	0.06
Cl	wt%			<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.007	<0.001
Moisture (as received)	wt%	max	3	31.8	23.6	24.1	20.2	19.3	39.8	18.3	22.1
Moisture (after lab preparation)	wt%	max	3	0.33	0.36	0.32	0.36	0.34	0.23	0.39	0.53
LOI**	%	max	6	16.46	13.25	12.33	17.68	17.03	11.26	15.78	15.37
Available Alkalies Test:											
Na_2O as Available Alkalies	wt%			0.19	0.2	0.17	0.26	0.19	0.24	0.21	0.2
K_2O as Available Alkalies	wt%			1.3	1.35	1.28	1.35	1.28	1.36	1.39	1.33
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			1.05	1.09	1.01	1.15	1.03	1.13	1.12	1.08

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Chemical Parameters - Chesterfield Power Station UAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		UAPPB-4-(20.0-30.0)	UAPPB-4-(30.0-40.0)	UAPPB-4-(40.0-50.0)	UAPPB-4-(50.0-60.0)	UAPPB-4-(60.0-70.0)	UAPPB-4-(70.0-80.0)	UAPPB-5-(0.0-10.0)	UAPPB-5-(10.0-20.0)
TEC ID				**17-841-10**	**17-841-11**	**17-841-12**	**17-841-13**	**17-841-14**	**17-841-15**	**17-841-16**	**17-841-17**
Impoundment				**Chesterfield UAP**	**Chesterfield UAP**	**Chesterfield UAP**	**Chesterfield UAP**	**Chesterfield UAP**	**Chesterfield UAP**	**Chesterfield UAP**	**Chesterfield UAP**
Bore				**4**	**4**	**4**	**4**	**4**	**4**	**5**	**5**
Depth				**20-30 ft**	**30-40 ft**	**40-50 ft**	**50-60 ft**	**60-70 ft**	**70-80 ft**	**0-10 ft**	**10-20 ft**
Bore Log Material Description*				**FA**	**FA**	**FA/BA/C**	**FA**	**FA**	**FA**	**FA**	**FA**
SiO_2	wt%			52.04	51.44	59.76	53.27	52.47	54.16	51.07	53.67
Al_2O_3	wt%			27.96	28.05	23.17	29.23	30.83	31.33	28.15	29.08
Fe_2O_3	wt%			9.82	10.74	9.38	8.32	7.14	5.69	9.14	9.33
Sum	wt%	min	70	89.81	90.24	92.31	90.82	90.44	91.19	88.37	92.08
CaO	wt%	max	10	1.27	1.44	0.98	1.18	1.29	1.17	1.17	1.27
MgO	wt%			1.16	1.14	0.87	1.07	1.15	1.12	1.13	1.14
Na_2O	wt%			0.42	0.44	0.38	0.43	0.44	0.43	0.4	0.46
K_2O	wt%			2.63	2.53	2.01	2.45	2.58	2.64	2.61	2.55
Total Na_2O	wt%			2.147	2.108	1.7	2.045	2.138	2.168	2.116	2.139
TiO_2	wt%			1.45	1.48	1.41	1.61	1.64	1.62	1.47	1.57
MnO_2	wt%			0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.04
P_2O_5	wt%			0.27	0.3	0.16	0.18	0.22	0.24	0.22	0.21
SrO	wt%			0.14	0.17	0.11	0.14	0.16	0.14	0.16	0.15
BaO	wt%			0.2	0.2	0.15	0.18	0.19	0.16	0.19	0.19
SO_3	wt%	max	5	0.06	0.08	0.09	0.07	0.07	0.04	0.05	0.05
Cl	wt%			<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001
Moisture (as received)	wt%	max	3	23.3	35.8	20.5	35.5	31.3	37.0	20.4	22.6
Moisture (after lab preparation)	wt%	max	3	0.45	0.32	0.55	0.32	0.23	0.21	0.46	0.23
LOI**	%	max	6	16.33	14.37	12.13	11.31	11.17	10.26	11.79	12.53
Available Alkalies Test:											
Na_2O as Available Alkalies	wt%			0.2	0.19	0.17	0.24	0.22	0.21	0.19	0.22
K_2O as Available Alkalies	wt%			1.35	1.31	1.09	1.27	1.34	1.33	1.36	1.36
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			1.09	1.05	0.89	1.08	1.10	1.09	1.08	1.11

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Chemical Parameters - Chesterfield Power Station UAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		UAPPB-5-(20.0-30.0)	UAPPB-5-(30.0-40.0)	UAPPB-5-(40.0-50.0)	UAPPB-5-(60.0-70.0)	UAPPB-5-(80.0-84.9)
TEC ID				17-841-18	17-841-19	17-841-20	17-850-1	17-850-2
Impoundment				Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore				5	5	5	5	5
Depth				20-30 ft	30-40 ft	40-50 ft	60-70 ft	80-84.9 ft
Bore Log Material Description*				FA/BA	FA	FA/C	FA/BA	FA
SiO_2	wt%			53.21	53.13	53.97	53.34	54.75
Al_2O_3	wt%			27.01	27.86	29.94	28.57	26.94
Fe_2O_3	wt%			10.03	8.88	10.92	9.09	8.33
Sum	wt%	min	70	90.26	89.86	94.83	91	90.03
CaO	wt%	max	10	1.33	1.37	1.47	1.13	1.03
MgO	wt%			1.1	1.15	1.12	1.04	1.1
Na_2O	wt%			0.42	0.45	0.44	0.41	0.45
K_2O	wt%			2.49	2.62	2.38	2.36	2.66
Total Na_2O	wt%			2.064	2.175	2.005	1.956	2.196
TiO_2	wt%			1.5	1.51	1.59	1.54	1.46
MnO_2	wt%			0.04	0.03	0.04	0.03	0.04
P_2O_5	wt%			0.23	0.24	0.21	0.18	0.16
SrO	wt%			0.15	0.16	0.17	0.13	0.1
BaO	wt%			0.18	0.18	0.17	0.16	0.16
SO_3	wt%	max	5	0.05	0.06	0.1	0.06	0.09
Cl	wt%			<0.001	0.002	0.001	<0.001	<0.001
Moisture (as received)	wt%	max	3	22.9	28.2	30.1	31.2	50.8
Moisture (after lab preparation)	wt%	max	3	0.44	0.35	0.36	0.29	0.57
LOI**	%	max	6	14.28	13.64	16.33	13.36	18.81
Available Alkalies Test:								
Na_2O as Available Alkalies	wt%			0.21	0.22	0.18	0.2	0.22
K_2O as Available Alkalies	wt%			1.36	1.34	1.2	1.32	1.45
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			1.10	1.10	0.97	1.07	1.17

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Chemical Parameters - Chesterfield Power Station UAP

Client ID	Units of Measure	ASTM C618 Class F Criteria		Upper Chesterfield Summary						
TEC ID				Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment										
Bore										
Depth										
Bore Log Material Description*										
SiO_2	wt%			37	46.29	59.76	52.70	52.75	-	-
Al_2O_3	wt%			37	23.17	31.33	27.82	28.07	-	-
Fe_2O_3	wt%			37	5.69	12.35	9.18	9.14	-	-
Sum	wt%	min	70	37	79.13	94.83	89.71	90.26	0	0.0%
CaO	wt%	max	10	37	0.98	8.02	1.78	1.32	0	0.0%
MgO	wt%			37	0.87	1.18	1.07	1.07	-	-
Na_2O	wt%			37	0.27	0.56	0.41	0.41	-	-
K_2O	wt%			37	1.97	2.93	2.47	2.51	-	-
Total Na_2O	wt%			37	1.57	2.49	2.03	2.05	-	-
TiO_2	wt%			37	1.25	1.64	1.50	1.51	-	-
MnO_2	wt%			37	0.03	0.05	0.03	0.03	-	-
P_2O_5	wt%			37	0.15	0.30	0.20	0.19	-	-
SrO	wt%			37	0.10	0.17	0.13	0.13	-	-
BaO	wt%			37	0.13	0.20	0.17	0.17	-	-
SO_3	wt%	max	5	37	0.04	4.76	0.40	0.09	0	0.00%
Cl	wt%			37	0.001	0.06	0.005	0.001	-	-
Moisture (as received)	wt%	max	3	37	18.34	50.79	27.63	25.78	37	100%
Moisture (after lab preparation)	wt%	max	3	37	0.07	0.67	0.31	0.32	0	0.0%
LOI**	%	max	6	37	10.26	24.42	15.11	14.44	37	100.0%
Available Alkalies Test:										
Na_2O as Available Alkalies	wt%			37	0.13	0.26	0.19	0.19	-	-
K_2O as Available Alkalies	wt%			37	0.91	1.45	1.27	1.32	-	-
Available Alkalies as Na_2O equivalent (Na_2O + $0.658K_2O$)	wt%			37	0.73	1.17	1.03	1.07	-	-

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.
Shading = parameters outside of ASTM C618 standards

Client ID	ASTM C618 Class F Criteria		UAPPB-1-(0.0-10.0)	UAPPB-1-(10.0-20.0)	UAPPB-1-(20.0-30.0)	UAPPB-1-(30.0-40.0)	UAPPB-1-(40.0-50.0)	UAPPB-1-(60.0-69.0)	UAPPB-2-(0.0-10.0)	UAPPB-2-(10.0-20.0)	UAPPB-2-(20.0-30.0)
TEC ID			17-828-2	17-828-3	17-828-4	17-828-5	17-828-6	17-828-7	17-828-8	17-828-9	17-828-10
Impoundment			Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore			1	1	1	1	1	1	2	2	2
Depth			0-10 ft	10-20 ft	20-30 ft	30-40 ft	49-50 ft	60-69 ft	0-10 ft	10-20 ft	20-30 ft
Bore Log Description*			FA	FA	FA/BA	FA	FA	FA/BA	FA	FA	FA
Specific Gravity			2.13	2.17	2.23	2.26	2.26	2.22	2.19	2.23	2.18
Soundness %	max	±0.8	-0.02	-0.02	0.02	-0.03	-0.04	-0.03	-0.03	-0.02	-0.03
Retained on #325 Mesh %	max	34	37.23	42.09	51.75	25.71	25.65	42.58	33.23	43.74	44.95
Water Req %	max	105	114	111	110	110	110	108	110	110	110
7 Day Control (PSI)			5040	5040	5040	5040	5040	5040	5040	4720	4720
7 Day (PSI)			3350	3420	3340	3890	3520	3800	3020	3220	3470
7-Day SAI, % of control	min	75	67	68	66	77	70	75	60	68	74
28 Day Control (PSI)			6150	6150	6150	6150	6150	6150	6150	6000	6000
28 Day (PSI)			4550	4650	4290	4970	4780	4870	4040	4260	4430
28-Day SAI, % of control	min	75	74	76	70	81	78	79	66	71	74
Organic Impurities (Color Plate #)	max	3	1	1	1	1	1	1	1	1	1

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			201	200.4	198.3	200.8	201	202.2	200.7	213.8	193.1
3/8"			1%	4%	1%	1%	0%	1%	0%	0%	1%
#4			1%	1%	3%	0%	0%	4%	0%	0%	1%
#8			1%	1%	5%	0%	0%	4%	0%	2%	2%
#16			1%	2%	5%	0%	0%	3%	1%	3%	2%
#30			1%	2%	4%	1%	0%	2%	1%	3%	3%
#50			4%	5%	7%	2%	2%	5%	3%	5%	5%
#100			8%	8%	11%	5%	5%	8%	7%	10%	9%
#200			13.9%	12.5%	12.7%	9.5%	9.6%	11.3%	13.3%	15.6%	14.7%
Pan			68.8%	64.3%	52.2%	79.7%	82.3%	61.6%	74.6%	60.8%	62.5%

ASTM D1921 (Percent Retained)

Sample Weight (g)			58.6	51.4	50.4	53.9	54.3	51	51.4	50.8	51
#230			4.8%	5.1%	5.6%	3.7%	3.7%	4.7%	4.5%	6.5%	5.9%
#270			6.8%	6.0%	6.3%	4.6%	4.8%	5.7%	6.4%	8.1%	7.5%
#325			7.0%	6.6%	6.5%	5.0%	5.0%	6.1%	6.4%	7.9%	7.6%
#400			8.2%	7.4%	7.7%	6.1%	5.9%	7.1%	7.8%	8.9%	8.8%
#450			67.9%	66.7%	65.5%	68.5%	72.4%	68.8%	66.9%	52.2%	64.9%
#500			1.7%	3.1%	1.6%	2.2%	2.6%	2.7%	3.1%	3.3%	1.0%
#635			1.5%	1.2%	2.0%	2.4%	1.3%	1.6%	1.6%	3.7%	1.2%
Pan			2.0%	3.9%	4.4%	7.4%	4.4%	3.1%	3.5%	9.3%	4.1%

Sample Weight (g) - Percent retained per fraction			201.0	200.4	198.3	200.8	201.0	202.2	200.7	213.8	193.1
3/8" (9510 micron)			1.2%	3.6%	1.1%	0.9%	0.0%	0.6%	0.0%	0.0%	1.0%
#4 (4760 micron)			0.9%	0.9%	3.3%	0.5%	0.0%	4.2%	0.0%	0.4%	1.0%
#8 (2380 micron)			0.8%	1.3%	4.7%	0.2%	0.2%	4.2%	0.4%	2.1%	1.6%
#16 (1190 micron)			0.7%	1.6%	4.5%	0.4%	0.1%	2.9%	0.6%	2.9%	2.4%
#30 (595 micron)			1.0%	1.9%	4.3%	0.7%	0.2%	2.1%	0.7%	3.3%	2.9%
#50 (297 micron)			3.9%	4.9%	6.6%	2.4%	2.2%	4.5%	2.9%	5.1%	5.1%
#100 (149 micron)			8.1%	8.4%	10.6%	5.3%	5.0%	8.0%	7.1%	9.5%	8.9%
#200 (74 micron)			13.9%	12.5%	12.7%	9.5%	9.6%	11.3%	13.3%	15.6%	14.7%
#230 (63 micron)			3.3%	3.3%	2.9%	3.0%	3.0%	2.9%	3.3%	3.9%	3.7%
#270 (53 icron)			4.7%	3.9%	3.3%	3.7%	3.9%	3.5%	4.8%	4.9%	4.7%
#325 (44 micron)			4.8%	4.3%	3.4%	4.0%	4.1%	3.7%	4.8%	4.8%	4.8%
#400 (37 micron)			5.6%	4.8%	4.0%	4.9%	4.9%	4.3%	5.8%	5.4%	5.5%
#450 (32 micron)			46.7%	42.9%	34.2%	54.5%	59.6%	42.4%	49.9%	31.7%	40.5%
#500 (28 micron)			1.2%	2.0%	0.8%	1.8%	2.1%	1.7%	2.3%	2.0%	0.6%
#635 (22 micron)			1.1%	0.8%	1.0%	1.9%	1.1%	1.0%	1.2%	2.3%	0.7%
Pan			1.4%	2.5%	2.3%	5.9%	3.6%	1.9%	2.6%	5.6%	2.6%
Sum			99.5%	99.7%	99.6%	99.8%	99.8%	99.4%	99.8%	99.6%	100.6%
Percent retained #325 Mesh			43.5%	46.7%	57.3%	30.8%	28.5%	48.1%	38.0%	52.6%	50.6%

Client ID	ASTM C618 Class F Criteria		UAPPB-2-(30.0-40.0)	UAPPB-2-(40.0-50.0)	UAPPB-2-(50.0-60.0)	UAPPB-2-(60.0-70.0)	UAPPB-2-(80.0-90.0)	UAPPB-2-(90.0-99.3)	UAPPB-3-(0.0-10.0)	UAPPB-3-(10.0-20.0)	UAPPB-3-(20.0-30.0)
TEC ID			17-828-11	17-828-12	17-828-13	17-828-14	17-828-15	17-828-16	17-841-1	17-841-2	17-841-3
Impoundment			Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore			2	2	2	2	2	2	3	3	3
Depth			30-40 ft	40-50 ft	50-60 ft	60-70 ft	80-90 ft	90-99.3 ft	0-10 ft	10-20 ft	20-30 ft
Bore Log Description*			FA	FA/BA	FA	FA/BA	FA/BA	FA	FA	FA	FA
Specific Gravity			2.25	2.22	2.16	2.2	2.08	2.16	2.23	2.19	2.21
Soundness %	max	±0.8	-0.01	-0.03	-0.03	-0.03	-0.02	-0.04	-0.04	-0.03	-0.03
Retained on #325 Mesh %	max	34	24.31	51.6	35.22	40.02	53.81	27.42	17.63	31.55	36.08
Water Req %	max	105	110	107	108	107	107	108	105	105	106
7 Day Control (PSI)			4720	4720	4720	4720	4720	4720	4720	4720	4720
7 Day (PSI)			3540	3630	3230	4150	3060	3270	3840	3640	3640
7-Day SAI, % of control	min	75	75	77	68	88	65	69	81	77	77
28 Day Control (PSI)			6000	6000	6000	6000	6000	6000	6000	6000	6000
28 Day (PSI)			4690	4500	4700	4920	3930	4420	5310	5040	4810
28-Day SAI, % of control	min	75	78	75	78	82	66	74	89	84	80
Organic Impurities (Color Plate #)	max	3	1	1	1	1	1	1	2	1	1

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			218.8	201.1	222.4	227.1	216.5	203.9	249.9	228.9	244
3/8"			0%	2%	1%	0%	2%	0%	0%	0%	3%
#4			0%	3%	0%	2%	2%	0%	0%	1%	2%
#8			1%	5%	1%	3%	2%	0%	0%	0%	1%
#16			1%	5%	1%	3%	2%	0%	0%	0%	1%
#30			1%	5%	1%	3%	3%	1%	0%	0%	1%
#50			2%	6%	3%	4%	6%	3%	1%	2%	3%
#100			4%	9%	7%	7%	10%	5%	3%	7%	7%
#200			9.0%	14.5%	13.3%	12.5%	15.9%	10.3%	8.4%	12.2%	13.9%
Pan			81.7%	49.4%	72.4%	66.2%	55.9%	80.0%	86.8%	76.2%	67.0%

ASTM D1921 (Percent Retained)

Sample Weight (g)			51.6	51.4	59.2	51	50.2	50.5	50.7	51.5	54.9
#230			3.3%	7.0%	4.4%	4.7%	7.0%	4.0%	2.8%	4.5%	5.3%
#270			4.1%	9.1%	6.1%	6.3%	8.0%	5.5%	4.3%	6.4%	10.7%
#325			4.8%	8.8%	6.9%	7.1%	8.4%	6.1%	5.3%	1.7%	6.6%
#400			6.2%	9.7%	7.9%	8.2%	8.8%	7.1%	6.5%	6.6%	6.9%
#450			68.2%	59.1%	67.2%	67.1%	60.0%	65.0%	69.4%	68.7%	64.5%
#500			3.5%	0.4%	1.2%	0.4%	1.2%	1.8%	2.6%	2.7%	0.5%
#635			2.3%	1.2%	1.7%	1.4%	1.4%	2.2%	2.0%	2.7%	1.6%
Pan			6.0%	3.7%	2.4%	4.9%	5.0%	8.1%	7.1%	2.7%	3.8%

Sample Weight (g) - Percent retained per fraction			218.8	201.1	222.4	227.1	216.5	203.9	249.9	228.9	244.0
3/8" (9510 micron)			0.0%	2.3%	0.7%	0.0%	2.1%	0.0%	0.0%	0.0%	2.9%
#4 (4760 micron)			0.4%	3.3%	0.2%	1.7%	2.1%	0.2%	0.2%	0.7%	1.6%
#8 (2380 micron)			0.6%	4.9%	0.9%	2.6%	2.4%	0.1%	0.0%	0.4%	1.1%
#16 (1190 micron)			0.7%	4.9%	1.1%	3.0%	2.2%	0.2%	0.2%	0.5%	1.2%
#30 (595 micron)			0.7%	4.8%	1.2%	3.0%	3.0%	0.6%	0.2%	0.5%	1.2%
#50 (297 micron)			2.1%	6.4%	3.2%	3.9%	5.9%	2.9%	0.9%	2.4%	3.1%
#100 (149 micron)			4.4%	9.3%	6.7%	6.8%	9.7%	4.9%	2.8%	6.9%	7.4%
#200 (74 micron)			9.0%	14.5%	13.3%	12.5%	15.9%	10.3%	8.4%	12.2%	13.9%
#230 (63 micron)			2.7%	3.5%	3.2%	3.1%	3.9%	3.2%	2.4%	3.4%	3.5%
#270 (53 icron)			3.3%	4.5%	4.4%	4.2%	4.5%	4.4%	3.8%	4.9%	7.2%
#325 (44 micron)			4.0%	4.3%	5.0%	4.7%	4.7%	4.9%	4.6%	1.3%	4.4%
#400 (37 micron)			5.1%	4.8%	5.8%	5.5%	4.9%	5.7%	5.7%	5.0%	4.6%
#450 (32 micron)			55.7%	29.2%	48.7%	44.4%	33.5%	52.0%	60.3%	52.4%	43.2%
#500 (28 micron)			2.8%	0.2%	0.9%	0.3%	0.7%	1.4%	2.2%	2.1%	0.4%
#635 (22 micron)			1.9%	0.6%	1.2%	0.9%	0.8%	1.7%	1.7%	2.1%	1.1%
Pan			4.9%	1.8%	1.7%	3.2%	2.8%	6.5%	6.2%	2.1%	2.6%
Sum			98.3%	99.4%	98.1%	99.7%	99.1%	99.3%	99.6%	96.9%	99.5%
Percent retained #325 Mesh			27.8%	62.8%	39.9%	45.5%	56.4%	31.9%	23.6%	33.3%	47.6%

Client ID	ASTM C618 Class F Criteria		UAPPB-3-(30.0-40.0)	UAPPB-3-(40.0-50.0)	UAPPB-3-(60.0-70.0)	UAPPB-3-(70.0-80.0)	UAPPB-4-(0.0-10.0)	UAPPB-4-(10.0-20.0)	UAPPB-4-(20.0-30.0)	UAPPB-4-(30.0-40.0)	UAPPB-4-(40.0-50.0)
TEC ID			17-841-4	17-841-5	17-841-6	17-841-7	17-841-8	17-841-9	17-841-10	17-841-11	17-841-12
Impoundment			Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore			3	3	3	3	4	4	4	4	4
Depth			30-40 ft	40-50 ft	60-70 ft	70-80 ft	0-10 ft	10-20 ft	20-30 ft	30-40 ft	40-50 ft
Bore Log Description*			FA	FA	FA/BA	FA	FA	FA	FA	FA	FA/BA/C
Specific Gravity			2.27	2.21	2.12	2.22	2.23	2.24	2.23	2.28	2.36
Soundness %	max	±0.8	0.04	-0.01	0.05	-0.04	-0.02	-0.02	-0.03	-0.02	-0.02
Retained on #325 Mesh %	max	34	52.48	35.94	53.84	22.8	31.72	30.99	30.49	33.59	38.82
Water Req %	max	105	106	107	107	107	106	106	105	105	105
7 Day Control (PSI)			4720	4720	4720	4720	4720	5440	5440	5440	5440
7 Day (PSI)			3350	3520	2790	3840	3660	3850	3990	3510	3510
7-Day SAI, % of control	min	75	71	75	59	81	78	71	74	65	65
28 Day Control (PSI)			6000	6000	6000	6000	6000	6390	6390	6390	6390
28 Day (PSI)			4420	4880	3820	5110	4720	5170	5310	4960	4760
28-Day SAI, % of control	min	75	74	81	64	85	79	81	83	78	74
Organic Impurities (Color Plate #)	max	3	1	1	1	1	2	1	1	1	1

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			275.4	264.7	248	231.2	265	260.9	274.7	286.2	285.6
3/8"			10%	0%	1%	0%	1%	0%	0%	0%	1%
#4			1%	2%	3%	0%	0%	0%	0%	0%	1%
#8			1%	2%	2%	0%	0%	0%	0%	0%	2%
#16			1%	3%	1%	0%	0%	0%	0%	0%	4%
#30			1%	3%	2%	0%	0%	0%	0%	1%	4%
#50			4%	5%	5%	1%	2%	2%	2%	3%	6%
#100			8%	9%	9%	2%	6%	7%	7%	7%	11%
#200			18.0%	14.6%	14.0%	7.9%	12.6%	12.7%	12.9%	12.4%	13.3%
Pan			56.4%	61.3%	61.9%	88.1%	76.3%	76.8%	76.6%	76.1%	56.3%

ASTM D1921 (Percent Retained)

Sample Weight (g)			51	52.1	57.3	50.1	51	50.4	52.4	56.5	51
#230			7.6%	4.6%	5.1%	3.2%	4.7%	4.4%	4.6%	4.4%	5.1%
#270			9.2%	7.1%	6.8%	4.8%	5.9%	5.8%	5.7%	6.2%	6.5%
#325			8.2%	7.3%	7.5%	5.6%	6.7%	6.0%	5.9%	5.8%	6.7%
#400			8.6%	8.1%	8.6%	6.6%	8.0%	7.1%	7.3%	7.4%	8.2%
#450			59.2%	59.5%	58.1%	66.5%	67.3%	67.9%	66.8%	61.1%	61.8%
#500			0.8%	3.6%	0.9%	2.0%	2.0%	2.4%	3.4%	3.0%	1.4%
#635			1.4%	1.9%	1.9%	2.2%	1.6%	3.0%	2.5%	3.2%	2.2%
Pan			4.7%	7.1%	10.5%	8.8%	3.5%	3.4%	3.4%	8.8%	7.3%

Sample Weight (g) - Percent retained per fraction			275.4	264.7	248.0	231.2	265.0	260.9	274.7	286.2	285.6
3/8" (9510 micron)			9.5%	0.0%	1.3%	0.0%	1.0%	0.0%	0.0%	0.0%	1.4%
#4 (4760 micron)			0.8%	1.6%	2.7%	0.5%	0.2%	0.0%	0.3%	0.3%	0.8%
#8 (2380 micron)			0.9%	2.4%	1.9%	0.3%	0.4%	0.4%	0.1%	0.2%	2.2%
#16 (1190 micron)			0.8%	3.1%	1.5%	0.4%	0.5%	0.4%	0.3%	0.4%	4.2%
#30 (595 micron)			0.9%	3.4%	2.4%	0.4%	0.5%	0.4%	0.4%	0.6%	4.2%
#50 (297 micron)			4.2%	5.1%	5.3%	0.5%	2.2%	2.2%	2.4%	2.7%	6.5%
#100 (149 micron)			8.2%	8.5%	8.8%	1.5%	6.0%	6.7%	6.5%	6.8%	10.9%
#200 (74 micron)			18.0%	14.6%	14.0%	7.9%	12.6%	12.7%	12.9%	12.4%	13.3%
#230 (63 micron)			4.3%	2.8%	3.1%	2.8%	3.6%	3.4%	3.5%	3.4%	2.9%
#270 (53 icron)			5.2%	4.4%	4.2%	4.2%	4.5%	4.4%	4.4%	4.7%	3.6%
#325 (44 micron)			4.6%	4.5%	4.6%	4.9%	5.1%	4.6%	4.5%	4.4%	3.8%
#400 (37 micron)			4.9%	4.9%	5.3%	5.8%	6.1%	5.5%	5.6%	5.7%	4.6%
#450 (32 micron)			33.4%	36.5%	36.0%	58.5%	51.3%	52.1%	51.1%	46.5%	34.8%
#500 (28 micron)			0.4%	2.2%	0.5%	1.8%	1.5%	1.8%	2.6%	2.3%	0.8%
#635 (22 micron)			0.8%	1.2%	1.2%	1.9%	1.2%	2.3%	1.9%	2.4%	1.2%
Pan			2.7%	4.4%	6.5%	7.7%	2.7%	2.6%	2.6%	6.7%	4.1%
Sum			99.7%	99.5%	99.4%	99.2%	99.4%	99.5%	99.3%	99.7%	99.2%
Percent retained #325 Mesh			57.6%	50.4%	49.9%	23.4%	36.6%	35.2%	35.5%	36.1%	53.7%

Client ID	ASTM C618 Class F Criteria		UAPPB-4-(50.0-60.0)	UAPPB-4-(60.0-70.0)	UAPPB-4-(70.0-80.0)	UAPPB-5-(0.0-10.0)	UAPPB-5-(10.0-20.0)	UAPPB-5-(20.0-30.0)	UAPPB-5-(30.0-40.0)	UAPPB-5-(40.0-50.0)	UAPPB-5-(60.0-70.0)	UAPPB-5-(80.0-84.9)
TEC ID			17-841-13	17-841-14	17-841-15	17-841-16	17-841-17	17-841-18	17-841-19	17-841-20	17-850-1	17-850-2
Impoundment			Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP	Chesterfield UAP
Bore			4	4	4	5	5	5	5	5	5	5
Depth			50-60 ft	60-70 ft	70-80 ft	0-10 ft	10-20 ft	20-30 ft	30-40 ft	40-50 ft	60-70 ft	80-84.9 ft
Bore Log Description*			FA	FA	FA	FA	FA	FA/BA	FA	FA/C	FA/BA	FA
Specific Gravity			2.24	2.17	2.17	2.27	2.24	2.18	2.25	2.22	2.2	2.08
Soundness %	max	±0.8	-0.04	-0.05	-0.05	-0.02	-0.04	-0.03	-0.02	-0.03	-0.03	-0.03
Retained on #325 Mesh %	max	34	24.78	23.88	9.34	20.81	29.29	35.42	28.69	37.4	41.53	58.72
Water Req %	max	105	105	105	103	103	103	104	104	104	103	110
7 Day Control (PSI)			5440	5440	5440	5440	5440	5440	5440	5440	5440	5440
7 Day (PSI)			3920	3750	4210	4110	3710	4330	3810	3960	3910	3230
7-Day SAI, % of control	min	75	72	69	77	76	68	80	70	73	72	59
28 Day Control (PSI)			6390	6390	6390	6390	6390	6390	6390	6390	6390	6390
28 Day (PSI)			5280	5300	5830	5170	5100	5610	5210	5040	4750	4240
28-Day SAI, % of control	min	75	83	83	91	81	80	88	82	79	74	66
Organic Impurities (Color Plate #)	max	3	1	1	1	2	1	1	1	1	1	1

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			259.2	248.1	235.9	286.9	288.7	284.5	270.1	251.2	285.3	267.9
3/8"			1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
#4			0%	0%	0%	0%	0%	1%	0%	1%	0%	0%
#8			1%	0%	0%	0%	1%	2%	1%	1%	0%	1%
#16			1%	0%	0%	0%	1%	3%	1%	1%	1%	1%
#30			1%	0%	0%	0%	1%	2%	1%	1%	1%	1%
#50			2%	1%	0%	1%	2%	4%	2%	3%	4%	5%
#100			4%	4%	1%	3%	6%	7%	5%	8%	8%	13%
#200			10.6%	9.1%	2.7%	9.2%	12.1%	12.1%	8.7%	13.5%	16.0%	24.6%
Pan			80.1%	85.9%	96.0%	86.0%	76.6%	68.7%	80.2%	71.6%	69.5%	55.0%

ASTM D1921 (Percent Retained)

Sample Weight (g)			57	51.4	50.4	51.9	50.3	50.5	52.5	50.5	54.5	53.7
#230			4.2%	3.3%	1.8%	3.5%	4.0%	4.8%	3.4%	5.0%	5.3%	9.5%
#270			6.1%	4.5%	2.2%	4.6%	5.4%	5.7%	4.2%	5.9%	7.3%	12.8%
#325			7.0%	5.1%	2.8%	5.2%	5.8%	5.9%	4.8%	6.3%	7.5%	11.5%
#400			8.9%	6.0%	4.4%	6.7%	6.8%	7.1%	5.5%	7.7%	9.0%	11.9%
#450			65.1%	64.4%	62.1%	63.2%	69.0%	65.9%	69.7%	60.6%	60.7%	7.4%
#500			1.1%	4.5%	8.9%	4.4%	1.2%	1.6%	1.1%	2.0%	1.7%	8.9%
#635			1.8%	6.4%	8.3%	4.4%	2.0%	2.4%	4.2%	2.8%	2.0%	12.1%
Pan			5.8%	6.8%	9.5%	7.9%	5.4%	6.5%	6.7%	9.1%	6.4%	25.5%

Sample Weight (g) - Percent retained per fraction			259.2	248.1	235.9	286.9	288.7	284.5	270.1	251.2	285.3	267.9
3/8" (9510 micron)			1.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.4%	0.0%	0.0%
#4 (4760 micron)			0.5%	0.0%	0.0%	0.1%	0.3%	0.6%	0.4%	0.6%	0.2%	0.1%
#8 (2380 micron)			0.5%	0.0%	0.0%	0.1%	0.9%	2.2%	1.0%	0.6%	0.3%	0.5%
#16 (1190 micron)			0.7%	0.0%	0.0%	0.1%	0.9%	2.8%	1.1%	0.9%	1.0%	0.7%
#30 (595 micron)			0.9%	0.0%	0.0%	0.2%	0.8%	2.5%	1.3%	1.1%	1.4%	1.5%
#50 (297 micron)			1.5%	0.9%	0.1%	0.9%	2.3%	3.7%	2.4%	3.5%	3.5%	4.6%
#100 (149 micron)			3.7%	3.5%	0.6%	3.1%	5.9%	7.0%	4.9%	7.8%	8.0%	13.0%
#200 (74 micron)			10.6%	9.1%	2.7%	9.2%	12.1%	12.1%	8.7%	13.5%	16.0%	24.6%
#230 (63 micron)			3.4%	2.8%	1.7%	3.0%	3.0%	3.3%	2.7%	3.5%	3.7%	5.2%
#270 (53 icron)			4.9%	3.8%	2.1%	4.0%	4.1%	3.9%	3.4%	4.3%	5.1%	7.1%
#325 (44 micron)			5.6%	4.3%	2.7%	4.5%	4.4%	4.1%	3.8%	4.5%	5.2%	6.4%
#400 (37 micron)			7.2%	5.2%	4.2%	5.8%	5.2%	4.9%	4.4%	5.5%	6.2%	6.6%
#450 (32 micron)			52.1%	55.3%	59.6%	54.4%	52.9%	45.3%	55.9%	43.4%	42.2%	4.1%
#500 (28 micron)			0.8%	3.8%	8.6%	3.8%	0.9%	1.1%	0.9%	1.4%	1.1%	4.9%
#635 (22 micron)			1.4%	5.5%	8.0%	3.8%	1.5%	1.6%	3.4%	2.0%	1.4%	6.7%
Pan			4.6%	5.9%	9.1%	6.8%	4.1%	4.5%	5.3%	6.5%	4.5%	14.0%
Sum			99.5%	100.4%	99.5%	99.7%	99.2%	100.0%	99.7%	99.6%	100.0%	99.9%
Percent retained #325 Mesh			33.3%	24.6%	10.0%	25.1%	34.6%	42.6%	29.8%	40.8%	44.5%	63.6%

Physical Parameters - Chesterfield Power Station UAP

Client ID	ASTM C618 Class F Criteria		Upper Chesterfield Summary						
TEC ID			Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment									
Bore									
Depth									
Bore Log Description*									
Specific Gravity			37	2.08	2.36	2.21	2.22	-	-
Soundness %	max	±0.8	37	-0.05	0.05	-0.02	-0.03	0	0.0%
Retained on #325 Mesh %	max	34	37	9.34	58.72	35.3	35.22	19	51.4%
Water Req %	max	105	37	103	114	107	107	23	62.2%
7 Day Control (PSI)			37	4720	5440	5053	5040	-	-
7 Day (PSI)			37	2790	4330	3621	3640	-	-
7-Day SAI, % of control	min	75	37	59	88	72	72	23	62.2%
28 Day Control (PSI)			37	6000	6390	6176	6150	-	-
28 Day (PSI)			37	3820	5830	4806	4810	-	-
28-Day SAI, % of control	min	75	37	64	91	78	79	12	32.4%
Organic Impurities (Color Plate #)	max	3	37	1	2	1	1	0	0.0%

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			37	193.1	288.7	240.4	244
3/8"			37	0.0%	9.5%	0.9%	0.0%
#4			37	0.0%	4.2%	0.9%	0.5%
#8			37	0.0%	4.9%	1.2%	0.6%
#16			37	0.0%	4.9%	1.4%	0.8%
#30			37	0.0%	4.8%	1.5%	1.0%
#50			37	0.1%	6.6%	3.3%	3.1%
#100			37	0.6%	13.0%	6.8%	6.9%
#200			37	2.7%	24.6%	12.4%	12.6%
Pan			37	49.4%	96.0%	71.4%	72.4%
ASTM D1921 (Percent Retained)							
Sample Weight (g)			37	50.1	59.2	52.4	51.4
#230			37	1.8%	9.5%	4.7%	4.6%
#270			37	2.2%	12.8%	6.3%	6.1%
#325			37	1.7%	11.5%	6.4%	6.4%
#400			37	4.4%	11.9%	7.6%	7.4%
#450			37	7.4%	72.4%	63.2%	65.5%
#500			37	0.4%	8.9%	2.4%	2.0%
#635			37	1.2%	12.1%	2.7%	2.0%
Pan			37	2.0%	25.5%	6.3%	5.8%

Sample Weight (g) - Percent retained per fraction			37	193.1	288.7	240.4	244
3/8" (9510 micron)			37	0.0%	9.5%	0.9%	0.0%
#4 (4760 micron)			37	0.0%	4.2%	0.9%	0.5%
#8 (2380 micron)			37	0.0%	4.9%	1.2%	0.6%
#16 (1190 micron)			37	0.0%	4.9%	1.4%	0.8%
#30 (595 micron)			37	0.0%	4.8%	1.5%	1.0%
#50 (297 micron)			37	0.1%	6.6%	3.3%	3.1%
#100 (149 micron)			37	0.6%	13.0%	6.8%	6.9%
#200 (74 micron)			37	2.7%	24.6%	12.4%	12.6%
#230 (63 micron)			37	1.7%	5.2%	3.3%	3.3%
#270 (53 icron)			37	2.1%	7.2%	4.3%	4.4%
#325 (44 micron)			37	1.3%	6.4%	4.4%	4.5%
#400 (37 micron)			37	4.0%	7.2%	5.3%	5.3%
#450 (32 micron)			37	4.1%	60.3%	45.6%	46.7%
#500 (28 micron)			37	0.2%	8.6%	1.8%	1.5%
#635 (22 micron)			37	0.6%	8.0%	2.0%	1.4%
Pan			37	1.4%	14.0%	4.5%	4.1%
Sum			37	96.9%	100.6%	99.5%	99.5%
Percent retained #325 Mesh			37	10.0%	63.6%	40.3%	39.9%

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Chemical Parameters - Possum Point Power Station

Client ID	Units of Measure	ASTM C618 Class F Criteria		PPD-B01-(0.0-15.0)	PPD-B02-(0.0-19.5)	PPD-B03-(0.0-10.0)	PPD-B03-(10.0-18.8)	PPD-B04-(0.0-10.0)	PPD-B04-(10.0-16.6)	PPD-B05-(0.0-10.0)	PPD-B05-(10.0-13.6)
TEC ID				17-819-1	17-819-2	17-819-3	17-819-4	17-819-5	17-819-6	17-819-7	17-819-8
Impoundment				Possum Point	Possum Point	Possum Point	Possum Point	Possum Point	Possum Point	Possum Point	Possum Point
Bore				B01	B02	B03	B03	B04	B04	B05	B05
Depth				0-10 ft	0-19.5 ft	0-10 ft	10-18.8 ft	0-10 ft	10-16.6 ft	0-10 ft	10-13.6 ft
Bore Log Material Description*				A	A/C	A/C	A/C	A	A	A/C	A/C
SiO_2	wt%			67.68	67.24	69.72	63.08	70.56	59.01	68.73	62.08
Al_2O_3	wt%			18.61	19.95	18.39	22.51	15.89	26.43	16.41	22.57
Fe_2O_3	wt%			6.87	6.00	6.25	6.59	6.45	6.21	6.74	6.78
Sum	wt%	min	70	93.16	93.18	94.36	92.18	92.91	91.65	91.89	91.43
CaO	wt%	max	10	0.76	0.87	0.59	0.90	0.69	0.92	0.63	1.19
MgO	wt%			0.81	0.97	0.78	0.92	0.77	0.96	0.78	1.09
Na_2O	wt%			0.33	0.32	0.28	0.30	0.32	0.33	0.27	0.39
K_2O	wt%			2.09	2.05	2.12	2.29	2.06	2.35	2.10	2.22
Total Na_2O	wt%			1.71	1.68	1.67	1.80	1.68	1.88	1.65	1.85
TiO_2	wt%			1.48	1.46	1.53	1.58	1.51	1.60	1.53	1.51
MnO_2	wt%			0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.05
P_2O_5	wt%			0.11	0.12	0.11	0.14	0.11	0.14	0.11	0.14
SrO	wt%			0.06	0.07	0.06	0.08	0.05	0.10	0.05	0.08
BaO	wt%			0.13	0.12	0.12	0.13	0.12	0.13	0.11	0.12
SO_3	wt%	max	5	0.07	0.10	0.06	0.10	0.08	0.07	0.09	0.16
Cl	wt%			0.002	0.006	0.000	0.005	0.005	0.002	0.002	0.012
Moisture (as received)	wt%	max	3	17.3	17.6	18.1	20.1	18.8	20.7	23.9	18.4
Moisture (after lab preparation)	wt%	max	3	0.90	0.74	1.03	0.59	0.83	1.50	0.87	0.72
LOI**	%	max	6	9.99	7.54	6.94	10.00	7.45	10.63	7.38	9.66
Available Alkalies Test:											
Na_2O as Available Alkalies	wt%			0.2	0.2	0.16	0.17	0.18	0.17	0.17	0.21
K_2O as Available Alkalies	wt%			1.46	1.45	1.52	1.57	1.53	1.43	1.52	1.62
Available Alkalies as Na_2O equivalent (Na_2O + 0.658K_2O)	wt%			1.16	1.15	1.16	1.20	1.19	1.11	1.17	1.28

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.
Shading = parameters outside of ASTM C618 standards

Chemical Parameters - Possum Point Power Station

Client ID	Units of Measure	ASTM C618 Class F Criteria		Possum Point Summary						
TEC ID				Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment										
Bore										
Depth										
Bore Log Material Description*										
SiO_2	wt%			8	59.01	70.56	66.01	67.46	-	-
Al_2O_3	wt%			8	15.89	26.43	20.10	19.28	-	-
Fe_2O_3	wt%			8	6.00	6.87	6.49	6.52	-	-
Sum	wt%	min	70	8	91.43	94.36	92.60	92.55	0	0.0%
CaO	wt%	max	10	8	0.59	1.19	0.82	0.82	0	0.0%
MgO	wt%			8	0.77	1.09	0.89	0.87	-	-
Na_2O	wt%			8	0.27	0.39	0.32	0.32	-	-
K_2O	wt%			8	2.05	2.35	2.16	2.11	-	-
Total Na_2O	wt%			8	1.65	1.88	1.74	1.69	-	-
TiO_2	wt%			8	1.46	1.60	1.53	1.52	-	-
MnO_2	wt%			8	0.03	0.05	0.04	0.04	-	-
P_2O_5	wt%			8	0.11	0.14	0.12	0.12	-	-
SrO	wt%			8	0.05	0.10	0.07	0.07	-	-
BaO	wt%			8	0.11	0.13	0.12	0.12	-	-
SO_3	wt%	max	5	8	0.06	0.16	0.09	0.09	0	0%
Cl	wt%			8	0.00	0.012	0.004	0.0035	-	-
Moisture (as received)	wt%	max	3	8	17.29	23.90	19.35	18.57	8	100%
Moisture (after lab preparation)	wt%	max	3	8	0.59	1.50	0.90	0.85	0	0%
LOI**	%	max	6	8	6.94	10.63	8.70	8.60	8	100%
Available Alkalies Test:										
Na_2O as Available Alkalies	wt%			8	0.16	0.21	0.18	0.18	-	-
K_2O as Available Alkalies	wt%			8	1.43	1.62	1.51	1.52	-	-
Available Alkalies as Na_2O equivalent ($Na_2O + 0.658K_2O$)	wt%			8	1.11	1.28	1.18	1.17	-	-

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill

** C618 criteria is <6% LOI; however, specific requirements may vary by region and manufacturer and could be as low as 2-3%.

Shading = parameters outside of ASTM C618 standards

Physical Parameters - Possum Point Power Station

Client ID	ASTM C618 Class F Criteria		PPD-B01-(0.0-15.0)	PPD-B02-(0.0-19.5)	PPD-B03-(0.0-10.0)	PPD-B03-(10.0-18.8)	PPD-B04-(0.0-10.0)	PPD-B04-(10.0-16.6)	PPD-B05-(0.0-10.0)	PPD-B05-(10.0-13.6)
TEC ID			17-819-1	17-819-2	17-819-3	17-819-4	17-819-5	17-819-6	17-819-7	17-819-8
Impoundment			Possum Point	Possum Point	Possum Point	Possum Point	Possum Point	Possum Point	Possum Point	Possum Point
Bore			B01	B02	B03	B03	B04	B04	B05	B05
Depth			0-10 ft	0-19.5 ft	0-10 ft	10-18.8 ft	0-10 ft	10-16.6 ft	0-10 ft	10-13.6 ft
Bore Log Material Description*			A	A/C	A/C	A/C	A	A	A/C	A/C
Specific Gravity			2.45	2.42	2.25	2.34	2.55	2.25	2.48	2.40
Soundness %	max	±0.8	0.01	0.00	-0.01	-0.02	-0.01	-0.08	0.01	-0.01
Retained on #325 Mesh %	max	34	45.88	39.37	42.55	36.51	53.46	26.18	51.73	37.18
Water Req %	max	105	107	107	107	107	107	107	110	110
7 Day Control (PSI)			4740	4740	4740	4740	4740	4740	5220	5220
7 Day (PSI)			3390	3590	3310	3600	3540	3720	3280	3250
7-Day SAI, % of control	min	75	72	76	70	76	75	79	63	62
28 Day Control (PSI)			5750	5750	5750	5750	5750	5750	5600	5600
28 Day (PSI)			4470	4400	4480	4530	4300	4950	4090	4170
28-Day SAI, % of control	min	75	78	77	78	79	75	86	73	75
Organic Impurities (Color Plate #)	max	3	3	2	4	3	4	1	4	2

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			200.5	212.1	175.9	186.5	174.9	174.5	179.1	199.2
3/8"			0.0%	2.0%	2.8%	0.7%	2.9%	0.0%	10.8%	0.0%
#4			1.8%	4.3%	20.6%	1.4%	11.9%	0.3%	14.1%	0.7%
#8			9.7%	11.2%	26.9%	5.1%	13.8%	0.8%	21.0%	2.6%
#16			11.2%	12.4%	18.8%	7.3%	13.2%	2.1%	19.2%	7.6%
#30			14.5%	15.3%	8.9%	9.0%	14.9%	3.8%	12.2%	7.7%
#50			17.6%	17.3%	3.9%	12.6%	15.0%	6.4%	6.0%	11.2%
#100			17.8%	12.8%	3.1%	17.2%	11.1%	11.5%	4.1%	12.7%
#200			13.6%	6.5%	3.4%	15.9%	6.7%	20.1%	3.8%	12.9%
Pan			14.0%	18.1%	11.2%	30.6%	10.4%	54.9%	8.7%	44.7%

ASTM D1921 (Percent Retained)

Sample Weight (g)			27.9	38.3	19.7	57	18.2	51.8	15.6	51.5
#230			15.8%	6.0%	5.6%	8.8%	11.0%	6.9%	7.1%	5.0%
#270			14.0%	7.3%	7.1%	9.1%	9.9%	8.3%	8.3%	6.4%
#325			11.1%	7.0%	8.1%	7.9%	9.3%	7.5%	10.3%	6.4%
#400			10.0%	8.9%	9.1%	7.9%	10.4%	7.5%	11.5%	7.4%
#450			6.1%	66.8%	65.5%	58.2%	38.5%	58.5%	51.9%	37.9%
#500			6.8%	0.5%	1.0%	1.6%	6.0%	4.6%	2.6%	14.4%
#635			9.7%	1.0%	1.5%	2.1%	3.8%	2.9%	4.5%	8.7%
Pan			26.5%	2.3%	2.0%	4.4%	10.4%	3.7%	3.8%	13.2%

Combined

Sample Weight (g) - Percent retained per fraction			200.5	212.1	175.9	186.5	174.9	174.5	179.1	199.2
3/8" (9510 micron)			0.0%	2.0%	2.8%	0.7%	2.9%	0.0%	10.8%	0.0%
#4 (4760 micron)			1.8%	4.3%	20.6%	1.4%	11.9%	0.3%	14.1%	0.7%
#8 (2380 micron)			9.7%	11.2%	26.9%	5.1%	13.8%	0.8%	21.0%	2.6%
#16 (1190 micron)			11.2%	12.4%	18.8%	7.3%	13.2%	2.1%	19.2%	7.6%
#30 (595 micron)			14.5%	15.3%	8.9%	9.0%	14.9%	3.8%	12.2%	7.7%
#50 (297 micron)			17.6%	17.3%	3.9%	12.6%	15.0%	6.4%	6.0%	11.2%
#100 (149 micron)			17.8%	12.8%	3.1%	17.2%	11.1%	11.5%	4.1%	12.7%
#200 (74 micron)			13.6%	6.5%	3.4%	15.9%	6.7%	20.1%	3.8%	12.9%
#230 (63 micron)			2.2%	1.1%	0.6%	2.7%	1.1%	3.8%	0.6%	2.3%
#270 (53 icron)			2.0%	1.3%	0.8%	2.8%	1.0%	4.6%	0.7%	2.9%
#325 (44 micron)			1.6%	1.3%	0.9%	2.4%	1.0%	4.1%	0.9%	2.9%
#400 (37 micron)			1.4%	1.6%	1.0%	2.4%	1.1%	4.1%	1.0%	3.3%
#450 (32 micron)			0.9%	12.1%	7.3%	17.8%	4.0%	32.1%	4.5%	16.9%
#500 (28 micron)			1.0%	0.1%	0.1%	0.5%	0.6%	2.5%	0.2%	6.4%
#635 (22 micron)			1.4%	0.2%	0.2%	0.6%	0.4%	1.6%	0.4%	3.9%
Pan			3.7%	0.4%	0.2%	1.3%	1.1%	2.0%	0.3%	5.9%
Sum			100.0%	99.8%	99.7%	99.7%	99.8%	99.9%	100.0%	99.7%
Percent retained #325 Mesh			91.7%	85.4%	90.8%	77.0%	92.6%	57.5%	93.5%	63.3%

Physical Parameters - Possum Point Power Station

Client ID	ASTM C618 Class F Criteria		Possum Point Summary						
TEC ID			Number of Samples	Minimum	Maximum	Average	Median	Number Failing Criteria	% Failing Criteria
Impoundment									
Bore									
Depth									
Bore Log Material Description*									
Specific Gravity			8	2.25	2.55	2.39	2.41	-	-
Soundness %	max	±0.8	8	-0.08	0.01	-0.01	-0.01	0	0.0%
Retained on #325 Mesh %	max	34	8	26.18	53.46	41.61	40.96	7	87.5%
Water Req %	max	105	8	107	110	108	107	8	100%
7 Day Control (PSI)			8	4740	5220	4860	4740	-	-
7 Day (PSI)			8	3250	3720	3460	3465	-	-
7-Day SAI, % of control	min	75	8	62	79	72	74	4	50.0%
28 Day Control (PSI)			8	5600	5750	5713	5750	-	-
28 Day (PSI)			8	4090	4950	4424	4435	-	-
28-Day SAI, % of control	min	75	8	73	86	78	78	1	12.5%
Organic Impurities (Color Plate #)	max	3	8	1	4	3	3	3	37.5%

* A = ash (not distinguished between bottom ash or fly ash in bore log); C = various types of clay; BA = bottom ash; FA = fly ash, LS = limestone fill
Shading = parameters outside of ASTM C618 standards

ASTM D6913 (Percent Retained)

Sample Weight (g)			8	174.5	212.1	187.8	182.8
3/8"			8	0.0%	10.8%	2.4%	1.3%
#4			8	0.3%	20.6%	6.9%	3.0%
#8			8	0.8%	26.9%	11.4%	10.4%
#16			8	2.1%	19.2%	11.5%	11.8%
#30			8	3.8%	15.3%	10.8%	10.6%
#50			8	3.9%	17.6%	11.2%	11.9%
#100			8	3.1%	17.8%	11.3%	12.1%
#200			8	3.4%	20.1%	10.4%	9.8%
Pan			8	8.7%	54.9%	24.1%	16.0%

ASTM D1921 (Percent Retained)

Sample Weight (g)			8	15.6	57.0	35.0	33.1
#230			8	5.0%	15.8%	8.3%	7.0%
#270			8	6.4%	14.0%	8.8%	8.3%
#325			8	6.4%	11.1%	8.5%	8.0%
#400			8	7.4%	11.5%	9.1%	9.0%
#450			8	6.1%	66.8%	47.9%	55.1%
#500			8	0.5%	14.4%	4.7%	3.6%
#635			8	1.0%	9.7%	4.3%	3.4%
Pan			8	2.0%	26.5%	8.3%	4.1%

Combined

Sample Weight (g) - Percent retained per fraction			8	174.5	212.1	187.8	182.8
3/8" (9510 micron)			8	0.0%	10.8%	2.4%	1.3%
#4 (4760 micron)			8	0.3%	20.6%	6.9%	3.0%
#8 (2380 micron)			8	0.8%	26.9%	11.4%	10.4%
#16 (1190 micron)			8	2.1%	19.2%	11.5%	11.8%
#30 (595 micron)			8	3.8%	15.3%	10.8%	10.6%
#50 (297 micron)			8	3.9%	17.6%	11.2%	11.9%
#100 (149 micron)			8	3.1%	17.8%	11.3%	12.1%
#200 (74 micron)			8	3.4%	20.1%	10.4%	9.8%
#230 (63 micron)			8	0.6%	3.8%	1.8%	1.7%
#270 (53 icron)			8	0.7%	4.6%	2.0%	1.6%
#325 (44 micron)			8	0.9%	4.1%	1.9%	1.4%
#400 (37 micron)			8	1.0%	4.1%	2.0%	1.5%
#450 (32 micron)			8	0.9%	32.1%	12.0%	9.7%
#500 (28 micron)			8	0.1%	6.4%	1.4%	0.6%
#635 (22 micron)			8	0.2%	3.9%	1.1%	0.5%
Pan			8	0.2%	5.9%	1.9%	1.2%
Sum			8	99.7%	100.0%	99.8%	99.8%
Percent retained #325 Mesh			8	57.5%	93.5%	81.5%	88.1%

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Senate Bill 1398 Response

Coal Combustion Residuals Ash Pond Closure Assessment

TECHNICAL MEMORANDUM 3

Closure by Removal to Off-Site Commercial Landfill

November 2017

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Senate Bill 1398 Response:
Coal Combustion Residuals Ash Pond Closure Assessment

Technical Memorandum 3:
Closure by Removal to Off-Site Commercial Landfill

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Table of Contents

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1. Introduction and Summary of Findings

Virginia Senate Bill 1398 (SB 1398) requires "that every owner or operator of a coal combustion residuals (CCR) surface impoundment that is located within the Chesapeake Bay watershed … conduct an assessment of each such CCR surface impoundment (CCR unit) regarding the closure of any such unit." The assessment must include describing groundwater and surface water conditions surrounding the surface impoundments (ash ponds) and evaluating corrective measures to restore water quality (if needed), evaluating the clean closure (closure by removal) of the CCR unit by recycling/reusing the ash or moving it to a landfill and demonstrating the long-term safety of the CCR unit if it is closed in place.

SB 1398 is applicable to eleven CCR surface impoundments (referred to as ash ponds in this report) at four Dominion Energy (Dominion) power stations. On behalf of Dominion, AECOM conducted an evaluation of the groundwater and surface water on all eleven ponds and an assessment of closure options on the five ponds that have been slated for closure. Ash has been removed or is in the process of being removed from the other six ponds; therefore, these ponds are being closed by removal. Table TM3-1 provides information on the Dominion power stations and ash ponds that were included in the study.

Table TM3-1: Ash Ponds included in the Study

Power Station	CCR Units	Remaining CCR Volume (CY)(1)	Operating Status	Area (acres)
Bremo Power Station	North Ash Pond(2)	4,800,000	Slated for closure	68
	East Ash Pond	1,400,000	Ash being actively removed and transported to North Ash Pond	27
	West Ash Pond	0	Ash removed	22
Chesapeake Energy Center(3)	Bottom Ash Pond(2)	60,000	Committed to closure by removal	5
Chesterfield Power Station	Lower Ash Pond(2)	3,600,000	Slated for closure	101
	Upper Ash Pond(2)	11,300,000	Slated for closure	112
Possum Point Power Station	Ash Pond A Ash Pond B Ash Pond C	40,000	Residual ash to be removed from Ash Ponds A, B, and C and transported to Ash Pond D	18
	Ash Pond D(2)	4,009,250	Slated for closure	70
	Ash Pond E	2,250	Residual ash to be removed and transported to Ash Pond D	38
	Total Volume	**25,211,500**		

(1) CCR volumes are based on Dominion estimates as of July 10, 2017

(2) Assessed for closure options

(3) While not subject to the assessment required by SB 1398, the CCR landfill at the Chesapeake Energy Center is slated for closure in accordance with VSWMR. Virginia DEQ issued a draft solid waste permit in June 2016 for closure of the landfill, which process was later suspended at Dominion's request. The draft permit required Dominion to evaluate and propose alternative corrective measures to address groundwater impacts. In addition, in connection with a July 31, 2017, court order, Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, to include proposed additional corrective measures to address site-wide groundwater impacts.

CCR = coal combustion residuals; CY = cubic yards; DEQ = Department of Environmental Quality; VSWMR = Virginia Solid Waste Management Regulations

1.1 Study Objective

The objective of the study was to comply with the following SB 1398 requirements to ensure the long-term safety of the ash ponds while protecting public health and the environment:

- Evaluate closure by removal with recycling or reuse (beneficial use) of the CCR material
- Evaluate closure by removal with placement of CCR material in a permitted landfill
- Evaluate closure-in-place addressing long-term safety, structural, and extreme weather event resiliency
- Describe groundwater and surface water quality surrounding each ash pond, and evaluate corrective measures if needed

AECOM was tasked with critically reviewing existing information, identifying additional studies that may be needed, performing the studies, and preparing a report that addresses the requirements of SB 1398 for each of the eleven Dominion ash ponds listed in Table TM3-1.

The objective of the SB 1398 requirements is to provide members of the legislature, environmental regulators, local government officials, and the local communities with an assessment of ash pond closure options as set forth in the legislation. Specifically, the report describes how the various options could meet the objectives of safe closure, compliance with applicable federal and state rules, and protection of public health and the environment. This report is not intended, and must not be construed, to provide recommendations or conclusions regarding the selection of the options detailed herein.

AECOM developed a series of Technical Memoranda that provide a detailed analysis of the primary technical information needed to comply with SB 1398 requirements. The Technical Memoranda provide an assessment of closure by removal options (including recycling/beneficial use and landfilling); ash sampling results to supplement the beneficial use study; and evaluations of closure-in-place, groundwater and surface water conditions, and potential groundwater corrective measures. The memoranda are included as attachments to the report and are referenced as appropriate.

1.2 Technical Memorandum 3 Objective

Technical Memorandum 3 describes closure by removal options associated with disposal of CCR in permitted off-site commercial landfills as requested by SB 1398 item 3. It includes a discussion of on-site handling activities, transportation options, and landfill options for each Dominion CCR impoundment subject to the SB 1398. If implemented, the closure by removal process would follow the requirements of the CCR Rule in 40 CFR § 257.102, including development of a formal closure plan for regulatory approval.

As specified in 40 CFR § 257.102:

> An owner or operator may elect to close a CCR unit by removing and decontamination all areas affected by releases from the CCR unit. CCR removal and decontamination of the CCR unit are complete when constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to § 257.95(h) for constituents listed in appendix IV to this part.

The following sections of this memorandum describe the process for identifying viable landfills to accept the 25 million cubic yards (CY) of CCR (Section 2); the on-site processes required to support closure by removal including site infrastructure upgrades; CCR dewatering, excavation, handling, and loading (Section 3); transportation off site by truck, rail, or barge for disposal in a commercial landfill (Section 4); and station-specific considerations and options with estimated costs, schedule, and potential issues associated with each option at each site (Section 5).

1.3 Summary of Findings

Viable options for closure by removal and disposal in an off-site commercial landfill are summarized in Table TM3-2 with implementation durations, costs, and potential impacts. In general, closure by removal and trucking to nearby (within 100 miles) off-site commercial landfills costs less than comparative rail and barge options, but takes longer to implement and has higher potential safety, environmental, and community impacts. The durations shown in Table TM3-2 include the time to excavate and haul the CCR to off-site landfills, along with the up-front design, permitting, regulatory approval, and infrastructure upgrades that may be required at individual power stations to facilitate the removal.

Table TM3-2: Costs, Duration, and Potential Impacts for Closure by Removal Options

Power Station	Closure by Removal Option	Est. Schedule (Years)	Est. Cost[(1)]	Potential Impacts
Bremo Power Station	Trucking	13	$1.03B	• Ash pond stays open for 13 years (1 year design/permit/construct, remaining to transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • Safety and community risks from excavation and over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks/day each way for 12 years; truck leaving site approximately every 3 minutes for 10 hours/day Monday through Friday) • Truck traffic may result in increased noise, emissions, traffic congestion, vehicle accidents • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
	Rail	10	$1.53B	• Ash pond stays open for 10 years (2 years design/permit/construct, remaining transport), increases safety risk, results in prolonged duration for dewatering/water treatment • Safety and community risks from excavation and rail hauling due to significant volume and multi-year duration removal project (200+ railcars per week for 8 years) • Reduced hauling risks for rail vs. trucking • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation

Table TM3-2 (cont.): Costs, Duration, and Potential Impacts for Closure by Removal Options

Power Station	Closure by Removal Option	Est. Schedule (Years)	Est. Cost(1)	Potential Impacts
Chesapeake Energy Center	Trucking	2 to 3 months	$13.3M	• Safety and community risks from over-the-road hauling • Increased noise, emissions, truck traffic, accident potential • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Engineering challenges for CCR dewatering and excavation
Chesterfield Power Station	Trucking	29	$2.68B	• Ash pond stays open for 29 years (1 year design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • 29 years duration to implement exceeds CCR closure requirements of 15 years • Safety and community risks from over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks per day each way for 28 years; truck leaving site approximately every 3 minutes for 10 hours per day Monday through Friday) • Truck traffic may result in increased noise, emissions, traffic congestion, vehicle accidents • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
	Rail	24	$4.63B	• Ash pond stays open for 24 years (4 years design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • 24 years duration to implement exceeds CCR closure requirements of 15 years • Safety and community risks from excavation and rail hauling due to significant volume and multi-year duration removal project (200+ railcars per week for 20 years) • Reduced hauling risks for rail vs. trucking • Increased noise, emissions, accident potential • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation

Table TM3-2 (cont.): Costs, Duration, and Potential Impacts for Closure by Removal Options

Power Station	Closure by Removal Option	Est. Schedule (Years)	Est. Cost(1)	Potential Impacts
Possum Point Power Station	Trucking	9	$799M	• Ash pond stays open for 9 years (1 year design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • Safety and community risks from excavating and over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks per day each way for 8 years; truck leaving site approximately every 3 minutes for 10 hours per day Monday through Friday) • Truck traffic may result in increased noise, emissions, traffic congestion, vehicle accidents • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
	Rail	9	$1.11B	• Ash pond stays open for 9 years (2 years design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • Safety and community risks from excavation and rail hauling due to significant volume and multi-year duration removal project (180 railcars per week for 7 years) • Reduced hauling risks for rail vs. trucking • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
	Barge and Trucking	15	$1.7B+	• Ash pond stays open for at least 15 years (4 years design/permit/construct, remaining transport), increases safety risk, results in prolonged duration for dewatering/water treatment • Safety and community risks from CCR removal; excavation and construction noise and traffic • Option involves trucking of CCR material to barge facility and once barge reaches destination, CCR material would be trucked an additional 18 miles on public roads to landfill. • Virginia regulations require sealed containers that would need to be loaded onto and off of barges by crane, requiring infrastructure construction at both ends • Engineering risks for CCR dewatering and excavation • Lower groundwater risks after removal is completed; higher groundwater risk during removal

(1) All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

B = billion; CCR = coal combustion residuals; M = million

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2. Off-Site Landfills

2.1 Identification of Candidate Off-Site Permitted Landfills

AECOM first reviewed available records published by the Virginia Department of Environmental Quality listing currently permitted landfills (DEQ 2017). Specifically, the annual report listing the capacity and remaining service life of municipal solid waste (MSW) (sanitary) landfills reported during 2016 was reviewed. A preliminary list of candidate off-site landfills was established using the following screening criteria:

- The candidate landfill must be permitted to accept CCR
- The candidate landfill should have available disposal capacity of at least 5 million CY to accommodate CCR from one or more Dominion facility
- The candidate landfill should have a minimum of 10 years of permitted service life to accommodate the projected schedule for closure by removal of CCR from one or more Dominion facilities
- The candidate landfill must not have restrictions on the source of waste or prohibition on accepting CCR
- Candidate landfills should ideally be located within 50 miles of one or more Dominion facility when hauling by truck is considered. Landfills beyond 50 miles could be considered but costs would increase.

In addition, permitted landfills within truck hauling distance in North Carolina and Maryland were also reviewed based on annual reports provided by the respective states. Landfills served by rail were also considered, and no limit to the hauling distance was applied.

AECOM plotted candidate landfill sites identified from annual reporting along with the locations of the four Dominion facilities included in the study onto a base map showing major highways and urban areas. This map is provided on Figure TM3-1 (all figures are provided in Section 9). The landfills were classified by size (capacity) and remaining permitted life. After screening the candidate sites using the criteria listed above, off-site landfills meeting project criteria were identified and are listed on Table TM3-3. Due to the quantity of CCR to be managed (5 to 15 million CY) and the operating life required (10 to 15 years), the candidate sites consisted of commercial MSW landfills. County or regional public landfills generally lacked the capacity and/or operating life to manage the CCR from the Dominion facilities.

AECOM contacted representatives of each commercial landfill listed in Table TM3-3. The waste company representatives confirmed the availability of airspace and that the facilities could be expanded within current property boundaries to dispose of CCR for at least 10 to 15 years. Each facility contacted agreed that the CCR would be managed in a monofill. In this way, the operations could be streamlined and concerns regarding landfill gas, vector control, and post-closure settlement normally associated with MSW landfilling could be avoided. Landfills that do not currently have an active monofill have indicated that permitting of a dedicated monofill could be accomplished under existing permits in 1 to 2 years.

Table TM3-3: Candidate Off-Site Permitted Landfills

Map ID(1)	Facility Name	Facility Owner	Reported Remaining Operating Life (Years)(2)	Reported Remaining Capacity (Million CY)(2)
1	Brunswick Waste Management Facility	Republic Services	168	7.5
2	Charles City County Landfill	Waste Management	54	9.5
3	King and Queen Sanitary Landfill	Republic Services	26	6.7
4	Maplewood Recycling and Waste Disposal(3)	Waste Management	148	11.6
5	USA Waste of Virginia Landfills – Bethel	Waste Management	89	17
6	Shoosmith Landfill	Shoosmith Brothers	32	14.8

(1) Map ID refers to locations shown on Figure TM3-1

(2) Remaining permitted operating life and capacity as reported in Virginia DEQ Solid Waste Report as of end of 2016; reported capacity based on total current permitted capacity which may not be fully available for CCR disposal

(3) Facility with rail access

CY = cubic yards

Although the Atlantic Waste Disposal facility in Waverly, VA, meets the proximity, reported capacity, and operating life requirements, the owner, Waste Management, has indicated that the facility is not an available option for coal ash because of existing long-term commitments. Additionally, if the USA Waste of Virginia Landfills (Bethel Sanitary Landfill) in Hampton, VA, is not available for CCR disposal, costs and hauling times from the Chesapeake Energy Center may increase significantly.

Suitable off-site landfills for the CCR located on the four Dominion facilities in this study would be further evaluated in more detail if the closure by removal option is pursued. The landfills listed in Table TM3-3 are considered to be feasible using general solid waste industry criteria and requirements of CCR disposal.

2.2 Candidate Off-Site Landfills Accessible by Rail

AECOM identified landfills in Virginia and surrounding states with capability to accept CCR by rail. Table TM3-4 shows the facilities identified as feasible options to receive CCR by rail, and Virginia and regional locations are shown on Figures TM3-2 and TM3-3, respectively. Given the low cost per mile of rail transportation, the specific location of the landfill receiving CCR by rail is less critical. Key issues are the rail infrastructure and expandability of the site to accept and unload trains in concert with excavation and loadout rates from the power stations. The landfills listed in Table TM3-4 have current or expandable rail access and infrastructure to handle the CCR generated during a closure by removal option. Note that this table provides a sample of landfills that can accept CCR by rail and is not intended to be an exhaustive list of potential landfill options with rail access.

2.3 Landfill Summary

AECOM evaluated closure by removal options based on the identified landfill facilities and associated trucking and rail transportation options for each site. Based on discussions with industry representatives, an average tipping fee of $25 per ton for CCR disposal was carried for all landfills in this analysis. Actual tipping fees could vary significantly depending on future market conditions and the ability to adjust when and where waste materials are routed to different landfills at the time of disposal. Landfill locations are a major factor in transportation pricing, and firms have the ability to adjust tipping fees to equalize overall transportation and disposal costs between landfills at varying distances from the CCR impoundment. If the closure by removal option is pursued, a request for bid would establish criteria such as CCR quantities, route restrictions, disposal rates, and schedules. The most feasible and cost-effective landfill alternatives can be identified during this process.

Table TM3-4: Facilities with Capability to Accept CCR by Rail

Off-Site Landfill with Rail Access	Location	Capacity	Comments
Waste Management Maplewood Recycling and Waste Disposal	Amelia County, VA	12M CY, expandable	35 rail cars/day capacity; expandable
Brunswick Waste Management	Brunswick, VA	20M CY, expandable	Would need to construct 2-mile rail spur extension and offloading upgrades
Sunny Hill Farms	Fostoria, OH	30M CY	Owns fleet of 1,500 rail cars
Tunnel Hill Reclamation	New Lexington, OH	30M CY	Owns fleet of 1,500 rail cars
Waste Industries Taylor County Disposal	Mauk, GA	6.7M CY, expandable	Accepts 80 to 100 rail cars per day
Arrowhead Landfill	Uniontown, AL	62M CY; 34M CY monofill expansion permitted	Accepts 150 gondola cars per day

CY= cubic yards; M = million

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3. On-Site Activities

Closure by removal involves several on-site activities prior to transporting material off site for disposal, including construction of laydown areas and internal infrastructure, dewatering and water management, CCR excavation, on-site transportation to staging/loadout areas, drying and stockpiling to prepare for transportation, loadout to truck or rail, and backfilling and restoration of the former ash pond. General on-site activities are discussed below with site-specific considerations provided in Section 5.

3.1 Site Infrastructure to Support Removal Activities

To support the logistics of closure by removal, infrastructure would need to be constructed at each power station based on specific site constraints and chosen mode of off-site transportation. Infrastructure improvements could include on-site road networks, CCR staging areas, truck handling areas, rail yards for staging trains and loading rail cars, support areas, intersection improvements, traffic control measures, or other improvements based on site conditions. Station-specific infrastructure improvements to support closure by removal are discussed in Section 5.

3.2 Dewatering and Water Management

Dewatering of the CCR impoundments and water treatment will be required to implement closure by removal options. Dewatering will be necessary before and during excavation of CCR to remove free water (surface water) from the ash pond and interstitial (pore) water from CCR, and to control stormwater runon/runoff and groundwater.

Dewatering will likely be implemented using a combination of deep wells to penetrate the full CCR thickness and temporary trenches to direct water to low points within the impoundments before CCR removal. Dewatering systems will also include a network of pumps, collection piping, temporary storage tanks, and transfer stations to gather water and pump it to a central location for treatment. Dewatering activities will likely be initiated before excavation work and will continue on a 24/7 basis or as long as necessary to ensure workable site conditions.

Water treatment will likely consist of pre-treatment storage, chemical mixing, suspended solids removal, pH adjustment, metals precipitation, solids handling (filter press), filtration, post-treatment storage, and discharge through a piping system and associated automation and controls. Depending on dewatering flow rates, water treatment may occur on a continuous or batch basis. Discharge parameters would be regulated through a Virginia Pollutant Discharge Elimination System (VPDES) permit.

Dewatering volumes are expected to be variable, with relatively drier conditions anticipated in the consolidated impoundments at Bremo (North Pond), Possum Point (Pond D), and Chesterfield (Upper Ash Pond), and relatively wetter conditions requiring more dewatering at Chesterfield (Lower Ash Pond).

Dewatering and water treatment are a significant portion of the closure by removal option costs, requiring upfront capital expenditures and monthly operation and maintenance. For estimating the closure by removal options, AECOM has assumed dewatering and treatment for the duration of the excavation and site restoration activities. Due to the recurring monthly costs for water management, project duration becomes a significant cost driver. Station-specific dewatering and water management costs are discussed in Section 5.

3.3 CCR Excavation

Closure by removal would involve removing accumulated CCR from the subject ponds such that no residual materials remain visible, followed by over-excavating the removal footprints by approximately 6 inches. Typically, the excavation is performed in successive benches to safely step down to the pond bottom depths. Excavation would be performed with excavators and other approved equipment as designated by a licensed contractor.

CCR excavation activities should be performed in compliance with the requirements of 29 CFR §§ 1926.651 and 1926.652 for excavation and trench safety. CCR remains stable when the water content of the excavated material is below 25%, allowing for tracked equipment, such as excavators and bulldozers, as well as rubber-tired off-road dump trucks to perform the excavation work safely.

Access and egress to the excavation area is typically maintained through a series of ramps strategically placed to allow for continuous work.

3.4 On-Site Transportation to Staging/Loadout Areas

Once excavated, CCR would be loaded into off-road dump trucks and hauled from the excavation area on dedicated haul routes either to an on-site staging area within the current impoundment or a dedicated on-site stockpile area with proper containment, dust control, and water collection and treatment systems. On-site haul routes will likely need to be constructed or improved at each site to provide sufficient widths and turn radii for efficient and safe operation of large off-road dump trucks. Water trucks will be necessary on site full time to reduce fugitive dust for the duration of hauling.

Mobile conveyor systems may also be used to transfer CCR on site depending on available space and site limitations. Conveyor systems may require additional dust control measures.

3.5 Drying and Stockpiling

In some cases, the CCR may need to be temporarily stockpiled to gravity drain and/or air dry to meet acceptable moisture content, typically between 25% and 35% moisture content for transport and placement in a dry landfill, prior to loadout for off-site transportation. Drying areas may be near excavation or loadout areas, but sufficient laydown area should be planned to stockpile CCR for at least a week or more of drying time prior to loadout.

Wind rows, with water diversion channels, are also a standard method for drying CCR. Wind rows increase surface area exposed to the atmosphere and allow greater evaporation potential through exposure to wind and sun. Wind rows should be oriented to limit fugitive dust emissions. Wind-rowed CCR may require re-handling several times to rotate CCR for maximum drying potential and to achieve desired moisture content prior to loadout.

3.6 CCR Loadout for Off-Site Transportation

Designated loadout areas would be established adjacent to truck and/or rail car staging areas for efficient loading operations. CCR would likely be loaded into trucks or rail cars using rubber-tired loaders or conveyors. Truck loadout would include an on-site one-way loop road to provide safe exit from the adjacent public road, and areas for stacking and loading trucks, replacing covers, weight scaling, tire washing, and safe re-entry to adjacent public road. Rail loadout would generally involve using new or existing rail sidings and spur tracks to receive empty unit trains (85 gondola cars), splitting unit trains into smaller groups of gondola cars for on-site handling using a locomotive, installing disposable liners and loading gondolas, re-assembling trains of filled gondola cars, and staging on the adjacent siding for pickup by a freight rail firm. Potential issues with off-site transportation by truck and rail are discussed in more detail in Section 3 and in the station-specific evaluations in Section 5.

3.7 Backfilling and Restoration of Former Ash Ponds

Restoration of former ash ponds will depend on future site needs and conditions. Restoration activities could include reusing former ash pond areas as stormwater management facilities, backfilling pond areas for re-development, removing dikes and restoring original grades, creating wetlands, or restoring habitat. Restored former ash ponds could also be used to support ongoing power generating activities by serving as equipment or material storage areas, parking or staging areas, maintenance areas, etc. Post-removal use of the site should be included in the closure by removal design.

At a minimum, closure by removal activities for former ash ponds that will not serve as stormwater management units should allow decommissioning and de-classification of the impoundment dams to remove them from regulatory oversight. This would involve breaching or completely removing the earthen embankment so that it can no longer impound water. Spillway structures could be abandoned in place by grouting or other approved means, or completely removed. Remaining soil removed from the embankments and that meets regulatory criteria to allow it to remain in place can be used for a variety of purposes either during the closure by removal process or as part of the site restoration. During restoration, the embankment soil can be used to restore pre-development lines and grades and to promote efficient surface water runoff.

Restoration activities should result in a site that requires minimum long-term maintenance. Establishment of vegetation, restoration of effective surface water conveyance, and providing for erosion and sediment control are key elements of any restoration project.

For the purposes of this study, AECOM assumes that ash pond embankments that will not be incorporated into future stormwater management ponds will be removed and used within the ash pond limits as part of the restoration.

3.8 Impacts of On-Site Activities

Potential impacts associated with on-site closure by removal activities include safety, environmental, community, schedule, and cost for the various on-site closure by removal options as outlined in Table TM3-5.

Table TM3-5: Closure by Removal Considerations

Category	Considerations
Safety	• Ash pond stays open for the duration of removal, increasing safety risk, resulting in prolonged duration for dewatering/water treatment • Safety risks from excavation and over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks per day for the duration of removal) • Excavation/construction safety during the removal duration due to operating heavy equipment and dump trucks on and adjacent to the station • Rail may decrease the duration, potentially decrease the transportation-related risks; on-site safety risks remain
Environmental	• Ash pond stays open for the duration of removal, with resulting prolonged duration for dewatering and water treatment • Noise and emissions from excavation equipment, truck traffic • Dust and odor control may be required • Rail may decrease the duration, potentially decreases the transportation-related risks • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation • Removal of the CCR materials would eliminate the source of potential groundwater impacts, which would eventually benefit the groundwater quality after ash removal is completed and groundwater undergoes natural attenuation over time
Community	• Community impacts from over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks per day for the duration of removal) • Increased noise, emissions, truck traffic, accident potential • Transportation by rail may decrease community impacts; noise, safety, and emissions remain concerns
Schedule	• Significant delays or large pond volumes (Chesterfield) could cause options to exceed CCR closure requirements of 15 years • Removal of the CCR materials would eliminate the source of potential groundwater impacts, which would eventually benefit the groundwater quality after ash removal is completed and groundwater undergoes natural attenuation over time

CCR = coal combustion residuals

4. Transportation Off-Site

CCR material can be transported by truck, rail, or barge, depending on the proximity of the disposal/end use facility, rail and barge site access, and on-site restrictions. Each mode of transportation presents unique safety, environmental, and community impacts and range in costs.

4.1 Transportation by Truck

Transportation by 15 to 18 CY dump trucks and trailers with maximum 18- to 22-ton capacities (tri-, quad-, and quint-axle dump trucks) would be the most efficient means of trucking CCR. The ability to load and manage trucks efficiently at the impoundment is the primary variable for determining the number of truck loads that can reasonably be transported off site per day.

Based on our experience and discussions with industry representatives, AECOM has assumed an aggressive rate of 150 truckloads (18 tons/load) per day being transported off site. Based on a 10-hour workday, this equates to a loaded truck leaving the site every 4 minutes on average. The station-specific variables of CCR volume, haul distance to the chosen landfill, and turnaround times will determine the number of trucks in rotation to support the 150 loads per day. This production rate will require very efficient and well-designed plans for safely managing truck traffic, loading, weighing, washing, and re-entry to the local road network.

While trucking provides flexibility and ease of loading and unloading CCR, and minimizes re-handling and initial infrastructure cost, it also presents potential safety, environmental, and community risks due to the use of public roads, interactions with other drivers, and fuel usage per mile.

4.1.1 Trucking Safety

Primary transportation safety concerns for trucking are vehicle accidents causing injuries or fatalities. The Federal Highway Administration's *2016 Freight Quick Facts Report* (2016) provides large truck involvement in accidents with injury and fatality rates of 32.95 and 1.38 per billion ton-miles, respectively. Trucking the total volume of ash at the four stations included in this study could generate over 2 billion ton-miles traveled, which may result in 70 injury accidents and 3 fatalities, based on the Federal Highway Administration data. Table TM3-6 provides estimates of the number of accidents involving injuries and fatalities for each trucking option for each station.

4.1.2 Environmental Impacts

One of the primary environmental impacts of transportation is air emissions. On-road truck engine emission factors in terms of grams per mile traveled were computed using the U.S. Environmental Protection Agency (USEPA) mobile source emissions model, Motor Vehicle Emission Simulator, or MOVES2014a (USEPA, 2015). For comparison, potential emissions for each truck hauling option from the four stations is provided in Table TM3-6.

Table TM3-6: Potential Trucking Durations, Safety Incidents, and Emissions

Landfill Option	Haul Distance (one way) (miles)	Total Truck Loads (18 tons/load)	Loaded Miles (one way) (truck miles)	Hauling Duration (years)	Safety[1]		Emissions[2] (tons)				
					Potential Injuries	Potential Fatalities	NOx	VOC	CO	PM10	CO_2e
Bremo Power Station – North Pond – 6.2M CY / 8M tons											
Maplewood Landfill, Amelia County	55	447,778	24,627,778	11.5	15	0.61	136.28	17.37	61.90	16.83	67,977
Charles City Co Landfill	82	447,778	36,717,778	11.5	22	0.91	203.18	25.90	92.28	25.09	101,348
Brunswick Waste Management	104	447,778	46,568,889	11.5	28	1.15	257.69	32.85	117.04	31.83	128,539
Chesterfield – Lower Ash Pond – 3.6M CY / 4.68M tons											
Shoosmith Landfill	8	260,000	2,080,000	6.7	1	0.05	11.51	1.47	5.23	1.42	5,741
Charles City County Landfill	27	260,000	7,020,000	6.7	4	0.17	38.85	4.95	17.64	4.80	19,377
Maplewood Landfill, Amelia Co.	43	260,000	11,180,000	6.7	7	0.28	61.87	7.89	28.10	7.64	30,859
Brunswick Landfill	59	260,000	15,340,000	6.7	9	0.38	84.89	10.82	38.55	10.48	42,341
Chesterfield – Upper Ash Pond – 11.3M CY / 14.69M tons											
Shoosmith Landfill	8	816,111	6,528,889	20.9	4	0.16	36.13	4.61	16.41	4.46	18,021
Charles City County Landfill	27	816,111	22,035,000	20.9	13	0.55	121.93	15.55	55.38	15.06	60,821
Maplewood Landfill, Amelia Co.	43	816,111	35,092,778	20.9	21	0.87	194.19	24.76	88.20	23.98	96,863
Brunswick Landfill	59	816,111	48,150,556	20.9	29	1.19	266.45	33.97	121.02	32.91	132,905
Possum Point Power Station – Pond D – 4M CY / 5.2M tons											
Charles City County Landfill	100	288,889	28,888,889	7.4	17	0.72	159.86	20.38	72.61	19.74	79,739
King and Queen Sanitary Landfill	99	288,889	28,600,000	7.4	17	0.71	158.26	20.18	71.88	19.55	78,941
Chesapeake Energy Center – Bottom Ash Pond – 60k CY / 78k tons											
Big Bethel Landfill	33	4,333	143,000	0.2	0	0.00	0.79	0.10	0.36	0.10	395

(1) Federal Highway Administration's *2016 Freight Quick Facts Report*, Injury and fatality rates of 32.953 and 1.375 per billion ton-miles, respectively.

(2) Emission factors in grams/mile from USEPA Motor Vehicle Emission Simulator, MOVES2014a (USEPA, 2015) for Diesel Heavy Trucks average freeway/arterial; i.e. NOx (2.51), VOC (0.32), CO (1.14), PM_{10} (0.31), CO_2e (1252)

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NOx = nitrogen oxides; PM_{10} = particulate matter less than 10 microns in diameter; VOC = volatile organic compounds

4.1.3 Community Impacts

In addition to the inherent safety considerations for mass trucking operations, community impacts would include increased traffic, noise levels, and roadway wear and tear. Properties adjacent to haul routes would be affected most.

4.1.3.1 Truck Volume and Durations

Trucking would add 300 truck trips (150 loaded outbound and 150 empty inbound) to the chosen haul route associated with each station for estimated durations of 12 years for Bremo, 28 years at Chesterfield, and 8 years at Possum Point Power Station.

The majority of traffic impacts would occur around each station and at intersections prior to trucks entering interstates and major roadways. As indicated in Table TM3-7, AECOM calculated miles of public and residential property frontage and secondary roads along viable haul routes to evaluate potential community impacts of trucking. Public and residential frontage and secondary road use along haul routes range widely, based on station and landfill locations, from 7 miles at Chesterfield Power Station to 75 miles at Bremo Power Station.

4.1.3.2 Truck Noise

According to Virginia Department of Transportation's noise policy, a traffic noise would have an impact if either of the following two conditions is met:

- Predicted future 1-hour equivalent continuous noise level decibels (dBA) at a noise-sensitive receptor under which a series of abatement measures must be considered.
- The predicted traffic noise levels are substantially higher than the existing noise levels. A substantial noise increase is defined by the Virginia Department of Transportation as when the predicted (future design year) highway traffic noise levels exceed existing noise levels by 10 dBA or more for all noise-sensitive exterior activity uses. For example, if a receptor's existing noise level is 50 dBA, it would be considered a traffic noise impact when the future noise level is 60 dBA.

Although this policy is essentially applicable to highway traffic noise, it is used as a measure of potential truck traffic noise impact for this project. Given the lack of existing traffic data along truck routes around each facility to and from designated landfill sites, the 10 dBA substantial increase is used as the measure for a potential truck traffic noise impact.

Daytime on-road hauling truck operations associated with material transport to and from Dominion facilities and landfill sites on local roads would result in adverse noise impacts, particularly at sensitive land areas immediately adjacent to truck routes. Table TM3-8 provides the worst-case heavy truck traffic noise levels as a result of 30 daytime peak hour truck trips (15 empty trucks coming in and 15 loaded trucks going out) traveling on a local truck route at the 25 mile per hour travel speed at several distances in 10-meter increments measured from the truck route centerline. These levels were predicted using Federal Highway Administration Traffic Noise Model (TNM Version 3.5). The truck traffic noise during daytime operations is anticipated to be readily noticeable to the neighborhood immediately adjacent to the local truck routes used by each facility.

Table TM3-7: Property Types Adjacent to Trucking Routes

Landfill Option Address	County/City	Owner	Trucking Distance (miles)	Estimated Drive Time	Public Lands[1] in miles (% route)	Census Designated Places (Residential)[2] in miles (% route)	VDOT Secondary Roadways[3] in miles (% route)
Possum Point	**Prince William**						
King & Queen Sanitary Landfill 4443 Iris Rd, Little Plymouth, VA 23091	King and Queen	Republic	99	1 hr 57 min	15 (15%)	23 (23%)	37 (37%)
Charles City County Landfill 8000 Chambers Rd, Charles City, VA 23030	Charles City	Waste Management	100	1 hr 46 min	1 (1%)	29 (29%)	5 (5%)
Bremo Power Station	**Fluvanna**						
Maplewood Recycling and Waste Disposal 20221 Maplewood Rd, Jetersville, VA 23083	Amelia	Waste Management	55	1 hr 7 min	2 (3%)	1 (2%)	26 (47%)
Charles City County Landfill 8000 Chambers Rd, Charles City, VA 23030	Charles City	Waste Management	82	1 hr 23 min	1 (2%)	20 (25%)	5 (6%)
Brunswick Waste Management Facility LLC 107 Mallard Crossing Road, Lawrenceville, VA 23868	Brunswick	Republic	104	2 hr 9 min	4 (4%)	11 (10%)	26 (25%)
Chesterfield Power Station	**Chesterfield**						
Shoosmith Sanitary Landfill 11800 Lewis Road, Chester, VA 23831	Chesterfield	Shoosmith Brothers Inc.	8	14 min	0 (0%)	5 (68%)	2 (26%)
Charles City County Landfill 8000 Chambers Rd, Charles City, VA 23030	Charles City	Waste Management	27	38 min	3 (10%)	1 (3%)	15 (54%)
Maplewood Recycling and Waste Disposal 20221 Maplewood Rd, Jetersville, VA 23083	Amelia	Waste Management	43	43 min	1 (2%)	12 (28%)	4 (8%)
Brunswick Waste Management Facility LLC 107 Mallard Crossing Road, Lawrenceville, VA 23868	Brunswick	Republic	59	1 hr 3 min	3 (6%)	13 (21%)	12 (21%)
Chesapeake Energy Center	**City of Chesapeake**						
USA Waste of Virginia Landfills – Bethel 100 North Park Lane, Hampton, VA 23666	Hampton	Waste Management	29	34 min	0 (0%)	25 (86%)	1 (4%)

(1) Local, state, and federally owned lands including conservation areas, recreation areas, and military installations (Virginia Department of Conservation and Recreation, 2017)

(2) CDPs are delineated [by the U.S. Census Bureau] for the decennial census as the statistical counterparts of incorporated places. CDPs are delineated to provide data for settled concentrations of population that are identifiable by name, but are not legally incorporated under the laws of the state in which they are located. The only population/housing size requirement for CDPs is that they must contain some housing and population (U.S. Census Bureau, 2016).

(3) Public Land, Residential, and Secondary Roads (Virginia Geography Information Network, 2017)

CDPs = Census Designated Places; hr = hours; min = minutes; VDOT = Virginia Department of Transportation

Table TM3-8: TNM-Predicted Worst-Case Truck Traffic Noise

Receptor Distance to Truck Route Centerline (meters)	Noise Level (L_{eq} in dBA)
10	63
20	58
30	56
40	54

dBA = A-weighted decibel; Leq = Equivalent Continuous Noise Level; TNM = Traffic Noise Model

However, based on the likely daytime ambient background noise levels shown in Table TM3-9 for a suburban or rural area where the four facilities are located, it is unlikely that truck traffic along a local route would result in a substantial traffic noise increase, even using a worst-case scenario (i.e., 10 dBA or greater than the existing condition), with the exception of the Bremo facility (see Table TM3-9). To reduce the likely substantial truck traffic noise at the Bremo facility, use of local routes that have minimal exposure to noise-sensitive receptors is recommended.

Table TM3-9: Potential Truck Traffic Noise Impact

Power Station	Neighborhood Characteristics	Typical Background Level (dBA)	With Substantial Increase	Potential Truck Traffic Noise Impact
Bremo	Rural	50	60	Likely
Chesterfield	Suburban	55	65	No
Chesapeake	Suburban	55	65	No
Possum Point	Suburban	55	65	No

dBA = A-weighted decibel

4.1.4 Road Wear

Physical impacts to secondary roads adjacent to power stations can be expected given the addition of 300 truck trips per day for each site associated with the trucking option. AECOM has assumed milling and replacement of 5 miles of adjacent secondary road surfaces at a 10-year interval or at least once at each station during or after CCR hauling by truck. At the Bremo Station, which requires the use of mostly secondary road for haul routes, we assumed 50 miles of road repaving and milling.

4.1.5 Trucking Cost

Trucking costs per ton are highly dependent on the haul distance and number of turns per day. Generally, trucking costs $1,000/day for the size of dump trucks that would likely be used for this project. The cost per ton would be directly related to the tons hauled per day per truck, which is directly related to distance from the power station to the landfill and turnaround times. For example, trucking costs would be approximately $15/ton for a truck hauling 18 tons per load completing four round trips per 10-hour day (total of 72 tons hauled). The cost per ton rate would be higher for longer turnaround times (fewer tons/day/truck) and lower for shorter turnaround times per day (more tons/day/truck), and will vary with oil prices at the time of the project.

4.2 Transportation by Rail

Each power station is located adjacent to mainline railroad tracks owned by CSX Transportation and includes adjacent rail sidings and spur tracks associated with current and former coal shipments. Three stations formerly received coal shipments by rail, and one station (Chesterfield) is currently receiving coal by rail.

Transportation by rail would include arrangements for dedicated unit trains to haul CCR from each station to a landfill with capability to accept CCR by rail. Ideally, the rail transportation would be handled by a single freight railroad operator to avoid added interchange fees.

The size and delivery frequency of unit trains would likely be determined by the ability to excavate, dry, and load CCR at each station. Loading would likely use rubber-tired wheel loaders or conveyor systems fed with loaders. Flat-bottom gondola cars with disposable liners would likely be the most efficient for CCR hauling and unloading at the landfill.

At the landfill, rail cars could be unloaded using a gantry-mounted smooth bucket excavator to move CCR from rail cars to off-road dump trucks for subsequent placement in the landfill. Rotary dumpers are another potential option for rapidly unloading rail cars, but the infrastructure investment would be significant. Numerous rail car options and unloading methods could be considered depending on contractor methods in the future.

Based on discussions with landfill operators, acceptance rates of CCR by rail is generally not a constraining factor as long as sufficient lead time (6 to 12 months) is provided in the project for permit modifications and physical expansion of monofills and rail infrastructure to match acceptance rate needs.

Transportation by rail will include significant upfront infrastructure investment to install and expand sidings, switches, and spurs to facilitate efficient train handling, loading, and staging at each power station. The extent and cost of infrastructure improvements to support rail transportation will be contractor specific and site specific, as discussed in Section 5.

4.2.1 Rail Safety

Railroad transportation safety metrics are typically measured in fatalities and incidents per billion ton-miles. According to the Federal Highway Administration's 2016 Freight Quick Facts Report, rail fatalities and injuries were 2.17 and 0.28 per billion ton-miles, respectively. Table TM3-10 provides a summary of potential incidents and fatalities for hauling all the CCR from each station by rail to the Maplewood Landfill facility in Amelia County.

4.2.2 Environmental Impacts

Railroad operations are usually described in terms of different types of operation, namely line haul and switching. Line haul rail operations refer to the movement of cargo over long distances and would include initiation or termination of a line haul trip at a facility. Switching rail operations refer to the assembling and dissembling of trains at various locations within a facility. USEPA has established port-related rail operation-related locomotive line haul emission factors in terms of grams per horsepower-hour for the year 2018 in *Current Methodologies in Preparing Mobile Source Port-related Emission Inventories* (USEPA, 2009). These emission factors are presented in Table TM3-11 and can be used to predict rail operational emissions for the proposed four facilities if the rail option is elected. If it is assumed that a locomotive has a 3,000-horsepower engine, the total emission from a unit rail trip can be predicted based on the engine size, number of locomotives used, and travel speed and distance.

Table TM3-10: Railroad Safety Summary

Power Station	CCR Volume (million CY)	Nearest Disposal Facility with Rail Access – Maplewood Landfill, Amelia County (miles)	Total Ton-Miles (billions)	Potential Injuries[(1)]	Potential Fatalities[(1)]
Bremo	6.2	97	0.78	1.70	0.22
Chesapeake	0.06	137	0.01	0.02	0.00
Chesterfield	14.9	51	0.99	2.15	0.27
Possum Point	4.0	120	0.62	1.36	0.17

[(1)] Federal Highway Administration's *2016 Freight Quick Facts Report* injury and fatality rates for freight rail of 2.172 and 0.278 per billion ton-miles, respectively.

Table TM3-11: Line-Haul Locomotive Emission Factor

		Emission Factor (gram/horsepower-hour)				
Year	Source	NOx	VOC	CO	PM_{10}	CO_2e
2018	Line-Haul Locomotive	6.20	0.23	1.28	0.15	495.25

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NOx = nitrogen oxides; PM_{10} = particulate matter less than 10 microns in diameter; VOC = volatile organic compounds

4.2.3 Rail Cost

Costs for transportation by rail can be efficient on a per-ton basis once the appropriate infrastructure is in place for loading, unloading, and handling railcars, but upfront costs can be significant. To cover these large upfront costs, rail will generally be a more efficient option for projects with longer durations.

Typically, the marginal cost for transportation by rail is low on a per-mile basis, which extends the area of feasible landfill locations much farther from the stations. Based on this advantage, the search for landfills with capability to accept CCR by rail extended to adjacent states and as far as Ohio and Alabama. The estimated cost for transportation by rail is approximately $50/ton. These costs do not include the on-site costs for rail infrastructure improvements, CCR dewatering, handling, or loading, and assume volumes on the order of 1 to 2 million tons per year over a 10-year duration.

4.3 Barge

Transporting ash by barge in Virginia must comply with 9VAC20-170, Transportation of Solid and Medical Wastes on State Waters, which requires use of watertight containers meeting strict specifications to prevent the release of wastes in the event of an incident. Containers must comply with the testing and certification requirements by the U.S. Coast Guard, including the International Convention for Safe Containers standards for ocean shipping containers, and the American Bureau of Shipping general specifications for weather tightness, and all associated testing initially and at 6-month intervals thereafter. Given the stringent requirements for containerizing CCR to meet these regulations and the associated infrastructure costs to load, handle, transport, and unload containers, the option to transport CCR in containers by barge is not considered to be a reasonable or cost-effective option for transporting CCR relative to trucking and rail options.

For comparison purposes, a conceptual container by barge option is presented for the Possum Point site in Section 5. In general, barge transportation requires adequate shoreline facilities with sufficient channel depth (typically greater than 12 feet mean low water), docking and mooring facilities, loading and unloading systems including container cranes and container handling systems installed at the station and port facilities, transportation systems (truck chassis) to haul containers from the port facility to the landfill, and a system to dump containers and reseal them for the return trip. The certified watertight containers would need to be special ordered a year or more ahead of time. Estimated capacity per container is approximately 20 tons, and containers would likely be transported 100 at a time on a deck barge pushed by a tug. To accommodate barge transportation, facility upgrades would be necessary, including dredging, support facility designs, and subsequent marine construction.

4.3.1 Barge Safety

Safety-related statistics for all modes of freight transportation show, on a ton-mile basis, that there is one fatality in the inland marine sector for every 22.7 fatalities in the rail sector and 155 fatalities in the highway sector. With respect to injuries among these sectors, there is one injury in the inland marine sector for every 125.2 in the rail sector and 2,171.5 in the highway sector.

4.3.2 Environmental Impacts

The same USEPA reference mentioned above was used to obtain tug boat general emission factors. A marine vessel trip such as for a tug boat includes several travel modes such as cruise, reduced speed zone, maneuvering, and hoteling. A tug boat typically travels at a relatively slow speed with an average speed around 10 knots and possibly half that when towing or pushing a barge. Table TM3-12 provides slow speed diesel emission factors in terms of grams per horsepower-hour assuming a tug boat engine is fired with marine diesel oil. For a tug boat with a 2,000-horsepower engine, the total emission from a unit marine trip can be predicted based on the engine size and travel speed and distance.

Table TM3-12: Tug Boat Emission Factor

	Emission Factor (gram/horsepower-hour)					
Source	**NOx**	**VOC**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**CO_2e**
Tug boat	12.68	0.45	1.04	0.34	0.31	439.07

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; VOC = volatile organic compounds

5. Site-Specific Closure by Removal Considerations

Site-specific options identified for closure by removal and disposal in a commercial landfill are discussed in the following sections of this memorandum. AECOM reviewed each site for trucking, rail, and barge transportation viability, as described in detail in the following sections.

5.1 Bremo Power Station

The remaining CCR at Bremo Power Station is being consolidated in the North Pond, which is estimated to contain approximately 6.2 million cubic yards of CCR (8.1 million tons). A dewatering and water treatment system is currently in use during excavation and consolidation of CCR from the East and West Ponds to the North Pond.

5.1.1 Trucking

A CCR stockpiling and truck loading area could be set up within the northern footprint of the North Pond or in a former recreation area immediately adjacent to the north. Truck access to the North Pond is via an existing entrance to State Route 656 immediately north of the North Pond. Due to an 18-ton bridge weight limit on Route 656 west of the site, truck hauling would have to proceed to the east on Route 656. A general arrangement for material handing for the trucking option is shown on Figure TM3-4 (Closure by Removal Trucking Plan for Bremo Power Station). Significant on-site costs to support the trucking option would include dewatering the impoundment, excavation and on-site hauling with off-road trucks to the stockpile area, construction of the stockpile containment area, and loading, weighing, and washing the trucks.

The closest reasonable landfill options for disposal of CCR by truck from Bremo include the Maplewood Landfill in Amelia County (46 miles), the Charles City County Landfill (82 miles), and the Brunswick Waste Management Facility in Lawrenceville, VA (104 miles). Potential trucking routes for these landfills are shown on Figure TM3-5.

Based on loading out 150 trucks per day for 5 days per week (hauling 2,700 tons off site per day) , the transportation and disposal portion of this trucking option has an expected duration of 13 years (1 year to design/permit/construct, and 12 years to transport).

5.1.2 Rail

The existing rail facilities at the Bremo station are suitable for re-purposing to transport CCR off site. Rail facilities include a CSX mainline to the south, with a siding on the north side of the mainline capable of storing up to 100 gondola cars, as indicated in Figure TM3-6. A spur from the siding leads to a small on-site rail yard located adjacent to the former coal pile. The yard has not been in use since the plant ceased burning coal and is ideal for a small locomotive to handle empty and loaded rail cars. A temporary CCR staging area could be constructed in the former coal pile area to load rail cars with a ramp and rubber tire loader or conveyor system.

Significant on-site costs to support the rail option would include dewatering the impoundment, excavation and on-site hauling with off-road trucks to the stockpile area, construction of the stockpile containment area, and a system for loading rail cars.

Based on loading out an average of 2.5 unit trains per week (85 gondola cars/train at 90 ton capacity each), which is the equivalent of 19,125 tons per week (~1M tons/year) via rail, the transportation and disposal activities for this rail option are expected to take approximately 10 years to complete (2 years to design/permit/construct, and 8 years to transport).

5.1.3 Barge

Based on the location of the Bremo Station on the upper James River, barging CCR off site is not a feasible option due to shallow water, rapids/rock ledges, and bridges.

5.1.4 Site Restoration

For cost estimating purposes, AECOM assumes restoration of the Bremo North Pond would include removing and re-grading the dam (approximately 1.2 million CY) into the footprint of the former pond to restore the area as a small valley. The entire disturbed area would be fine-graded, seeded, and allowed to naturalize over time.

5.1.5 Costs

Cost estimates for the viable closure by removal options identified for the Bremo Power Station are summarized in Table TM3-13. Additional details on cost components are provided in Section 6. The cost estimate includes the infrastructure development, dewatering, on-site handling, and site restoration associated with each transportation option.

Table TM3-13: Duration, Costs, and Potential Impacts for Closure by Removal to Off-Site Commercial Landfill – Bremo

Closure by Removal Option	Schedule (years)	Cost[1]	Potential Impacts
Trucking	13	$1.03B	• Ash pond stays open for 13 years (1 year design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • Safety/community risks from excavation and over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks/day each way for 12 years; truck leaving site approx. every 3 minutes for 10 hours/day Monday through Friday) • Truck traffic may result in increased noise, emissions, traffic congestion, vehicle accidents • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
Rail	10	$1.53B	• Ash pond stays open for 10 years (2 years design/permit/construct, remaining transport), increases safety risk, results in prolonged duration for dewatering/water treatment • Safety and community risks from excavation and rail hauling due to significant volume and multi-year duration removal project (200+ railcars per week for 8 years) • Reduced hauling risks for rail vs. trucking • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation

(1) All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

B = billion; CCR = coal combustion residuals

5.2 Chesapeake Energy Center

Dominion has committed to removing the CCR materials from the Bottom Ash Pond for beneficial use or off-site disposal. Closure by removal at Chesapeake Energy Center would likely be accomplished by transporting CCR by truck. Due to the relatively small volume of CCR at the Chesapeake Energy Center (60,000 CY), reestablishment of the existing rail spur or barge dock and constructing loading facilities to haul the small volume would be cost prohibitive.

5.2.1 Trucking

A general arrangement for material handing for the trucking option is shown on Figure TM3-7. The closest reasonable landfill option for disposal of CCR by truck from the Chesapeake Energy Center is the USA Waste of Virginia Landfills (Bethel Sanitary Landfill) in Hampton, VA, operated by Waste Management (33 miles). The potential trucking routes for these landfills are shown on Figure TM3-8.

Due to the low volume of CCR, the truck hauling rate would be slower than the other stations. Based on trucking approximately 1,800 tons off site per day (100 truckloads) for 5 days per week, this option is expected to take approximately 2 to 3 months to complete.

5.2.2 Rail

Due to the relatively small volume of CCR, removal by rail is cost-prohibitive when considering required infrastructure improvement costs.

5.2.3 Barge

Due to the relatively small volume of CCR, removal by barge is cost-prohibitive when considering required infrastructure improvement costs.

5.2.4 Site Restoration

For cost estimating purposes, AECOM assumed 60,000 CY of clean fill would be imported to replace the bottom ash and provide stability for the landfill.

5.2.5 Costs

Viable closure by removal options identified for the Chesapeake Energy Center are summarized in Table TM3-14, including schedule, costs, and potential impacts. More detailed cost components are included in Section 6.

Table TM3-14: Duration, Cost, and Potential Impacts for Closure by Removal to Off-Site Commercial Landfill – Chesapeake Energy Center

Closure by Removal Option	Schedule	Cost(1)	Potential Impacts
Trucking	2 to 3 months	$13.3M	• Safety and community risks from over-the-road hauling • Increased noise, emissions, truck traffic, accident potential • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Engineering challenges for CCR dewatering and excavation

(1) All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

CCR = coal combustion residuals; M = million

5.3 Chesterfield Power Station

AECOM evaluated the Chesterfield Power Station for trucking, rail, and barge transportation viability, as described in detail in the following sections. Two separate CCR impoundments are located at the Chesterfield Power Station:

- The Lower Ash Pond contains approximately 3.6 million CY of CCR, which is transported from the plant as a slurry, excavated from the channel, and stacked for additional handling. The Lower Ash Pond is located close to the water table and dewatering and treatment is expected to be necessary full-time during all site activities.
- The Upper Ash Pond contains approximately 11.3 million CY of CCR that was dewatered, trucked, and placed in controlled lifts well above the height of the surrounding berms. The Upper Ash Pond is much higher on the landscape and the CCR has previously been dried, so dewatering is only expected to be necessary for approximately the last third of the excavation activities.

5.3.1 Trucking

CCR stockpiling and truck loading area(s) could be set up within the northern footprint of the Lower Ash Pond or western end of the Upper Ash Pond. Truck access is via existing Coxendale Road and Old Stage Road, which also serves the Henricus Historical Park and county boat ramp. A general arrangement for material handing for the trucking option is shown on Figure TM3-9. The truck routing around Chesterfield Power Station could create localized traffic conditions that could impact access to Henricus Park and the county boat ramp, and would require amendment of the current Conditional Use Permit to allow hauling of CCR on county roads.

Significant on-site costs to support the trucking option would include dewatering the impoundments; excavation and on-site hauling with off-road trucks to the stockpile area; construction of the stockpile containment area; and loading, weighing, and washing the trucks.

The closest reasonable landfill options for disposal of CCR by truck from Chesterfield Power Station are the Shoosmith Landfill in Chester, VA (8 miles), Charles City County Landfill (27 miles), Maplewood Landfill in Amelia County (43 miles), and the Brunswick Landfill in Brunswick County (59 miles). Potential trucking routes for these landfills are shown on Figure TM3-10.

Based on trucking approximately 2,700 tons off site per day (150 truckloads) for 5 days per week, the transportation and disposal activities are expected to take a total of 29 years to complete (1 year to design/permit/construct, and 28 years to transport).

5.3.2 Rail

The existing rail facilities at Chesterfield Power Station are fully utilized for transporting coal to the power station. A new rail network would need to be constructed to receive, stage, load, and re-assemble gondolas for CCR loading and transportation. Sufficient space appears to be available for a new siding adjacent to the existing sidings west of the station, and a new spur to the south with four to six switched tracks for loading CCR adjacent to the Lower and Upper Ash Ponds. However, space is extremely limited for constructing a dedicated rail connection between a new siding to the west and spurs to the south. This connection may require moving current tracks or adding switches to share a portion of track with the inbound coal trains. Close coordination during movement of coal and CCR rail cars would be required to minimize delays to either operation. A general concept for adding additional siding and spurs at Chesterfield Power Station is provided in Figure TM3-11. On-site rail improvements and train handling activities to facilitate transporting CCR by rail at the Chesterfield Power Station are estimated to cost approximately $60 million.

Significant on-site costs to support the rail option would include dewatering the impoundments, excavation and on-site hauling with off-road trucks to the stockpile area, construction of the stockpile containment area, and a system for loading rail cars with rubber-tire loaders or conveyors.

Several in-state and out-of-state landfill options are available for receiving CCR by rail, including the Maplewood facility in Amelia County, VA and the Brunswick facility in Lawrenceville, VA, as well as facilities in Ohio, Georgia, and Alabama.

Based on loading out an average of 2.5 unit trains per week (85 gondola cars/train at 90 ton capacity each), which is the equivalent of 19,125 tons per week (~1M tons/year) via rail, the transportation and disposal activities for this rail option are expected to take approximately 24 years to complete (4 years to design/permit/construct, and 20 years to transport).

Given the ongoing use of coal at Chesterfield Power Station, an option for using the empty coal trains to backhaul CCR was considered and determined to be non-viable for numerous reasons. First, CCR and coal are fundamentally different materials with different handling properties and would require different types of rail cars. Coal hopper cars loaded with CCR would likely experience problems with the CCR bridging and jamming the hopper systems, and would require extensive cleaning before the car could be used for coal again. The locations for coal loading and unloading would differ from the locations for CCR loading and unloading, so separate handling systems would be required regardless of whether the same trains and cars were used for both hauls. Coordination of coal trains and power demands requires accurate scheduling. Using coal trains to haul CCR would hamper and complicate coal shipments and create inefficiencies in coal delivery. For these reasons, backhauling CCR in empty coal trains was eliminated from further consideration as an option for CCR transportation.

5.3.3 Barge

Given the stringent requirements for containerizing CCR to meet the regulations and the associated infrastructure costs to load, handle, transport, and unload containers, the option to transport CCR in containers by barge is not considered to be a reasonable or cost-effective option for transporting CCR relative to trucking and rail options. In general, barge transportation would require adequate shoreline facilities with sufficient channel depth (typically greater than 12 feet mean low water), docking and mooring facilities, loading and unloading systems including container cranes and container handling systems installed at the station and port facilities, transportation systems (truck chassis) to haul containers from the port facility to the landfill, and a system to dump containers and reseal them for the return trip. The certified watertight containers would need to be special ordered at least 1 year in advance. To accommodate barge transportation, facility upgrades would be necessary, including dredging, support facility designs, and subsequent marine construction.

The Chesterfield Power Station is approximately 18 nautical miles northwest of Port of Weanack in Charles City, VA, which is a viable port location to support CCR offloading and trucking another 12 miles to the Charles City Landfill. However, given the extensive infrastructure requirements and inefficient handling required to support a container by barge option for such a short distance and large volume of CCR, barging is not considered feasible for Chesterfield Power Station.

A preliminary option to transport CCR to a barge port on the Mississippi River was also considered, but eliminated based on the excessive costs to handle CCR. Under this option, CCR would have to be transferred from a river barge to an ocean-going barge to make the trip around to the Gulf of Mexico and up the Mississippi, where it would be offloaded at a barge port onto trucks and transported to a landfill in the Midwest. Given viable rail and trucking options for CCR transportation and disposal, transportation by barge from Chesterfield Power Station was not considered to be viable.

5.3.4 Site Restoration

Site restoration for Chesterfield Power Station following CCR removal includes restoring the footprints of the Upper and Lower Ash Ponds to a grade above the floodplain, or approximately 18 feet msl. For cost estimating purposes, AECOM assumed the remaining berms around the Upper Ash Pond would be pushed into the pond and re-graded to restore the area to a flat surface. Due to its lower elevation, the Lower Ash Pond would require importing approximately 3 million CY of clean fill to replace the removed CCR and restore the site to an elevation of 18 feet msl.

5.3.5 Costs

Cost estimates for the viable closure by removal options identified for the Chesterfield Power Station, including a breakdown for the Upper and Lower Ash Ponds, are summarized in Table TM3-15, with more details on cost components provided in Section 6.

5.4 Possum Point Power Station

The remaining CCR at Possum Point Power Station has been consolidated in Pond D, which is estimated to contain approximately 4.0 million CY of CCR (5.2 million tons). A dewatering and water treatment system is currently on site and used for water management during consolidation of CCR in Pond D. Well points are installed in Pond D to remove surface water and pore water and facilitate CCR placement. The following sections provide site-specific considerations, durations, and cost estimates for closing Pond D by removal and disposal of CCR in a commercial landfill.

Table TM3-15: Duration, Cost, and Potential Impacts for Closure by Removal to Off-Site Landfill – Chesterfield Power Station

Closure by Removal Option	Schedule (years)	Cost(1)	Potential Impacts
Trucking	29	$2.68B	• Ash pond stays open for 29 years (1 year design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • 29 years duration to implement exceeds CCR closure requirements of 15 years • Safety and community risks from over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks per day each way for 28 years; truck leaving site approximately every 3 minutes for 10 hours per day Monday through Friday) • Truck traffic may result in increased noise, emissions, traffic congestion, vehicle accidents • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
Rail	24	$4.63B	• Ash pond stays open for 24 years (4 years design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • 24 years duration to implement exceeds CCR closure requirements of 15 years • Safety and community risks from excavation and rail hauling due to significant volume and multi-year duration removal project (200+ railcars per week for 20 years) • Reduced hauling risks for rail vs. trucking • Increased noise, emissions, accident potential • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation

(1) All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

B = billion; CCR = coal combustion residuals

5.4.1 Trucking

CCR stockpiling and truck loading area(s) could be set up within the footprint of Pond D itself, or the adjacent former Pond E. Truck access is via the existing Possum Point Road. A general arrangement for material handling for the trucking option is shown on Figure TM3-12.

Significant on-site costs to support the trucking option would include dewatering the impoundment; excavation and on-site hauling with off-road trucks to the stockpile area; construction of the stockpile containment area; and loading, weighing, and washing the trucks.

The closest reasonable landfill options for disposal of CCR by truck from Possum Point are the Charles City Landfill in Charles City County (100 miles) and the King and Queen Sanitary Landfill in King and Queen County (99 miles). Potential trucking routes for these landfills are shown on Figure TM3-13.

Based on trucking approximately 2,700 tons off site per day (150 truckloads) for 5 days per week, the transportation and disposal activities for this trucking option are expected to take a total of approximately 9 years to complete (1 year to design/permit/construct, and 8 years to transport).

5.4.2 Rail

The existing rail facilities at the Possum Point Power Station consist of mainline tracks and a siding east of the plant. The former coal yard southwest of the plant is served by a rail spur and several yard tracks west of the main line, and is a viable location to stockpile CCR and load rail cars, as shown on Figure TM3-14. This option would require transportation of CCR from the impoundment to the train loading area using on-road trucks traveling on Possum Point Road. This extra transportation step is not ideal, but would be necessary to access the existing rail infrastructure at Possum Point.

An alternative option was considered to eliminate the hauling on Possum Point Road, by constructing a new rail spur and track yard on the west side of the mainline, which would provide direct access to transport CCR from Pond D to the rail loading operation in one step using off-road dump trucks. This option was eliminated due to the difficulty of switching CCR rail cars to and from a western spur, which would create untenable conflicts with frequent commuter trains and freight rail traffic on the main line.

Based on loading out an average of two unit trains per week (85 gondola cars/train at 90 ton capacity each), which is the equivalent of 15,300 tons per week (~800,000 tons/year) via rail, the transportation and disposal activities for this rail option are expected to take approximately 9 years to complete (2 years to design/permit/construct, and 7 years to transport). Due to frequent commuter rail traffic on the main line adjacent to the Possum Point Power Station, the estimated frequency of train loads was reduced to an average of two per week rather than the two and a half per week assumed at other stations.

5.4.3 Barge

Given the stringent requirements for containerizing CCR to meet the regulations and the associated infrastructure costs to load, handle, transport, and unload containers, the option to transport CCR in containers by barge is not considered to be a reasonable or cost-effective option for transporting CCR relative to trucking and rail options. In general, barge transportation would require adequate shoreline facilities with sufficient channel depth (typically greater than 12 feet mean low water), docking and mooring facilities, loading and unloading systems including container cranes and container handling systems installed at the station and port facilities, transportation systems (truck chassis) to haul containers from the port facility to the landfill, and a system to dump containers and reseal them for the return trip. The certified watertight containers would need to be special ordered at least 1 year in advance. To accommodate barge transportation, facility upgrades would be necessary, including dredging, support facility designs, and subsequent marine construction.

To comply with current state code, transportation of CCR by barge would require use of certified watertight containers meeting the required specifications in 9VAC20-170. Because the Possum Point Power Station is located on the Potomac River and the trucking distance to viable CCR landfills is relatively long (100 miles), a conceptual option of transporting CCR in containers by barge was developed. This option would include placing CCR in 20-foot by 8-foot by 8-foot watertight steel containers (approximately 20 tons of CCR per container), transporting the containers to a staging area at Possum Point adjacent to the river, loading the containers onto deck barges using a crane system, transporting the barge with a tug down the Potomac River to Chesapeake Bay and up the James River to the Port of Weanack in Charles City County, offloading at Weanack using a container crane, staging containers and loading them on truck chassis, and transporting the containers by truck an additional 12 miles on public roads to the Charles City Landfill for offloading. The system would be reversed for concurrently transporting empty containers back to Possum Point for refilling. Figure TM3-15 shows a conceptual arrangement for loading barges. Figure TM3-16 shows the potential barge route between Possum Point and the Port of Weanack, and subsequent truck route to the Charles City County Landfill.

Extensive infrastructure development would be required at Possum Point to enable container handling, including dredging in the Potomac River from the main channel to a barge loading area; constructing a mooring system, finger pier, and mooring dolphins for securing empty and full barges; constructing a container crane system or roll-on/roll-off ramp system at Possum Point to load full containers onto the barges; and removing and staging empty containers. Bulkheading, shoreline stabilization, or other geotechnical ground improvement would also likely be necessary to support the infrastructure. Dredging and marine construction would require full engineering design and permitting by the U.S. Army Corps of Engineers, Virginia Department of Environmental Quality, and likely the Virginia Marine Resources Commission. Infrastructure at the Port of Weanack is already in place including a bulkhead and mooring systems, a paved back lot with a heavy load rating, and existing crane rails. A container crane and yard carriers would need to be brought in for container handling.

If a container by barge option were pursued, feasible options would likely include at least six deck barges in rotation with each carrying approximately 150 containers (approximately 3,000 tons CCR/barge load). Each barge rotation would likely include 2 days at Possum Point to unload empty containers and load full containers, 2 days marine transit to Port of Weanack, 2 days at Port Weanack to offload full containers and reload with empty containers, and 2 days return transit. Assuming three full barge loads leaving Possum Point per week (approximately 9,000 tons/week, or 468,000 tons/year), the transportation and disposal activities under this option are expected to take approximately 15 years to complete (4 years to design/permit/construct infrastructure, and 11 years to transport and dispose CCR).

5.4.4 Costs

Cost estimates for the closure by removal options identified for the Possum Point Power Station are summarized in Table TM3-16, with more details on cost components provided in Section 6. The cost estimate includes the infrastructure development, dewatering, on-site handling, and site restoration associated with each transportation option. Due to the complexity and inefficiency of a container by barge option, the marine terminal industry could not provide planning level pricing for this option. The barging cost estimate below is based on a cursory preliminary analysis.

Table TM3-16: Duration, Cost, and Potential Impacts for Closure by Removal to Off-Site Landfill – Possum Point Power Station

Closure by Removal Option	Schedule (Years)	Cost[1]	Potential Impacts
Trucking	9	$799M	• Ash pond stays open for 9 years (1 year design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • Safety and community risks from excavating and over-the-road hauling due to significant volume and multi-year duration removal project (150 trucks per day each way for 8 years; truck leaving site approximately every 3 minutes for 10 hours per day Monday through Friday) • Truck traffic may result in increased noise, emissions, traffic congestion, vehicle accidents • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
Rail	9	$1.11B	• Ash pond stays open for 9 years (2 years design/permit/construct, remaining transport), increases safety risk, and results in prolonged duration for dewatering/water treatment • Safety and community risks from excavation and rail hauling due to significant volume and multi-year duration removal project (180 railcars per week for 7 years) • Reduced hauling risks for rail vs. trucking • Excavation and construction noise and traffic • Removes source of potential groundwater impacts • Greater potential for groundwater migration during CCR removal • Engineering challenges for CCR dewatering and excavation
Barge and Trucking	15	$1.7B+	• Ash pond stays open for at least 15 years (4 years design/permit/construct, remaining transport), increases safety risk, results in prolonged duration for dewatering/water treatment • Safety and community risks from CCR removal; excavation and construction noise and traffic • Option involves trucking of CCR material to barge facility and once barge reaches destination, CCR material would be trucked an additional 18 miles on public roads to landfill. • Virginia regulations require sealed containers that would need to be loaded onto and off of barges by crane, requiring infrastructure construction at both ends • Engineering risks for CCR dewatering and excavation • Lower groundwater risks after removal is completed; higher groundwater risk during removal

(1) All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

B = billion; CCR = coal combustion residuals; M = million

6. Cost Summary and Assumptions

To support this assessment, AECOM developed cost estimates for various closure alternatives for each of the four power stations. These Opinions of Probable Cost are estimates of possible construction costs for informational purposes. The estimates are Class 5 Estimates (see Table TM3-17) and are limited to the conditions existing at issuance and not a guarantee of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, etc. may affect the accuracy of these estimates. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

Table TM3-17: Cost Estimate Classification Matrix

Estimate Class	Primary Characteristic	Secondary Characteristic			
	Level of Project Definition[1]	End Usage[2]	Methodology[3]	Expected Accuracy Range[4]	Preparation Effort[5]
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: –20% to –50% H: +30% to +100%	1
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: –15% to –30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, authorization, or control	Semi-detailed unit costs with assembly level line items	L: –10% to –20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: –5% to –15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: –3% to –10% H: +3% to +15%	5 to 100

Source: AACE (2005)

(1) Expressed as percent of complete definition

(2) Typical purpose of estimate

(3) Typical estimating method

(4) Typical variation in low and high ranges. The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

(5) Typical degree of effort relative to least cost index of 1. If the range index value of “1” represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

H = high; L = low

A summary of costs associated with closure by removal options for the four Dominion power stations is provided as Table TM3-18. The cost estimate includes the infrastructure development, dewatering, on-site handling, and site restoration associated with each transportation option as well as applied overheads, contingency, and escalation rates based on project duration.

Table TM3-18: Cost Summary for Closure by Removal Options

Removal Method	Bremo North Ash Pond (6.2M CY/ 8.1M Tons)	Chesapeake Bottom Ash Pond (60k CY/ 78k Tons)	Chesterfield Lower/Upper Ash Ponds (14.9M CY/ 19.4M Tons)	Possum Point Ash Pond D (4M CY/ 5.2M Tons)
Trucking to Landfill				
Site Upgrades, Temporary Facilities, Maintenance	$12M	$1.3M	$40M	$10M
Dewatering and Treatment	$132M	$3.5M	$253M	$128M
Site Restoration	$15M	$1.7M	$228M	$14M
Road Milling	$48M	—	$12M	$5M
CCR Excavation and On-site Handling	$109M	$0.7M	$322M	$70M
Loadout	$14M	$0.1M	$40M	$9M
Transportation and Disposal	$696M	$6.0M	$1,788M	$563M
Trucking Total	$1,026M	$13.3M	$2,683M	$799M
Duration(1)	**13 years**	**2–3 months**	**29 years**	**9 years**
Rail Transportation to Landfill				
Site Upgrades, Temporary Facilities, Maintenance	$11M		$34M	$16M
Dewatering and Treatment	$95M		$182M	$114M
Site Restoration	$15M		$228M	$14M
Rail Upgrades and Train Handling	$17M		$97M	$16M
CCR Excavation and On-site Handling	$77M		$228M	$94M
Loadout	$10M		$28M	$8M
Transportation and Disposal	$1,305M		$3,832M	$845M
Rail Total	**$1,530M**	**N/A**	**$4,629M**	**$1,107M**
Duration(1)	**10 years**	**N/A**	**24 years**	**9 years**

All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

(1) Durations include estimated time to design, permit, and construct the required infrastructure upgrades

CY = cubic yards; M = million; NA = not applicable

7. References

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8. Abbreviations

B	billion (dollars)
CCR	coal combustion residuals
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CY	cubic yards
dBA	A-weighted decibel
FMCSA	Federal Motor Carrier Safety Administration
Leq	Equivalent Continuous Noise Level
M	million (dollars)
msl	mean sea level
MSW	municipal solid waste
NOx	nitrogen oxides
PM_{10}	particulate matter less than 10 micrometers in diameter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
SB 1398	Senate Bill 1398
TNM	Traffic Noise Model (Federal Highway Administration)
USEPA	U.S. Environmental Protection Agency
VAC	Virginia Administrative Code
VOC	volatile organic compounds

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Figures

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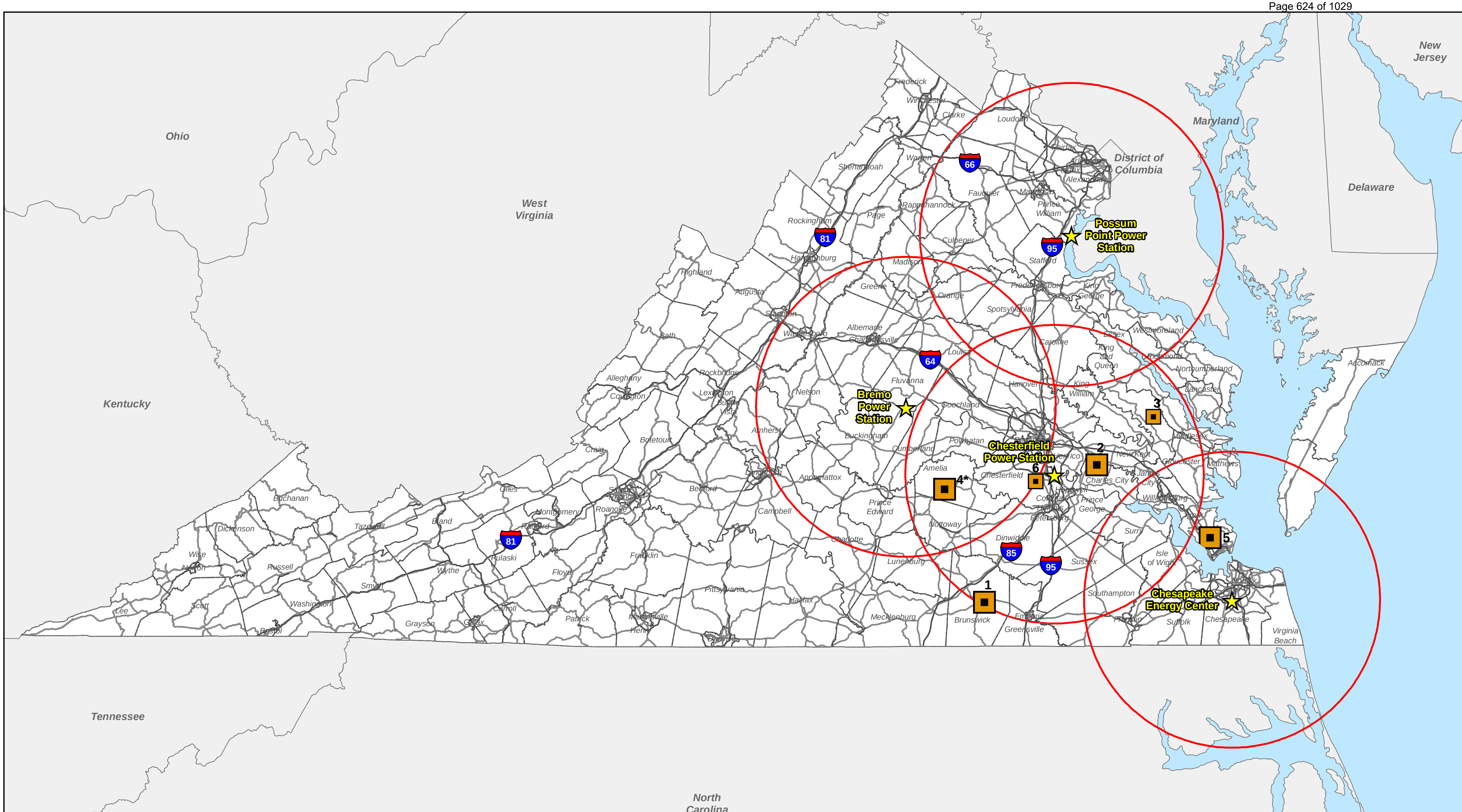

LEGEND

- Limited Access Highway
- High Occupancy Vehicle (HOV) Lane
- US Primary Highway
- 50 Mile Radius
- Virginia County

Landfill Location (remaining life)

- 10 - 25 yrs.
- 25 - 50 yrs.
- > 50 yrs.
- Dominion Plant Location

N

0 12.5 25 50
Miles

AECOM

Figure TM3-1
Candidate Landfills in Study Area

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MPS	JAB	DOS	REV. 0

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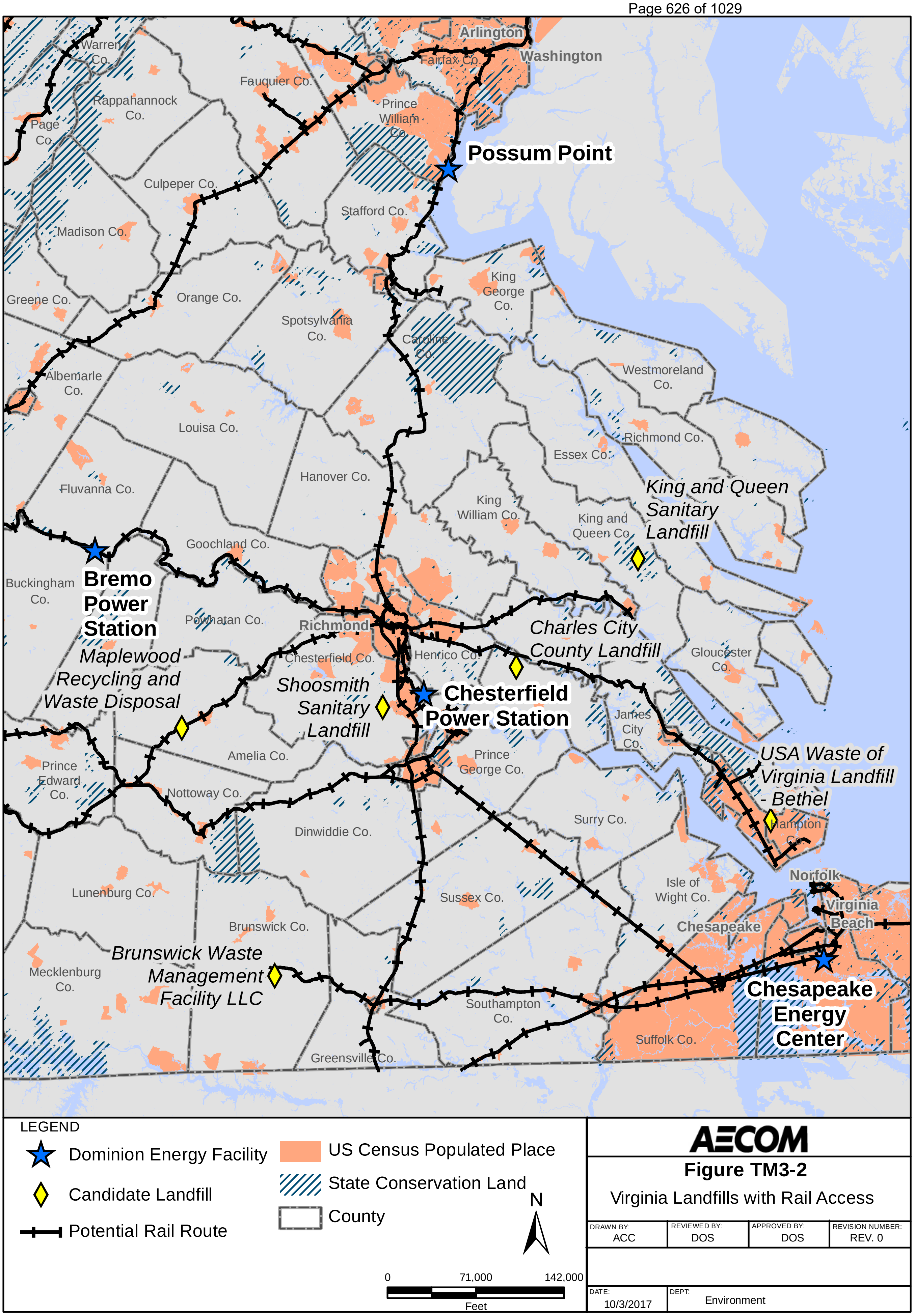

AECOM

Figure TM3-2

Virginia Landfills with Rail Access

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ACC	DOS	DOS	REV. 0

DATE:	DEPT:
10/3/2017	Environment

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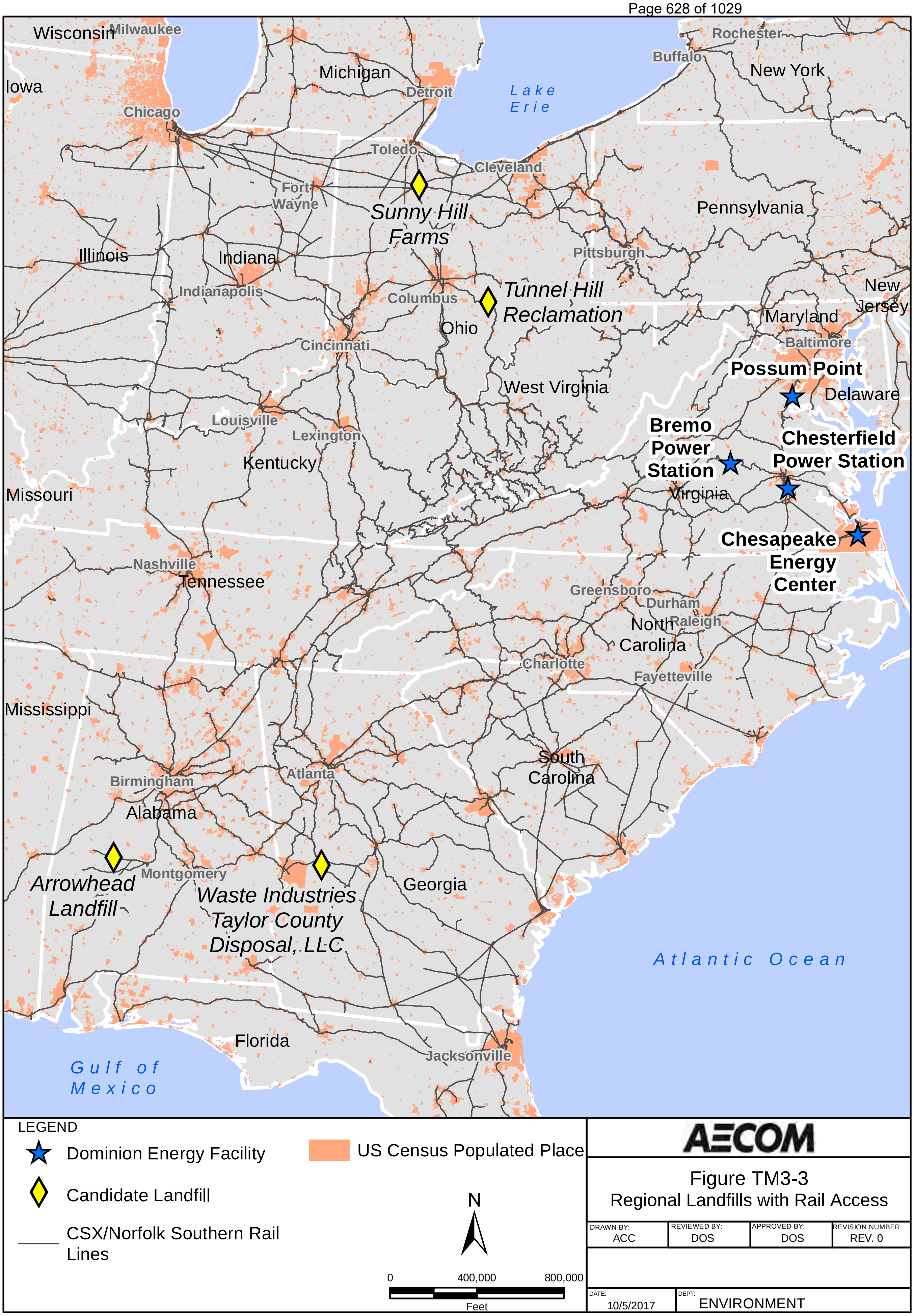

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Figure TM3-3
Regional Landfills with Rail Access

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ACC	DOS	DOS	REV. 0

DATE:	DEPT:
10/5/2017	ENVIRONMENT

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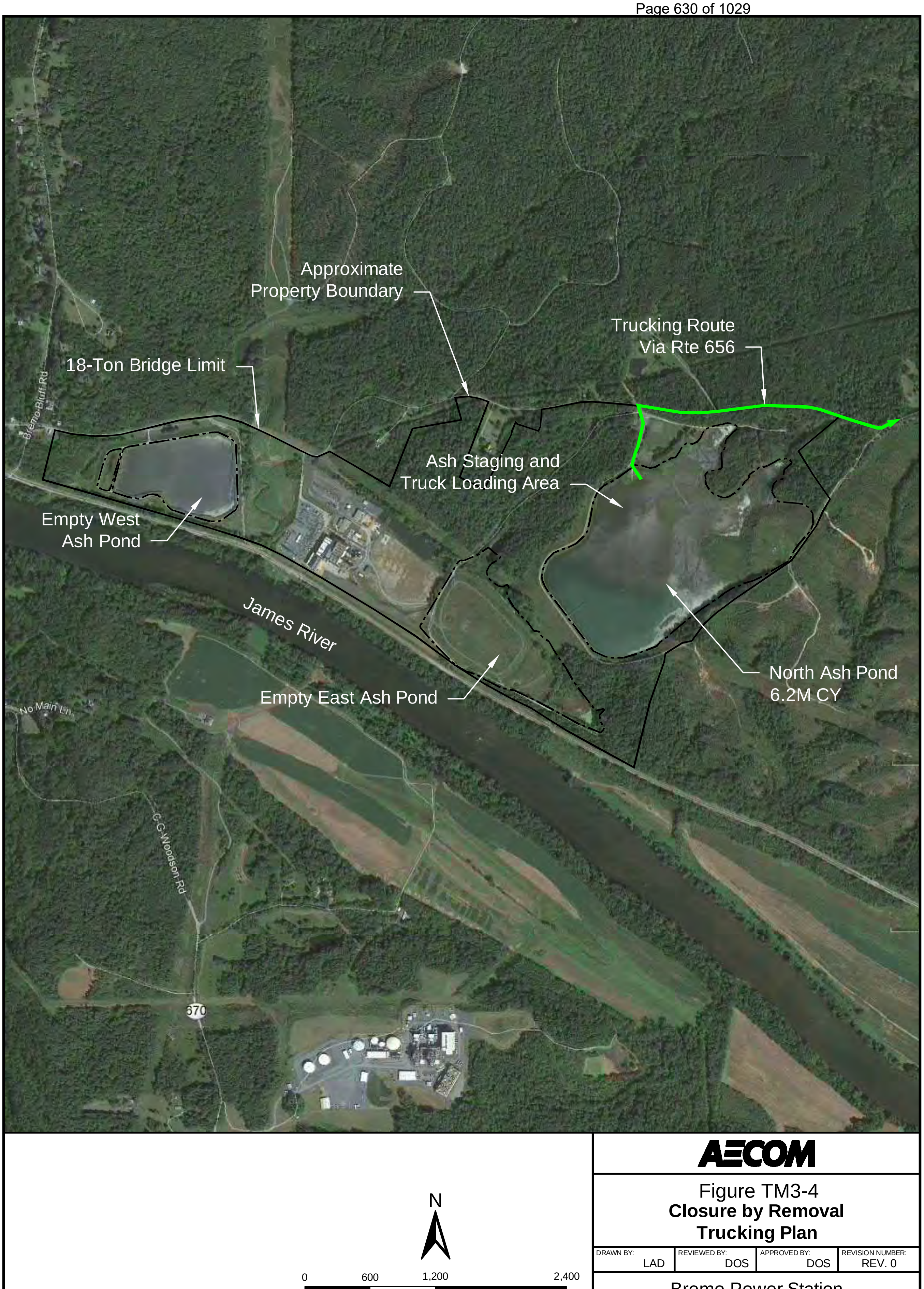

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Figure TM3-4
Closure by Removal Trucking Plan

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
LAD	DOS	DOS	REV. 0

Bremo Power Station

DATE: 10/05/2017 DEPT: Environment

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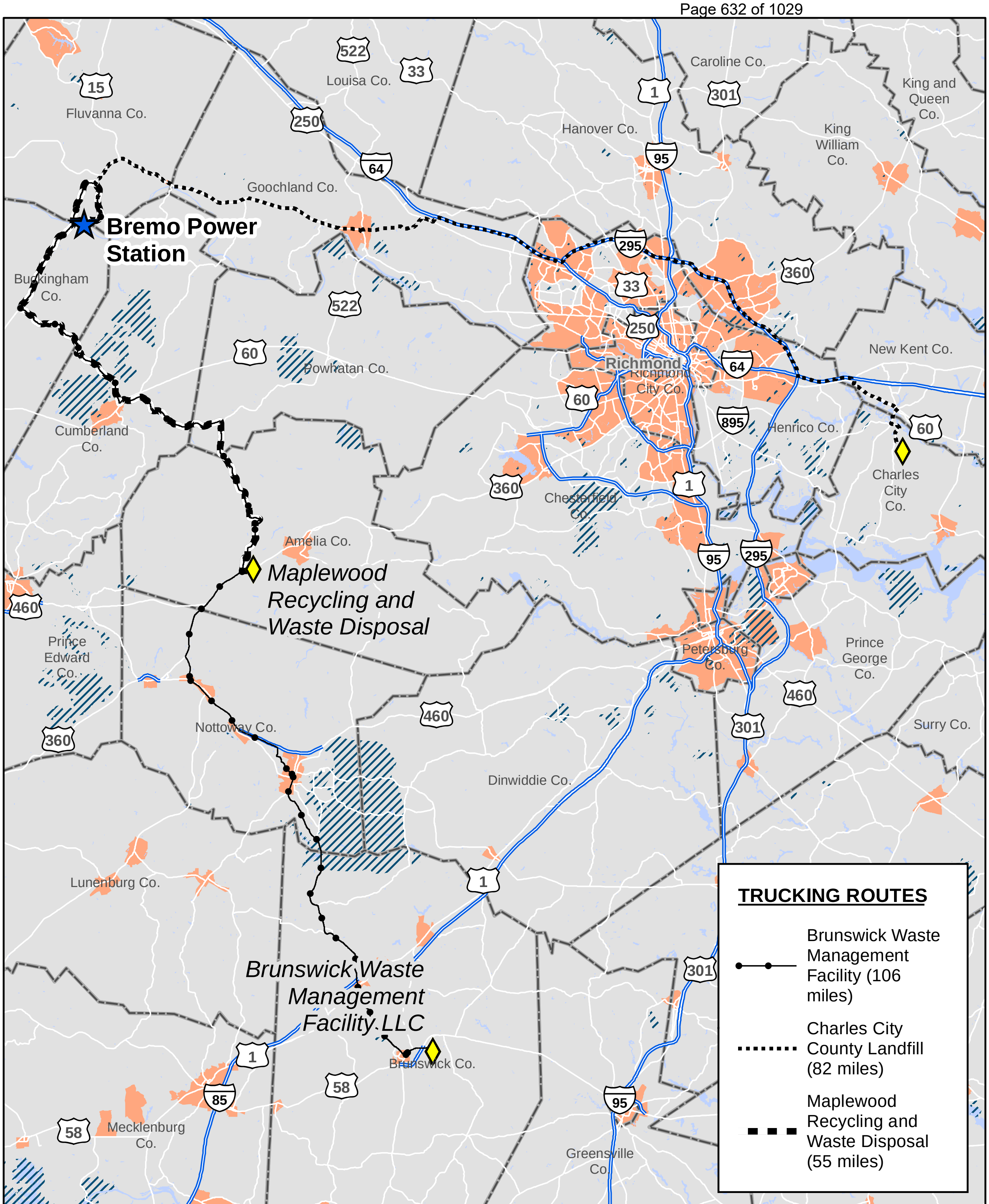

LEGEND

- Dominion Energy Facility
- Candidate Landfill
- Interstate Highway
- State Routes and Major Roads
- US Census Populated Place
- State Conservation Land
- County

N

0 40,000 80,000
Feet

AECOM

Figure TM3-5
Trucking Routes

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
ACC	DOS	DOS	REV. 0

Bremo Power Station

DATE:	DEPT:
10/5/2017	ENVIRONMENT

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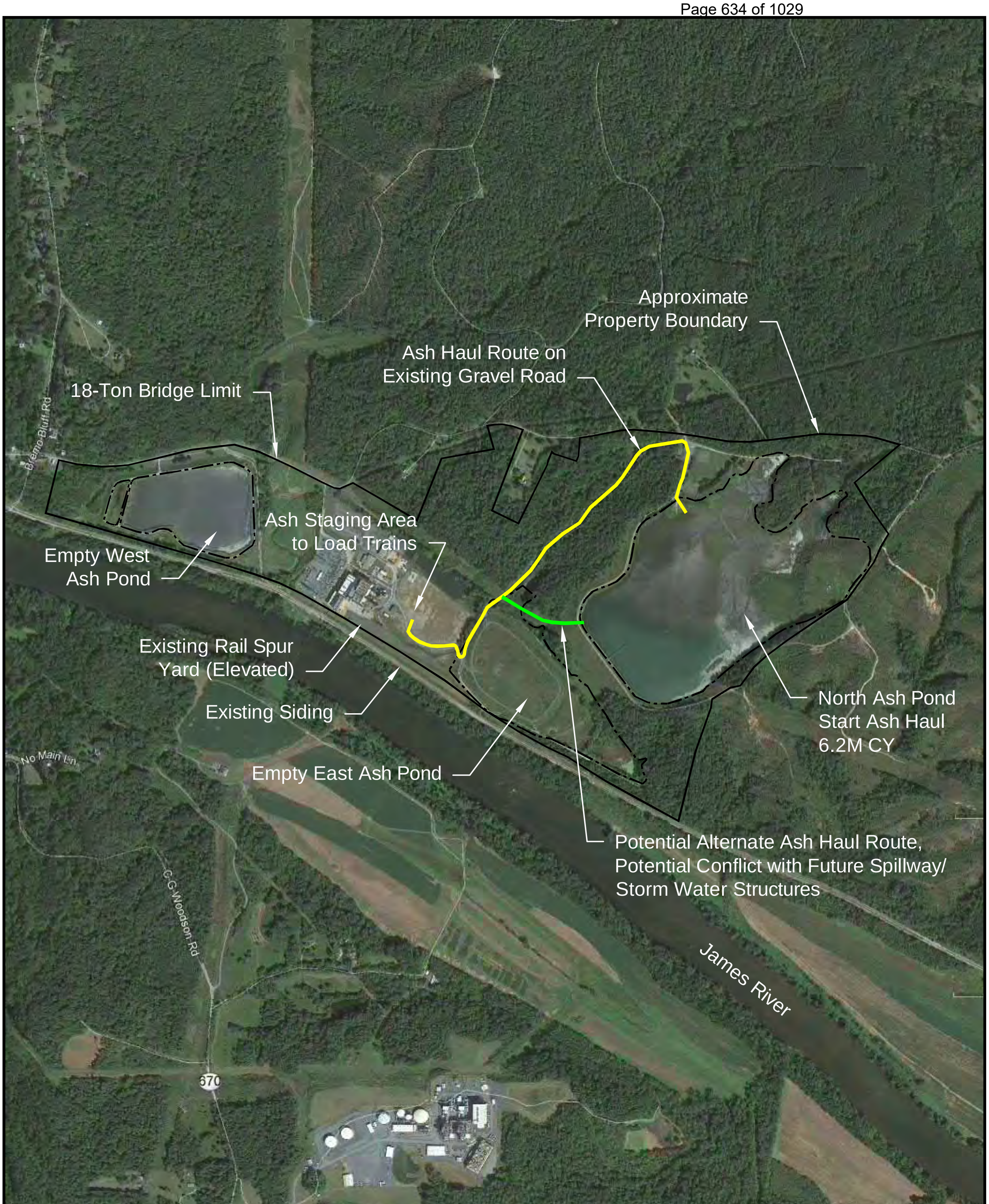

AECOM

Figure TM3-6
Closure by Removal
Rail Plan

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
LAD	DOS	DOS	REV. 0

Bremo Power Station

DATE: 10/05/2017 DEPT: Environment

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AECOM

Figure TM3-7
Closure by Removal
Trucking Plan

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LAD	DOS	DOS	REV. 0

Chesapeake Energy Center

DATE:	DEPT:
10/05/2017	Environment

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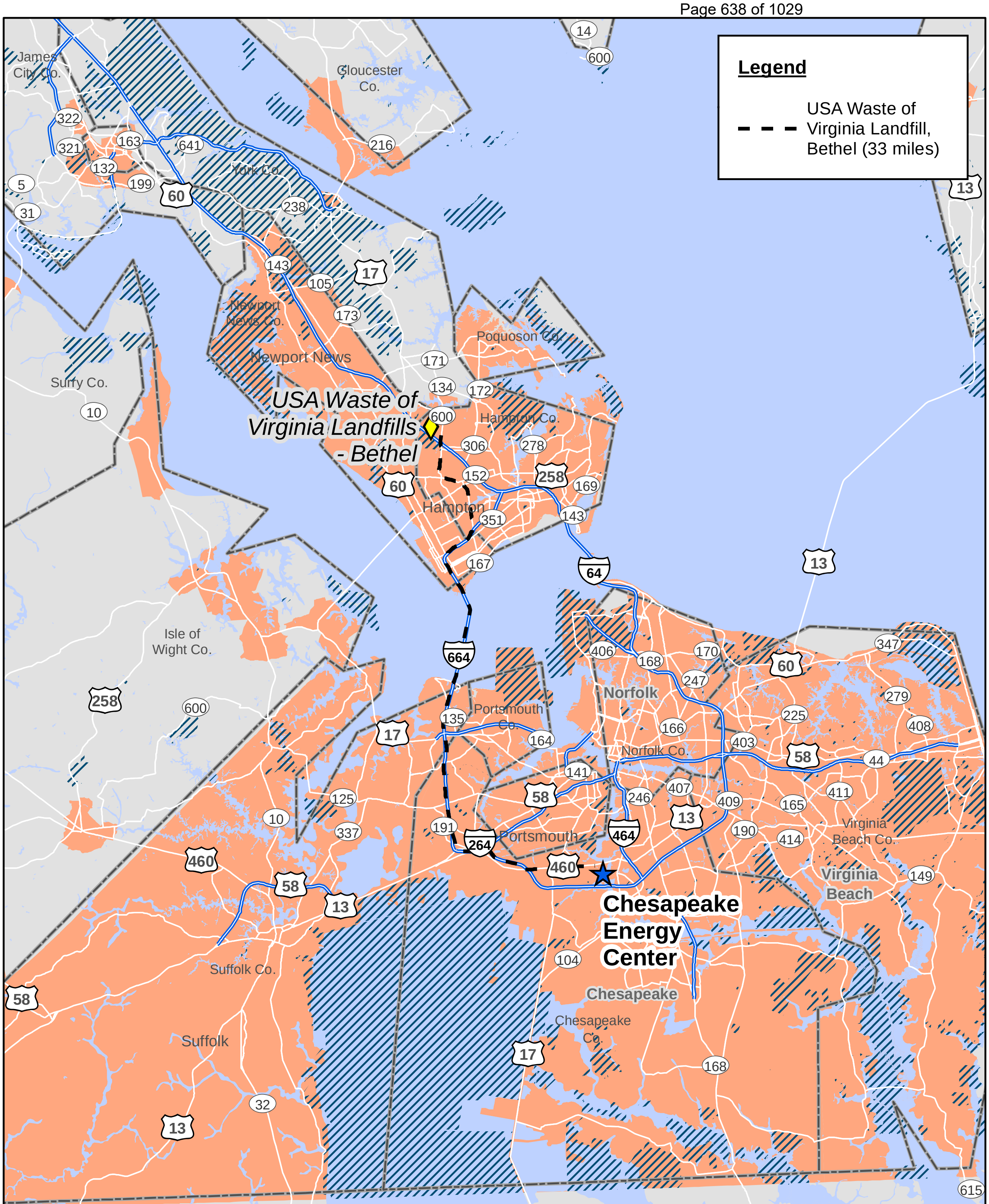

LEGEND

- Dominion Energy Facility
- Candidate Landfill
- Interstate Highway
- State Routes and Major Roads
- US Census Populated Place
- State Conservation Land
- County

N

0 24,000 48,000
Feet

AECOM

Figure TM3-8
Trucking Routes

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
ACC	DOS	DOS	REV. 0

Chesapeake Energy Center

DATE:	DEPT:
10/3/2017	Environment

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AECOM

Figure TM3-9
Closure by Removal
Trucking Plan

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Chesterfield Power Station

DATE: 10/05/2017 DEPT: Environment

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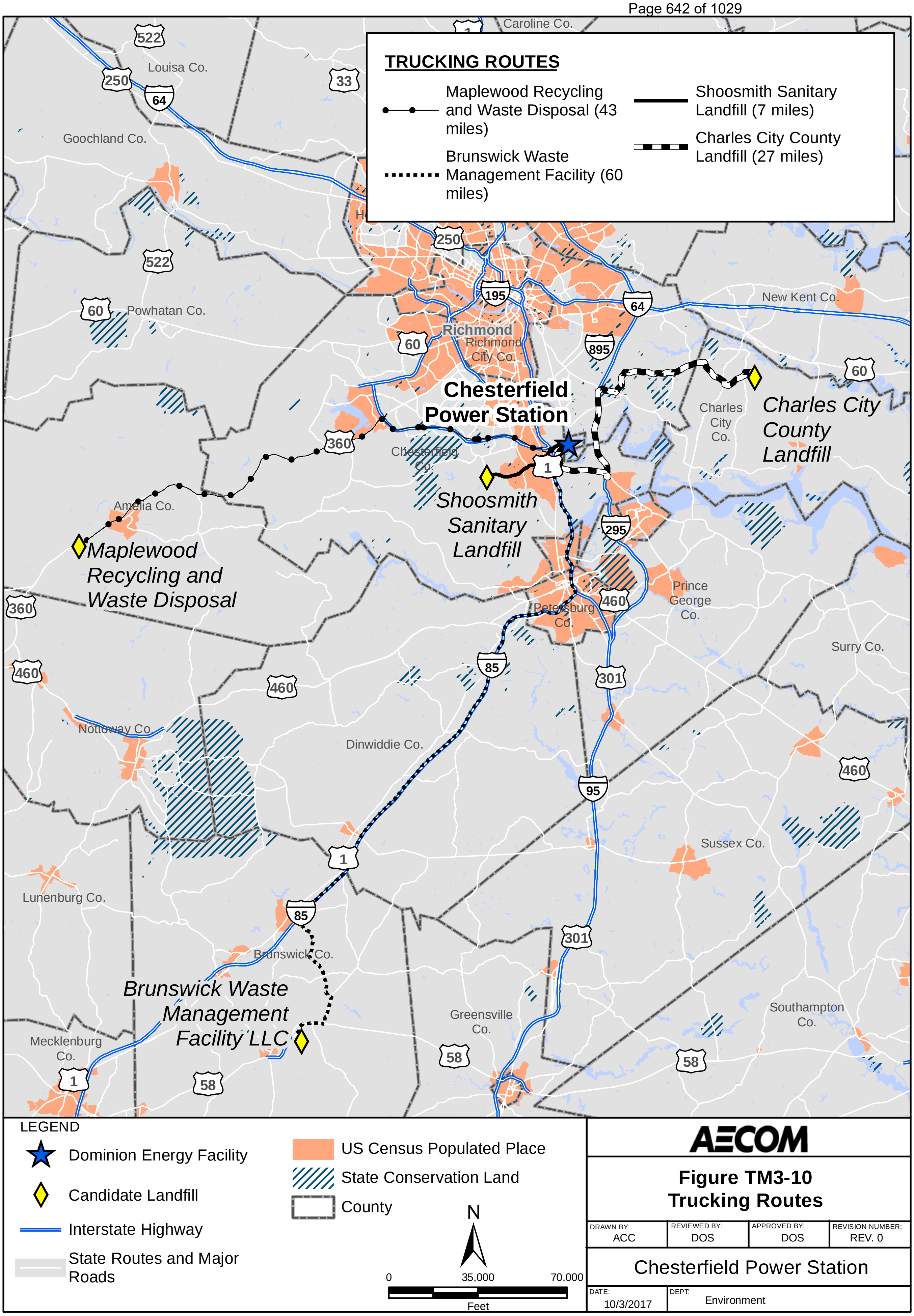

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Figure TM3-10
Trucking Routes

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ACC	DOS	DOS	REV. 0

Chesterfield Power Station

DATE:	DEPT:
10/3/2017	Environment

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N

0 1,000 2,000 4,000
Feet

AECOM

Figure TM3-11
Closure by Removal
Rail Plan

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LAD	DOS	DOS	REV. 0

Chesterfield Power Station

DATE: 10/26/2017 DEPT: Environment

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Figure TM3-12
Closure by Removal
Trucking Plan

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Possum Point Power Station

DATE: 10/23/2017 DEPT: Environment

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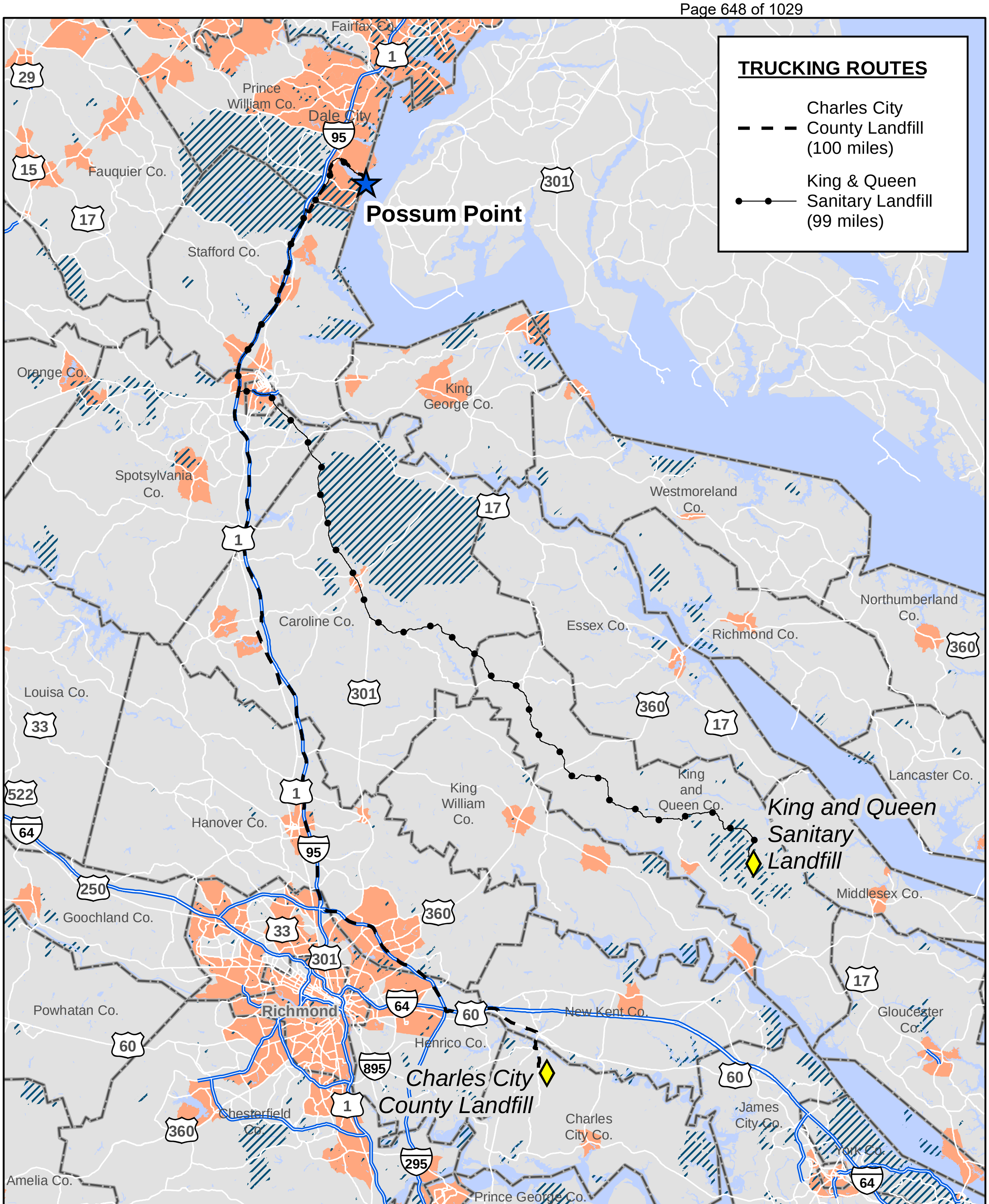

LEGEND

- Dominion Energy Facility
- Candidate Landfill
- Interstate Highway
- State Routes and Major Roads
- US Census Populated Place
- State Conservation Land
- County

N

0 43,000 86,000
Feet

AECOM

Figure TM3-13
Trucking Routes

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
ACC	DOS	DOS	REV. 0

Possum Point Power Station

DATE: 10/3/2017 DEPT: Environment

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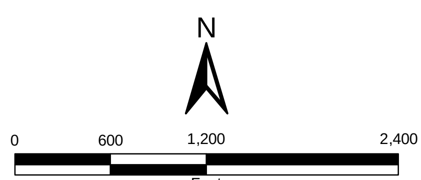

AECOM

Figure TM3-14
Closure by Removal
Rail Plan

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LAD	JM	JM	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/06/2017	Environment

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N

0 600 1,200 2,400
Feet

AECOM

Figure TM3-15
Closure by Removal
Container by Barge Plan

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LAD	JM	JM	REV. 0

Possum Point Power Station

DATE: 10/23/2017 DEPT: Environment

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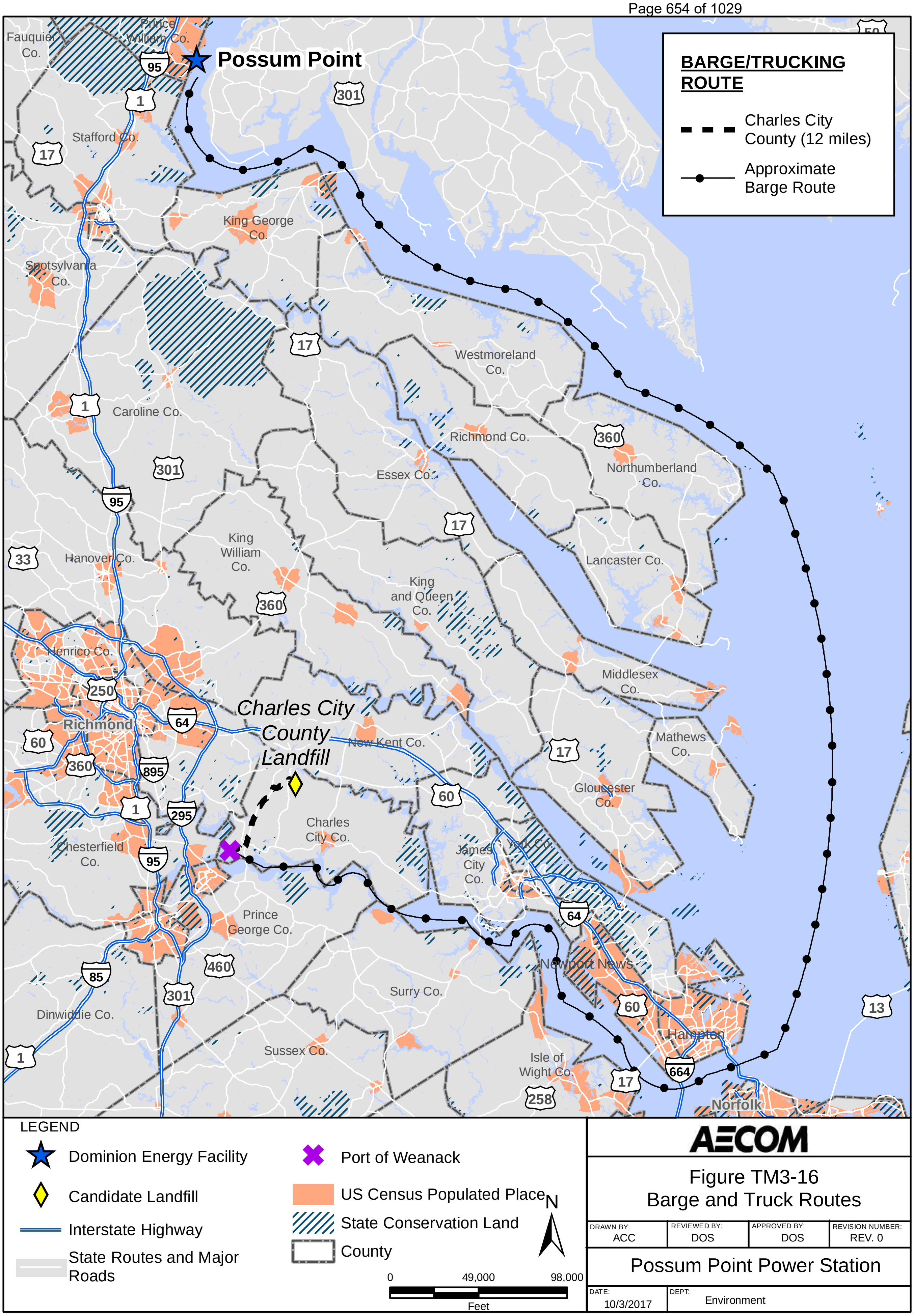

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Figure TM3-16
Barge and Truck Routes

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ACC	DOS	DOS	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/3/2017	Environment

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Senate Bill 1398 Response

Coal Combustion Residuals Ash Pond Closure Assessment

TECHNICAL MEMORANDUM 4

New or Expanded Landfill Analyses

November 2017

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Senate Bill 1398 Response:
Coal Combustion Residuals Ash Pond Closure Assessment

Technical Memorandum 4: New or Expanded Landfill Analyses

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Table of Contents

Tables

Figures

1. Introduction and Summary of Findings

Virginia Senate Bill 1398 (SB 1398) requires "that every owner or operator of a coal combustion residuals (CCR) surface impoundment that is located within the Chesapeake Bay watershed … conduct an assessment of each such CCR surface impoundment (CCR unit) regarding the closure of any such unit." The assessment must include describing groundwater and surface water conditions surrounding the surface impoundments (ash ponds) and evaluating corrective measures to restore water quality (if needed), evaluating the clean closure (closure by removal) of the CCR unit by recycling/reusing the ash or moving it to a landfill and demonstrating the long-term safety of the CCR unit if it is closed in place.

SB 1398 is applicable to eleven CCR surface impoundments (referred to as ash ponds in this report) at four Dominion Energy (Dominion) power stations. On behalf of Dominion, AECOM conducted an evaluation of the groundwater and surface water on all eleven ponds and an assessment of closure options on the five ponds that have been slated for closure. Ash has been removed or is in the process of being removed from the other six ponds; therefore, these ponds are being closed by removal. Table TM4-1 provides information on the Dominion power stations and ash ponds that were included in the study.

Table TM4-1: Ash Ponds included in the Study

Power Station	CCR Units	Remaining CCR Volume (CY)(1)	Operating Status	Area (acres)
Bremo Power Station	North Ash Pond(2)	4,800,000	Slated for closure	68
	East Ash Pond	1,400,000	Ash being actively removed and transported to North Ash Pond	27
	West Ash Pond	0	Ash removed	22
Chesapeake Energy Center(3)	Bottom Ash Pond(2)	60,000	Committed to closure by removal	5
Chesterfield Power Station	Lower Ash Pond(2)	3,600,000	Slated for closure	101
	Upper Ash Pond(2)	11,300,000	Slated for closure	112
Possum Point Power Station	Ash Pond A Ash Pond B Ash Pond C	40,000	Residual ash to be removed from Ash Ponds A, B, and C and transported to Ash Pond D	18
	Ash Pond D(2)	4,009,250	Slated for closure	70
	Ash Pond E	2,250	Residual ash to be removed and transported to Ash Pond D	38
	Total Volume	**25,211,500**		

(1) CCR volumes are based on Dominion estimates as of July 10, 2017

(2) Assessed for closure options

(3) While not subject to the assessment required by SB 1398, the CCR landfill at the Chesapeake Energy Center is slated for closure in accordance with VSWMR. Virginia DEQ issued a draft solid waste permit in June 2016 for closure of the landfill, which process was later suspended at Dominion's request. The draft permit required Dominion to evaluate and propose alternative corrective measures to address groundwater impacts. In addition, in connection with a July 31, 2017, court order, Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, to include proposed additional corrective measures to address site-wide groundwater impacts.

CCR = coal combustion residuals; CY = cubic yards; DEQ = Department of Environmental Quality; VSWMR = Virginia Solid Waste Management Regulations

1.1 Study Objective

The objective of the study was to comply with the following SB 1398 requirements to ensure the long-term safety of the ash ponds while protecting public health and the environment:

- Evaluate closure by removal with recycling or reuse (beneficial use) of the CCR material
- Evaluate closure by removal with placement of CCR material in a permitted landfill
- Evaluate closure-in-place addressing long-term safety, structural, and extreme weather event resiliency
- Describe groundwater and surface water quality surrounding each ash pond, and evaluate corrective measures if needed

AECOM was tasked with critically reviewing existing information, identifying additional studies that may be needed, performing the studies, and preparing a report that addresses the requirements of SB 1398 for each of the eleven Dominion ash ponds listed in Table TM4-1.

The objective of the SB 1398 requirements is to provide members of the legislature, environmental regulators, local government officials, and the local communities with an assessment of ash pond closure options as set forth in the legislation. Specifically, the report describes how the various options could meet the objectives of safe closure, compliance with applicable federal and state rules, and protection of public health and the environment. This report is not intended, and must not be construed, to provide recommendations or conclusions regarding the selection of the options detailed herein.

AECOM developed a series of Technical Memoranda that provide a detailed analysis of the primary technical information needed to comply with SB 1398 requirements. The Technical Memoranda provide an assessment of closure by removal options (including recycling/beneficial use and landfilling); ash sampling results to supplement the beneficial use study; and evaluations of closure-in-place, groundwater and surface water conditions, and potential groundwater corrective measures. The memoranda are included as attachments to the report and are referenced as appropriate.

1.2 Technical Memorandum 4 Objective

Technical Memorandum 4 describes two potentially feasible options for closure by removal and landfilling: disposal into an on-site landfill or disposal into an off-site landfill newly constructed by Dominion. In addition to discussing these two disposal options, this memo presents a general discussion of risk (Section 2) and some general assumptions (Section 5). References and acronyms are presented in Sections 6 and 7, respectively.

Assessment of closure by removal and landfilling in a commercial landfill is addressed in Technical Memorandum 3 (Closure by Removal).

1.3 Summary of Findings

The results of this assessment of closure by removal and landfilling present potentially feasible options for disposing of CCR into a new lined landfill located on the power station site. No feasible options for disposal of CCR in existing on-site landfills were identified. A newly constructed off-site landfill designed to manage CCR from several Dominion facilities could be a feasible alternative although more study is required. Each option is presented and discussed in greater detail in the sections that follow.

1.3.1 New or Existing On-Site Landfill

A summary of the assessment of the alternative to manage CCR on site, through expansion of an existing on-site landfill, development of a new on-site landfill, or development of a new on-site landfill over existing CCR ash ponds is provided in Table TM4-2.

The assessment of potential on-site landfills indicates that expanding the existing landfills is not possible at Bremo and Possum Point Power Stations as no existing landfills are present. The existing Chesapeake Energy Center landfill is no longer receiving ash. At Chesterfield, additional capacity to manage the CCR removed from the ash ponds is not available in the planned CCR landfill and therefore this option is not currently considered feasible.

Table TM4-2: Summary of Alternative Assessment for On-Site Landfills

Power Station	Expansion of Existing On-Site Landfill	Development of New On-Site Landfill on Green Site	Development of New On-Site Landfill Over Existing CCR Ponds
Bremo Power Station	**Not feasible.** No existing facility.	**Not feasible.** Inadequate available property suitable for landfill development.	**Not feasible.** Although North Ash Pond is of sufficient size, there is no available location to temporarily store excavated CCR.
Chesapeake Energy Center	**NA**[1]	**NA**[1]	**NA**[1]
Chesterfield Power Station	**Not feasible.** Sufficient capacity not available in planned CCR landfill.	**Not feasible.** Inadequate available property suitable for landfill development.	**Potentially feasible.** This option is only feasible on Lower Ash Pond footprint if the DEQ and local authorities grant a variance to allow the setback from the road to be reduced from 500 to 100 feet. This option also requires a variance to the County Conditional Use Permit to truck 3.6 million CY of CCR materials to the new FFCP landfill. The design and construction estimate of 20 years would not meet the 15-year CCR Rule closure timeframe.
Possum Point Power Station	**Not feasible.** No existing facility.	**Not feasible.** Inadequate available property suitable for landfill development.	**Potentially feasible.** This option is only feasible within Ash Pond E if the DEQ and local authorities grant a variance to allow the setback from the road to be reduced from 500 to 100 feet or if the Pond E landfill is combined with other removal or landfill options.

[1] Not applicable because Dominion has committed to remove CCR materials from the Bottom Ash Pond at Chesapeake Energy Center

CCR = coal combustion residual; CY = cubic yards; DEQ = Department of Environmental Quality; FFCP = Fossil Fuel Combustion Products

1.3.2 Disposal in New Off-Site Landfill Constructed by Dominion

AECOM performed a screening level assessment of the feasibility of identifying a single off-site location to serve as a future new landfill to serve multiple Dominion facilities. A complete site selection process would be required to narrow the search area and to employ more complete site selection criteria.

The primary area for this assessment is located in central Virginia roughly centered along I-95 north of I-64 and south of Fredericksburg. Considering regulatory setbacks, stormwater management, sources for borrow soil, administrative and operations facilities, etc., the target size for a landfill site ranges from 500 to 800 acres. Sites with direct access from a major roadway are preferred.

Based on a preliminary screening level assessment, developing a single new off-site landfill to manage CCR from one or more Dominion facilities is feasible if its development meets the timeline required to manage the CCR closure by the removal alternative established by Dominion and regulatory authorities. Significant additional work is required to identify candidate sites, evaluate the transportation routes to the sites, and determine which power stations it would need to serve.

1.3.3 General Discussion of Risk Associated with Landfilling

The alternatives discussed in this Technical Memorandum include closure by removal of CCR, and transportation and disposal in a lined landfill. Risks associated with excavating CCR, transporting CCR, and disposing of CCR must be evaluated for all of the alternatives described in this memo. Risk categories for these alternatives include safety, environmental impacts, community impacts, regulatory compliance, schedule, engineering impacts and cost.

From the perspective of safety, environmental impacts, schedule, and cost, use of an existing CCR landfill located on the power station site, if this is a feasible alternative, is the most desirable closure by removal alternative. If there is no existing landfill on the facility, developing a new lined CCR landfill on the power station site is the preferred alternative.

If it is not feasible to use an existing or new on-site landfill, an off-site landfill can be considered. While the risks associated with excavating CCR are significant and must be considered, the risks associated with transporting CCR over the roadway to an off-site location for disposal or for beneficial use are greatly increased as compared with disposal in an on-site facility or closure-in-place.

For the purpose of this assessment, AECOM considered the following closure by removal with landfill disposal alternatives in order of increasing risk:

- Disposal of CCR in an existing on-site landfill (discussed in Section 2)
- Development of a new on-site landfill (discussed in Section 2)
- Hauling and disposal in a new off-site landfill developed by Dominion (discussed in Section 3)

Additional description of impacts related to safety, environmental, community, schedule, and cost are provided in Sections 2.6 and 3.2.

2. Disposal in a New or Existing On-Site Landfill

AECOM completed assessments for each of the four power stations of on-site disposal options using available site information provided by Dominion, limited visual observation of the site, and regulatory criteria for siting and constructing CCR landfills. There are no existing engineering studies for new landfill development at any of the four power stations.

A general description of the risks and benefits for disposing of CCR to a new or existing on-site landfill are provided for each power station in Sections 2.2 to 2.5. More detailed assessments of critical risk elements described in Section 1.3.3 are provided in the Sections 2.6 to 2.10.

The siting assessments in this section are conceptual to establish the feasibility of various CCR management alternatives.

A summary of the volume of CCR assumed to be managed at each pond slated for closure is provided in Table TM4-3, to include an industry standard 25% engineering safety factor applied to the volumes of ponded ash to obtain a target volume for potential landfill design. This safety factor is to account for disposal of soil below the in-place CCR excavated as part of closure by removal, uncertainty in estimation of the volume of in-place CCR to be disposed of, and engineering uncertainty regarding site conditions in this conceptual level assessment.

Table TM4-3: Summary of CCR Volume

Power Station	Ash Pond	Estimated CCR Volume (CY) (1)	Assumed Total CCR Disposal Volume (CY)
Bremo Power Station	North Ash Pond(2)	6,200,000	7,750,000
Chesterfield Power Station	Upper Ash Pond	11,300,000	14,125,000
	Lower Ash Pond	3,600,000	4,500,000
	Total	**14,900,000**	**18,625,000**
Possum Point Power Station	Pond D(3)	4,052,500	5,066,000

(1) CCR volumes are based on Dominion estimates as of July 10, 2017
(2) Estimated total after consolidation from East and West Ash Ponds
(3) Estimated total after consolidation from Ash Ponds A, B, C, and E
CY = cubic yards

Potential general risks and benefits associated with closure by removal and landfilling on the power station site are summarized in Table TM4-4. Risks and benefits should be evaluated on a site-specific basis and may vary from those provided below.

2.1 On-Site Landfill Impacts

In order to develop a new on-site landfill, either on the site of a former ash pond or on land not used for CCR management, the existing CCR must be removed from the current ash ponds and hauled, placed, and compacted in the new landfill. There are significant safety, engineering, schedule, cost, and potentially environmental impacts associated with an alternative that includes closure by removal. Such impacts should be considered additive to the impacts associated with landfilling. A more detailed assessment of these impacts is included Technical Memorandum 3.

Table TM4-4: Summary of Benefits and Risks for Closure by Removal and Landfilling on Power Station Site

Potential Benefits	Potential Risks
• Avoids hauling of CCR to off-site facility (safety, environmental, community) • Reduces cost and schedule (cost, schedule) • Allows Dominion to retain long-term control of CCR (environmental) • Potential redevelopment of existing CCR ponds (environmental, engineering) • Reduced impacts to open land, including jurisdictional areas, that would be needed to develop off-site landfill	• Requires dewatering, excavation, conditioning, and stockpiling of CCR (safety, environmental, engineering, cost, schedule) • Limited available space to develop landfill; potentially impacts future development for other power generating facilities (engineering) • Challenges in exploration and design for landfill sites located within existing ash pond (regulatory, engineering) • Potential challenges for groundwater assessment and remediation when building a landfill over a former ash pond (environmental, regulatory)

CCR = coal combustion residual

2.2 Bremo Power Station

The following describes the assessment of expanding an existing on-site landfill and developing a new on-site landfill at the Bremo Power Station.

2.2.1 Expansion of Existing On-Site Landfill

Bremo Power Station no longer burns coal for power generation, and no active or closed landfills are located on site. Therefore, no on-site landfill expansion alternative was considered for Bremo.

2.2.2 Development of New On-Site Landfill

AECOM reviewed the site plan for the Bremo Power Station to identify available land outside of active CCR management area (including ash ponds) and power generating facilities having sufficient area to meet landfill siting criteria. To accommodate the entire volume of CCR currently at the site, a landfill footprint of approximately 50 acres is required. AECOM evaluated developing a new on-site landfill in a greenfield area and over an existing ash pond.

2.2.2.1 Landfill on Greenfield Area

Siting restrictions such as floodplains, streams, wetlands, and property line setbacks limit area for development of a new CCR landfill to an approximately 13-acre area to the northeast of the North Ash Pond. Due to regulatory siting restrictions, the area has an irregular shape that restricts the available storage capacity. Based on conceptual assessment, AECOM concluded that potential storage space available is less than 500,000 CY. Therefore, no areas large enough to manage the target CCR disposal volume provided for Bremo in Table TM4-3 and meet regulatory siting criteria were identified.

2.2.2.2 Landfill over Existing Ash Pond

Dominion is in the process of consolidating ash from the East and West Ash Ponds into the North Ash Pond. According to information provided by Dominion, the North Ash Pond currently contains approximately 4.8 million CY of CCR. Most of the CCR has been removed from the West Ash Pond, and as of July 10, 2017, the East Ash Pond contains about 1.4 million CY of CCR.

Regulatory submittals indicate that the East Ash Pond and West Ash Pond areas will be used to manage site stormwater and are not available for future CCR landfill development. In addition, these ponds are small in area (approximately 27 and 22 acres, respectively), which would limit available development area that meets siting criteria. Therefore, the East Ash Pond and West Ash Pond are not considered feasible for future CCR landfill development.

AECOM conducted a conceptual assessment of the North Ash Pond, which has an area of about 96 acres. CCR material excavated from the West and East Ash Ponds has been placed and compacted in the North Ash Pond. Based on preliminary conceptual grading, it is feasible to develop a CCR landfill large enough to contain all of the CCR located in the North Ash Pond on the Bremo facility, as shown on Figure TM4-1.

The conceptual North Ash Pond CCR landfill shown on Figure TM4-1 has an approximate area of 53 acres and a disposal capacity of about 7.8 million CY. The conceptual landfill is proposed toward the northern portion of the North Ash Pond, where subgrade elevations are higher and less structural fill will likely be required.

Developing a conceptual CCR landfill in the North Ash Pond requires overcoming some significant challenges, such as excavation of the existing CCR, temporary CCR storage during landfill construction, and placement and compaction in the new disposal facility. The temporary storage of CCR is a significant engineering and regulatory challenge because there are no existing CCR areas of adequate size to contain the CCR excavated from the North Ash Pond. Based on this constraint, as well as safety and schedule impacts, AECOM does not consider a CCR landfill located within the North Ash Pond to be a feasible alternative.

Development of a new landfill on the Bremo Power Station facility using available undeveloped areas or existing ash ponds is not considered feasible due to the extensive development and limited areas of used land that would be potentially suitable.

2.3 Chesapeake Energy Center

The following describes the assessment of expanding an existing on-site landfill and developing a new on-site landfill at the Chesapeake Energy Center Station.

2.3.1 Expansion of Existing On-Site Landfill

Chesapeake Energy Center no longer burns coal for power generation and no active landfills are located on site. The existing landfill is no longer receiving ash and is not considered a candidate for expansion. Therefore, no on-site landfill expansion alternative is considered for Chesapeake Energy Center.

2.3.2 Development of New On-Site Landfill

According to Dominion, only the 60,000 CY of bottom ash to be removed from the Bottom Ash Pond would need to be managed in a landfill. It is not considered practical from an economic and schedule standpoint to develop a disposal facility for this quantity of CCR.

2.4 Chesterfield Power Station

The following describes the assessment of expanding an existing on-site landfill and developing a new on-site landfill at the Chesterfield Power Station.

2.4.1 Expansion of Existing On-Site Landfill

Chesterfield Power Station is an active power generating facility. In preparation of future closure of the CCR ash ponds, Dominion has obtained permit approvals for a lined on-site landfill, which is essential for the continued operation of the power station. This landfill is referred to as Fossil Fuel Combustion Products (FFCP) in Dominion documents and is planned to be in operation by October 2017. The total FFCP capacity, as permitted, is 9.4 million CY and is expected to serve the existing generating units for 20 years, until approximately 2038, assuming 100% of the future CCR is routed to this landfill. The design assumed an average CCR acceptance rate of 2,300 tons per day, an in-place density of 1.25 tons per CY, and 5 landfill operating days per week in performing these calculations.

AECOM evaluated the potential for laterally and/or vertically expanding the storage capacity of the FFCP to verify if excavated CCR from the ash ponds could be placed here without adversely affecting the future operations of the power station. The design drawings for the FFCP indicate lateral expansion is not feasible because floodplains and wetlands limit the areas available adjacent to the landfill. The original landfill design optimized the vertical space available for vertical expansion options using traditional methods.

Based on the quantity of CCR on site and the size and capacity of the FFCP, it is not considered feasible to expand the planned landfill to manage CCR removed from ash ponds.

2.4.2 Development of New On-Site Landfill

A landfill footprint of approximately 85 acres would be required to accommodate the 14.9 million CY of CCR in the ash ponds including an industry standard 25% engineering safety factor applied to the volumes of ponded ash to obtain a target volume for potential landfill design. This safety factor is to account for disposal of soil below the in-place CCR excavated as part of closure by removal, uncertainty in estimation of the volume of in-place CCR to be disposed of, and engineering uncertainty regarding site conditions in this conceptual level assessment.

2.4.2.1 Landfill on Greenfield Area

AECOM evaluated potentially available land outside of active CCR management areas or power generating facilities that would be large enough to meet landfill siting criteria. The Chesterfield Power Station is heavily built up with facilities to support electricity generation, and the ongoing development of new wastewater treatment facilities to meet compliance requirements after the closure of CCR ash ponds have taken up the smaller undeveloped areas on the property. Because of siting restrictions in locations such as floodplains, wetlands, and areas with overhead power lines, insufficient open space is available for developing a new landfill.

2.4.2.2 Landfill over Existing Ash Pond

Developing a new landfill within the footprint of an existing ash pond would require overcoming several significant regulatory and engineering challenges. Construction sequencing would require dewatering and stabilization of the ash pond; excavation of the CCR; temporary storage of the CCR during landfill construction; and conditioning, placement, and compaction of the CCR into the landfill. Constructing a landfill would also require trucking in significant quantities of soil from off-site sources (a landfill in the

Lower Ash Pond footprint would require approximately 3.2 million CY of soil to construct the new landfill and restore the Upper Ash Pond area).

Temporary storage of the CCR would create a significant regulatory challenge. Neither ash pond could be used for temporary storage while constructing a new landfill on the footprint of the other pond, as CCR Rules prohibit placement of new CCR materials in either of the ash ponds after October 2018. There is no suitable location on the station property to temporarily store the volume of CCR currently located in the Upper Ash Pond (11.3 million CY). However, there may be a viable option for temporary storage of the smaller Lower Ash Pond volume (3.6 million CY) using the newly constructed 9.4 million CY FFCP landfill (see Section 2.4.1). The FFCP landfill would concurrently be used to dispose of CCR associated with on-going power generation, as designed. Once Lower Ash Pond closure conditions were met and the new lined CCR landfill was constructed within the former Lower Ash Pond, CCR could be excavated from the Upper Ash Pond directly to this new conceptual landfill.

Virginia Solid Waste Management Regulations (VSWMR) landfill siting requirements require a 500-foot setback from public roadways, with an exception for “units that are located in areas that are zoned for industrial use under authority of state law or in unzoned industrial areas as determined by the Commonwealth Transportation Board” (9VAC20-81-120). Constructing a new landfill on the Lower Ash Pond footprint would not provide enough volume for the CCR materials unless the Virginia Department of Environmental Quality (DEQ) and local authorities grant a variance to reduce the setback from Coxendale Road and Henricus Road from 500 feet to 100 feet. The presence of Henricus Park and Aiken Swamp adjacent to the area in question would be considered in this determination. If this variance is granted, the preliminary layout on the footprint of the Lower Ash Pond (shown in Figure TM4-2) would provide a landfill area of 85 acres with a sufficient disposal capacity of approximately 19 million CY.

Another consideration is that the facility’s Conditional Use Permit issued by Chesterfield County prohibits hauling CCR on public roadways, including Coxendale Road and Henricus Road. This could restrict both hauling of CCR to the FFCP landfill from the Lower Ash Pond and future hauling of CCR from the plant to the new conceptual landfill developed in the Lower Ash Pond site. The use of Coxendale Road and/or Henricus Road to haul CCR would impact public access to the Henricus Park and the public boat ramp. Crossing or use of public roadways could also restrict the rate that CCR is hauled to the disposal units. An assessment of whether the Conditional Use Permit could be amended and the potential resulting impacts on the public would determine the feasibility of this alternative.

Additionally, the CCR Rule restricts reuse of former ash ponds until it can be demonstrated that closure by removal criteria, including those for groundwater, are met. Addressing CCR Rule groundwater criteria could potentially be accomplished by isolating the new landfill with a double liner system, but could potentially add time to the landfill construction process.

Permitting, constructing, and placing all material in a landfill in the footprint of the Lower Ash Pond is projected to take 20 years to complete, exceeding the maximum allowable CCR Rule closure timeline of 15 years. Design and permitting is projected to take 2 to 3 years, constructions of the new landfill an additional 2 to 3 years, and moving of the ash is expected to take approximately 15 years.

Based on the conceptual assessment presented above, it could potentially be feasible to construct a new lined CCR landfill within the Lower Ash Pond, using the reduced roadway setback, although the challenges described above would all need to be addressed in order to make this a viable option compared to other closure alternatives.

2.5 Possum Point Power Station

The following describes the assessment of expanding an existing on-site landfill and developing a new on-site landfill at the Possum Point Power Station.

2.5.1 Expansion of Existing On-Site Landfill

Possum Point Power Station no longer burns coal for power generation, and no active or closed landfills are located on site. Therefore, no on-site landfill expansion alternative is considered for Possum Point Power Station.

2.5.2 Development of New On-Site Landfill

CCR has been managed in Ponds A, B, C, D, and E. At the time of this report, Dominion had consolidated most CCR from Ponds A, B, C, and E into Pond D. However, there is some remaining CCR in Pond E (approximately 2,500 CY) and adjacent to Ponds A, B, and C (approximately 40,000 CY) that has not yet been consolidated into Pond D. For purposes of this assessment, a target landfill capacity of 5.1 million CY was selected (3.6 million CY of CCR in the ponds plus a 25% safety factor that would require at least 50 acres of land. This 25% safety factor is to account for disposal of soil below the in-place CCR excavated as part of closure by removal, uncertainty in estimation of the volume of in-place CCR to be disposed of, and engineering uncertainty regarding site conditions in this conceptual level assessment.

2.5.2.1 Landfill on Greenfield Area

AECOM reviewed the site plan for the Possum Point Power Station to identify available land of sufficient area to meet landfill siting criteria. We first reviewed site plans for potential landfill sites located outside of the current CCR management areas or power generating facilities. The largest undeveloped area for landfill development is approximately 25 acres, as shown on Figure TM4-3. This area is not large enough to manage the target quantity of CCR on the site and meet regulatory siting criteria. AECOM then assessed the potential to site and construct a CCR landfill within the footprint of existing CCR management areas, including ash ponds.

2.5.2.2 Landfill over Existing Ash Pond

Developing a new landfill within the footprint of an existing ash pond would require overcoming several significant regulatory and engineering challenges. Construction sequencing would require dewatering and stabilization of the ash pond; excavation of the CCR; temporary storage of the CCR during landfill construction; and conditioning, placement, and compaction of the CCR into the landfill.

Considering setbacks from the property line, roadways, and floodplains, a landfill of less than 10 acres could be developed on the footprint of Ponds A, B, and C, which not would provide an adequate volume. Since more than 4 million CY of ash is currently stored in Pond D, constructing a new landfill in that area would require identifying and constructing a temporary ash storage area, moving the ash to that temporary location, constructing a new lined landfill on the Pond D footprint, and then moving the ash back. Along with the lack of storage space at the site, the presence of several large transmission corridors within the Pond D footprint makes this option not feasible.

However, a preliminary assessment determined that a 45-acre landfill could be developed in the area of the Pond E footprint, which would allow construction of a new landfill while maintaining the CCR in Pond D, hauling it directly to the new landfill once constructed and eliminating the need for temporary storage. AECOM's assessment included considerations of regulatory setbacks, avoidance of main power line easements, conservative assumptions regarding long-term groundwater levels, and a 500-foot setback from Possum Point Road to the limit of waste on the south side of the conceptual landfill. This landfill layout would have a capacity of up to 3.9 million CY, which is less than the target design capacity of 5.1 million CY. The layout of this conceptual landfill is shown in Figure TM4-3.

Virginia Solid Waste Management Regulations (VSWMR) landfill siting requirements require a 500-foot setback from public roadways, with an exception for "units that are located in areas that are zoned for industrial use under authority of state law or in unzoned industrial areas as determined by the Commonwealth Transportation Board" (9VAC 20-81-120). If the DEQ and local authorities grant a variance to allow a reduction of the setback from Possum Point Road from 500 feet to 200 feet, a 53-acre landfill could conceptually be constructed in the Pond E footprint that would be sufficient to meet the entire 5.1 million CY target volume. The presence of residential areas adjacent to the station would need to be considered in this determination. The layout of this conceptual landfill (reducing the setback to 200 feet) is shown in Figure TM4-4.

To address CCR Rule groundwater requirements, the new landfill would need to be isolated with a double liner system with a leak detection zone, which could potentially add time to the landfill construction process.

Based on the conceptual assessment, it could be potentially feasible to construct a new lined CCR landfill within the Pond E Ash Pond footprint, using the reduced roadway setback, although the challenges described above would all need to be addressed in order to make this a viable option compared to other closure alternatives.

2.6 Risk Impacts for On-Site Landfill

As described in Section 2, there are risks associated with excavating CCR, transporting CCR, and disposing of CCR. The following subsections provide a general discussion of the potential impacts related to safety, environmental impacts, community, schedule, and cost related to on-side disposal alternatives.

2.6.1 Safety Impacts

In addition to the safety impacts associated with closure by removal, materials hauling and construction pose potential safety impacts. Construction of a lined landfill on a Dominion power station facility would involve heavy equipment or conveyors, commonly used for any large conventional earthwork project. Excavations can be deep, but tend to be wide and sloped, with little risk of trench collapse normally associated with heavy utility or foundation construction. Although safety must be a prime consideration during landfill construction, the risks associated with landfill construction are generally comparable to similar heavy earthwork projects.

Operations of the landfill include hauling of the CCR using off-road dump trucks, loaders, hydraulic excavators, dozers, and compactors. This equipment is typical for most municipal solid waste and industrial landfills. The use of equipment, especially dump trucks, on slopes has potential safety impacts.

The compacted CCR in the landfill is generally a stable subgrade for equipment operations, and roadways and staging areas must be properly maintained.

Once the landfill is closed, the main activities will be routine inspection and maintenance, including mowing of grass over the final cover surface, some of which will be sloped. Assuming proper equipment is selected for mowing landfill side slopes, activities associated with landfill post-closure pose typical safety risks for similar operations conducted for roadway embankments and commercial or industrial sites.

2.6.2 Environmental Impacts

Environmental impacts associated with CCR landfills are generally tied to dust, leachate, or groundwater impacts. Dust control requirements are well defined in the CCR Rule, as well as air quality permits. Leachate must be managed continuously through the landfill post-closure period to prevent spills to adjacent surface water. Regulatory requirements currently in place are well established in the waste management industry and would apply to CCR landfills.

Properly designed and operated landfills with a composite liner and leachate collection system are required under both the U.S. Environmental Protection Agency (USEPA) and Virginia regulations.

Operation of a CCR landfill on the site of a Dominion facility would have potential environmental impacts comparable with such impacts for a permitted lined off-site landfill. Through the Virginia regulatory process, such impacts have been shown to be acceptable when the landfill is properly designed, operated, and maintained.

2.6.3 Community Impacts

Community impacts associated with development of an on-site landfill would be minimal compared with closure by removal alternatives that involve hauling CCR off the site for beneficial use or disposal.

Construction and operation-related impacts to the nearby community should be evaluated when an on-site landfill location is considered. Dust impacts are mitigated by using proper control mechanisms. Site-specific impacts stemming from noise during construction and operation should be evaluated.

2.6.4 Schedule Impacts

The time required to site, permit, design, and construct an on-site landfill should be considered and compared with other alternatives to manage the CCR.

An off-site commercial landfill that has a landfill of suitable size and capacity currently constructed and immediately available for CCR disposal could be favorable with regard to schedule in the short term. However, depending on the quantity of CCR to be managed, the rate that the CCR can be hauled from the site and the impacts to roads and bridges along the haul route, an on-site landfill could result in the most favorable schedule over the life of the project. Schedule should be considered when evaluating any alternative involving development of an on-site landfill.

2.6.5 Costs

Cost summaries for the on-site and off-site landfills considered to be feasible closure-by-removal and landfilling alternatives are provided in Table TM4-5.

Table TM4-5: Summary of Costs for Chesterfield and Possum Point On-Site Landfill

Item	Cost	
	Chesterfield	Possum Point
Closure by removal	$523M	$131M
Landfill construction	$69M	$40M
Landfill operations	$594M	$162M
Landfill closure and post-closure	$89M	$47M
Total	**$1,275M**	**$380M**

All costs in this Technical Memorandum are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study.

M = million

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3. Disposal in New Off-Site Landfill

Closure by removal could also be accomplished by excavating the CCR from the Dominion facilities and hauling it to an off-site landfill that has been sited, permitted, and constructed to dispose of CCR. This new facility may be located in an area that can serve more than one power station. In this scenario, CCR would be dewatered, excavated, and hauled in a similar fashion as required for off-site commercial landfills. CCR can be hauled to the new landfill by truck or rail, depending on the location of the off-site landfill and proximity to rail.

A general description of risks and benefits for this alternative are provided in Table TM4-6. More detailed assessments of the risk elements described in Section 2.0 are provided in the other sections of this Technical Memorandum.

Table TM4-6: Summary of Benefits and Risks for Closure by Removal and Landfilling at New Off-Site Landfill

Potential Benefits	Potential Risks
• CCR disposal in properly permitted and monitored lined landfill (environmental) • Allows Dominion to retain long-term control of CCR (environmental) • Allows Dominion to consolidate much of the CCR into a single location (environmental, cost, engineering) • Project costs for hauling and disposal of CCR likely to be lower than commercial landfill alternatives (cost) • Off-site disposal may be more acceptable to the community surrounding the power station compared with on-site alternatives (community)	• Requires dewatering, excavation, conditioning, and stockpiling of CCR (safety, environmental, engineering, cost, schedule) • Over-the-road hauling required for a period of 5 to 15 years (safety, community, environmental, cost) • Dominion is responsible for post-closure activities (schedule, cost) • The time and costs associated with site selection, permitting, and construction of a new landfill could be extensive (schedule, regulatory, cost) • Potential for opposition from communities hosting the new landfill and located along haul route (community, schedule)

CCR = coal combustion residual

3.1 Siting of Potential New Off-Site Landfill

This alternative includes development of a new off-site landfill specifically for the purpose of disposing of CCR from Dominion facilities. It is assumed that this new facility would be located in an undeveloped or “greenfield” site and that Dominion would complete the site selection, permitting, design, and landfill construction and operation. Dominion could contract out these activities to a private waste management firm, but the activities, risks, and schedule impacts would be comparable. A site that has already begun the solid waste disposal permitting process, if available, could be an off-site alternative that could result in schedule reduction.

The purpose this section is to assess the feasibility of selecting a candidate landfill site suitable to serve multiple Dominion facilities. For purposes of this screening assessment, AECOM assumed that only one new landfill site would be developed to manage CCR from one or more Dominion facilities. It is not the purpose of this assessment to identify individual parcels suitable for development of a CCR landfill, but to view the feasibility of developing such a facility in a location suitable to serve multiple Dominion facilities. A complete site selection process is required to narrow the search area and to employ more complete site selection criteria.

3.1.1 Study Approach

As a first step, AECOM established a study radius of 50 miles (map miles, not road miles) from each of the four power stations to establish a practical range for truck hauling to a newly developed landfill. A range of 50 miles is the same range established for hauling to off-site commercial landfills. A new landfill beyond 50 miles could be considered but costs would increase. The study radius from each station is shown on Figure TM4-5.

Ideally a new landfill site would be located to serve multiple Dominion sites from a central location. As can be seen from Figure TM4-5, there are area overlaps between Bremo, Possum Point, and Chesterfield Power Stations and between Chesapeake Energy Center and Chesterfield Power Station. The Chesapeake Energy Center would contribute a relatively low quantity of CCR for off-site disposal, so its location would have correspondingly less influence on the location of a new off-site landfill. For this reason, the primary area for this assessment is the area shown on Figure TM4-6 located in central Virginia roughly centered along I-95 north of I-64 and south of Fredericksburg. This covers portions of Madison, Culpeper, Orange, Louisa, Spotsylvania, Hanover, Caroline, King William, King and Queen, and Essex Counties.

AECOM applied our OPTI-Site process to evaluate locations for a new off-site landfill. OPTI-Site is a raster-based geographic information system (GIS) tool used to identify and compare potential landfill sites. This tool provides an objective site selection process that takes regulatory, operational, client, and community criteria into account; screens candidate sites within a prescribed radius; and identifies suitable areas. This process allows a technical, decision-based approach to identifying candidate sites and justifying their selection once siting selection is completed.

AECOM applied OPTI-Site for the primary search area between the Bremo, Possum Point, and Chesterfield Power Stations. Exclusionary criteria available from GIS databases were overlain on the search area and are shown on Figure TM4-7.

Areas of Figure TM4-7 that have no shading represent portions of the search area that conceptually meet the screening criteria applied for this scope of work.

In addition, land within municipal boundaries was excluded from further assessment. Parcel data, including zoning where available, was also loaded into the OPTI-Site search area. These data are shown on Figure TM4-8 overlain on the siting restrictions referenced above. For this assessment, we assumed that parcels in the search area that are zoned residential or agricultural are excluded from this initial screening. Although zoning can be changed or conditional, or special use permits could be issued to allow development of a landfill on agricultural or un-zoned land, the procedures vary by county and cannot be incorporated into the assessment at this screening level. Areas of Figure TM4-8 that have no shading after overlay of zoning data can be considered candidate landfill locations, although more assessment is required.

Once specific owner, community, and transportation criteria are identified, a more detailed site selection process could include the following criteria, in no particular order:

- Site topography
- Soil type

- Depth to rock
- Proximity to major roads
- Proximity to schools and churches
- Proximity to rail facilities
- Parcel size and number of parcels

3.1.2 Study Results

To accommodate the CCR from the four Dominion power stations, we estimate that a landfill unit with a footprint ranging from 150 to 200 acres would be required. In addition to the land required to establish the landfill itself, additional property is needed to satisfy regulatory setbacks; avoid streams and wetlands; provide for stormwater management; construct roads, scale facilities, administrative and operational support structures; and to provide a source for borrow soil to construct the landfill and the final cover. Experience indicates that a site at least three to four times greater in size than the total landfill footprint is required. For this reason, it is estimated that the target size for a landfill site ranges from 500 to 800 acres. Sites with direct access from a major roadway are preferred. The facility size will vary widely, depending on topography, presence of jurisdictional areas, proximity to roadways, and other factors. The landfill facility could consist of a single parcel or be made up of multiple parcels currently owned by multiple entities. Identification of individual parcels suitable for development of a CCR landfill is beyond the scope of this feasibility screening. A preliminary assessment of parcels in the target search area indicates that a limited number of single parcels would meet the screening size threshold and siting criteria. Combinations of multiple parcels will likely be required.

Based on a preliminary screening level assessment, development of a single new off-site landfill to manage CCR from one or more Dominion facilities is feasible if it meets the timeline required to manage the CCR closure by removal alternative established by Dominion and regulatory authorities. Significant additional work is required to identify candidate sites, evaluate the transportation routes to the sites, and the source power stations that need to be served.

3.2 Risk Impacts for New Off-Site Landfill

As described in Section 1.3.2, there are risks associated with excavating CCR, transporting CCR, and disposing of CCR. The following subsections provide a general discussion of the potential impacts related to safety, environmental impacts, community, schedule, and cost related to developing a new off-site landfill.

3.2.1 Safety Impacts

Safety impacts associated with constructing a landfill off site would be similar as for constructing one on site, described in Section 2.6.1.

Safety impacts associated with hauling hundreds of thousands of truckloads of CCR over public roads and highways are significant and must be closely considered in any closure by removal alternative that involves off-site beneficial use or disposal, regardless of the destination.

Once the CCR is brought to the off-site landfill location, the potential safety impacts are similar to those associated with any landfill facility regardless of location. Professional landfill construction contractors, landfill operators or operations contractors must employ well-understood safety measures during construction, operations and post-closure activities.

3.2.2 Environmental Impacts

Siting a new “greenfield” landfill could result in impacts to jurisdictional areas such as streams or wetlands, which could be mitigated under current environmental regulations. The loss of trees or agricultural land has an environmental impact on the scale of other large commercial, residential, or commercial developments. Lateral expansions of commercial landfills are also likely to have these impacts.

Environmental impacts associated with disposal of CCR at properly permitted lined landfills would be similar for off-site or on-site landfills. Through the Virginia regulatory process, such impacts have been shown to be acceptable when the landfill is properly designed, operated, and maintained. At an off-site facility, day-to-day responsibility for managing environmental impacts would fall to Dominion as the owner of the landfill.

As discussed for the on-site alternatives in Section 2.6.2, environmental impacts are generally tied to dust and leachate, or groundwater impacts. Dust control requirements are well defined in the CCR Rule, as well as air quality permits. Leachate must be managed continuously until landfill closure to prevent spills to adjacent surface water. Regulatory requirements currently in place are well established in the waste management industry and would apply to CCR landfills.

Properly designed and operated landfills with a composite liner and leachate collection system are required under both USEPA and Virginia regulations. These elements are widely recognized as regulatory and engineering standards and greatly reduce the risk of groundwater impacts.

3.2.3 Community Impacts

Siting and development of a new landfill can result in community concern, opposition, and even resistance. Opposition to the proposed new facility could begin during the landfill site selection process, when multiple candidate sites may be evaluated in parallel. The level of community involvement could delay the opening of a new landfill and affect cost and closure schedule for Dominion at one or more of its power stations. As is the case of any off-site landfill, the impacts associated with hauling and those associated with disposal are additive.

As described in Section 2.6.3, construction- and operation-related impacts to nearby communities should be evaluated when considering an off-site landfill location.

3.2.4 Schedule Impacts

An off-site CCR landfill will require a potentially lengthy site selection, land acquisition, permitting, and construction schedule. These activities could take 5 to 7 years to complete, and there is a risk that acquiring and developing a suitable site cannot be accomplished due to potential public opposition. Even under favorable conditions, the schedule for developing a new landfill would be longer than that for hauling CCR to existing commercial landfills, even if these landfills do not have all the required disposal capacity currently under permit.

The long-term schedule for moving all of the CCR from one or more Dominion facilities is dependent on the mode of CCR transportation and the rate that CCR can be hauled. Transportation constraints could affect the schedule and would need to be evaluated in conjunction with the CCR and the haulers.

The most streamlined option for constructing a new landfill would entail identifying properties within a 50-mile radius of the Dominion power stations that have already gone through preliminary zoning and permitting for waste acceptance. Depending upon the property owner and permit status, this could potentially save 3 to 5 years from the timeline to purchase an undeveloped property and permit it as a solid waste facility.

3.2.5 Costs

Table TM4-7 provides a summary of costs.

Table TM4-7: Summary of Costs for New Off-Site Landfill

Item	Cost
Closure by removal	$1,342M
CCR loading and over the road transportation	$1,113M
Public roadway restoration	$64M
Landfill construction	$485M
Landfill operations	$1,021M
Landfill closure and post-closure	$129M
Total	**$4,154M**

All costs in this Technical Memorandum are Class 5 estimates (+100%, -50%) and represent opinions of probable cost based on information available at the time of this study.

CCR = coal combustion residual; M = million

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4. Assumptions

4.1 General Assumptions

For any disposal facility to accept CCR from the Dominion facilities, it is assumed that the facility meets all the siting, engineering, and operations requirements outlined in the CCR Rule and VSWMR (9VAC20-81). This applies to new facilities, as well as existing facilities and expansions of existing facilities.

Landfill facilities developed on Dominion property will have adequate capacity to dispose of all of the CCR that is removed from the ash ponds located on that facility. For purposes of this assessment, it is assumed that CCR removed from one Dominion facility will not be disposed of in a landfill located on another Dominion facility.

For landfill sites developed on the footprint of an existing or former ash pond, it is assumed that the CCR will be removed from the ash pond in order to meet the criteria for closure by removal, and the landfill subgrade will be established to meet groundwater separation criteria. AECOM assumed conservative base elevations for the purpose of conceptual landfill development, but this will have to be established after detailed subsurface and groundwater analyses are completed.

AECOM established conceptual landfill layouts on the power station sites based on available information from site plans provided by Dominion. The lateral extents of the potential landfill locations were established based on regulatory siting criteria and available site information. No detailed site reconnaissance, subsurface exploration, or groundwater evaluation have been completed, so the landfill limits shown are conceptual layouts only for the purpose of comparing CCR management alternatives.

A contingency of 25% was added to the reported on-site CCR volume for this assessment of airspace needs for landfill disposal. Such a contingency is typical for this level of conceptual design and accounts for the following:

- Capacity to dispose of soil below the in-place CCR that is excavated as part of closure by removal
- Uncertainty in estimation of the volume of in-place CCR that will have to be disposed of
- Engineering uncertainty regarding site conditions in this conceptual level assessment

4.2 Cost Estimating Assumptions

To support this assessment, AECOM developed cost estimates for various closure alternatives for each of the four power stations. These Opinions of Probable Cost are estimates of possible construction costs for informational purposes. The estimates are based on Class 5 Estimates (see Table TM4-8) and are limited to the conditions existing at issuance and not a guarantee of actual price or cost. Uncertain market conditions such as, but not limited to local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, etc. may affect the accuracy of these estimates. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

Table TM4-8: Cost Estimate Classification Matrix

	Primary Characteristic	Secondary Characteristic			
Estimate Class	Level of Project Definition[(1)]	End Usage[(2)]	Methodology[(3)]	Expected Accuracy Range[(4)]	Preparation Effort[(5)]
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: –20% to –50% H: +30% to +100%	1
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: –15% to –30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, authorization, or control	Semi-detailed unit costs with assembly level line items	L: –10% to –20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: –5% to –15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: –3% to –10% H: +3% to +15%	5 to 100

Source: AACE (2005)

(1) Expressed as percent of complete definition

(2) Typical purpose of estimate

(3) Typical estimating method

(4) Typical variation in low and high ranges. The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

(5) Typical degree of effort relative to least cost index of 1. If the range index value of “1” represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

H = high; L = low

5. References

DEQ (Virginia Department of Environmental Quality). 2017. *Solid Waste Managed in Virginia During the Calendar Year 2016*.

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6. Abbreviations

CCR	coal combustion residuals
CY	cubic yards
DEQ	Virginia Department of Environmental Quality
FFCP	Fossil Fuel Combustion Products
GIS	geographic information system
M	million
SB 1398	Senate Bill 1398
USEPA	U.S. Environmental Protection Agency
VAC	Virginia Administrative Code
VSWMR	Virginia Solid Waste Management Regulations

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Figures

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Legend

- Index Grading Contour (Proposed)
- Intermediate Grading Contour (Proposed)
- Ash Boundary
- Coal Yard (Closed)
- Site Boundary

N

0 300 600 1,200
Feet

AECOM

Figure TM4-1
Conceptual North Ash Pond Landfill Site Plan

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MPS	JAB	DOS	REV. 0

Bremo Power Station

DATE:	DEPT:
10/25/2017	Environment

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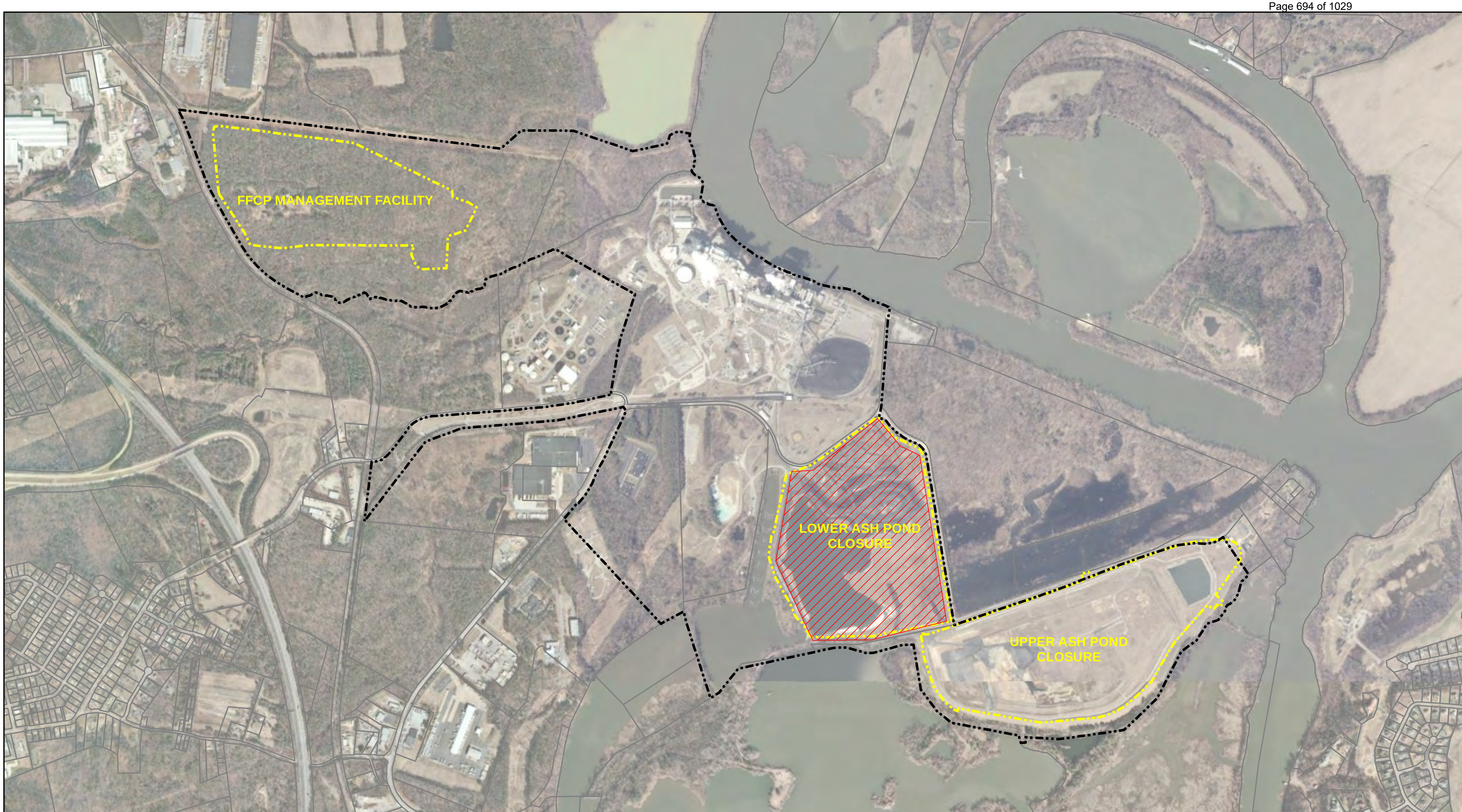

Legend

- Proposed Landfill Boundary
- Chesterfield Power Station Boundary
- Boundary
- Parcel Boundary

N

0 600 1,200 2,400
Feet

AECOM

Figure TM4-2
Conceptual Lower Ash Pond Landfill Site Plan

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MPS	JAB	DOS	REV. 0

Chesterfield Power Station

DATE:	DEPT:
10/25/2017	Environment

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OPEN AREA
NORTH END
ASH POND E
METALS
POND B
METALS
POND A
ASH POND D
POSSUM POINT RD
COCKPIT POINT RD
10' PROPOSED CONTOURS
POND BOUNDARIES
N
0 100 200 400
AECOM
Figure TM4-3
Conceptual On-Site Landfill Options - Standard Setbacks
DRAWN BY: MWB
REVIEWED BY: JAB
APPROVED BY: DOS
REVISION NUMBER: REV. 0
Possum Point Power Station
DATE: 10/26/2017
DEPT:

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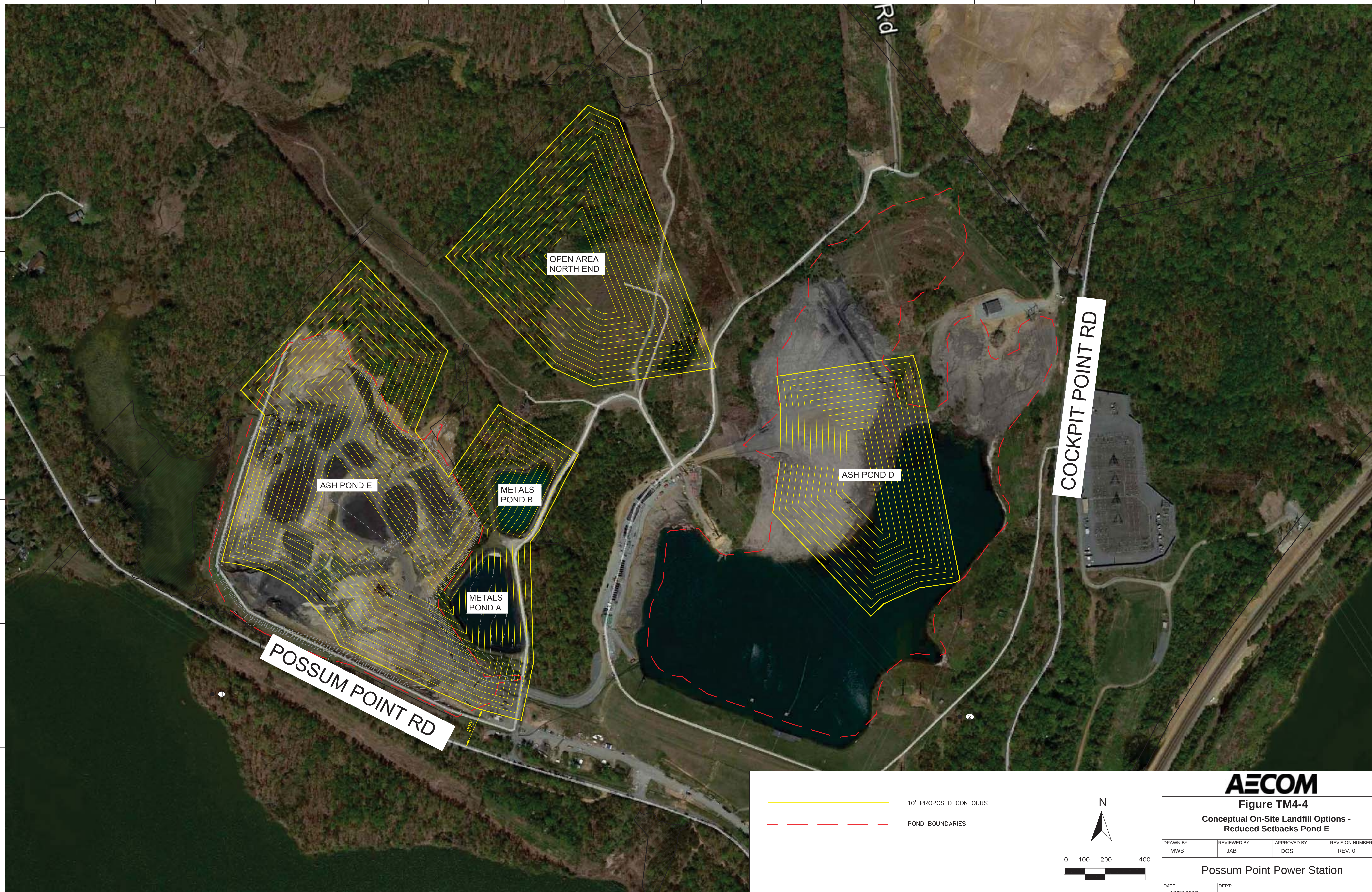

AECOM

Figure TM4-4

Conceptual On-Site Landfill Options - Reduced Setbacks Pond E

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MWB	JAB	DOS	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/26/2017	

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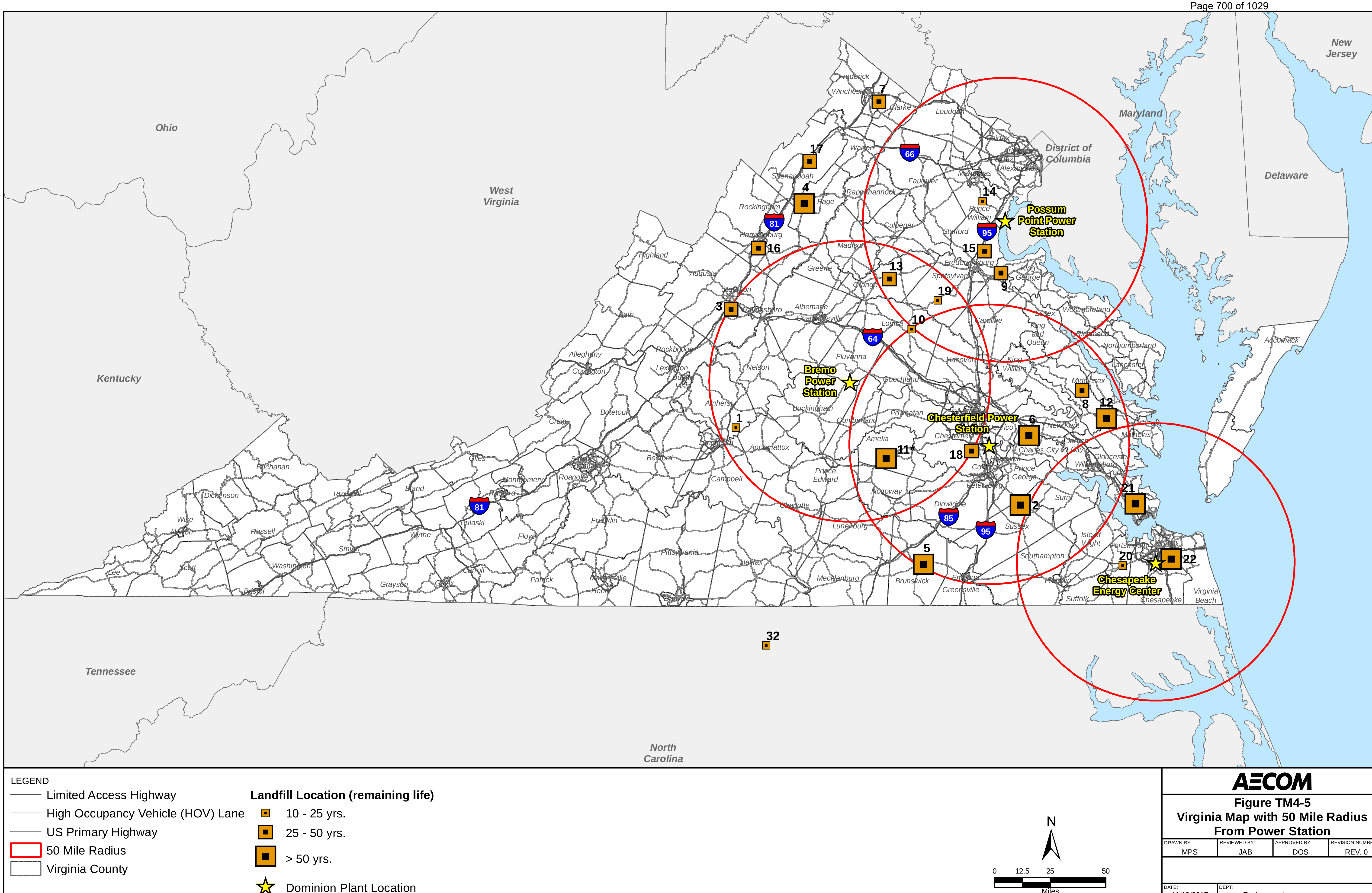

AECOM

Figure TM4-5
Virginia Map with 50 Mile Radius From Power Station

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MPS	JAB	DOS	REV. 0

DATE:	DEPT:
11/13/2017	Environment

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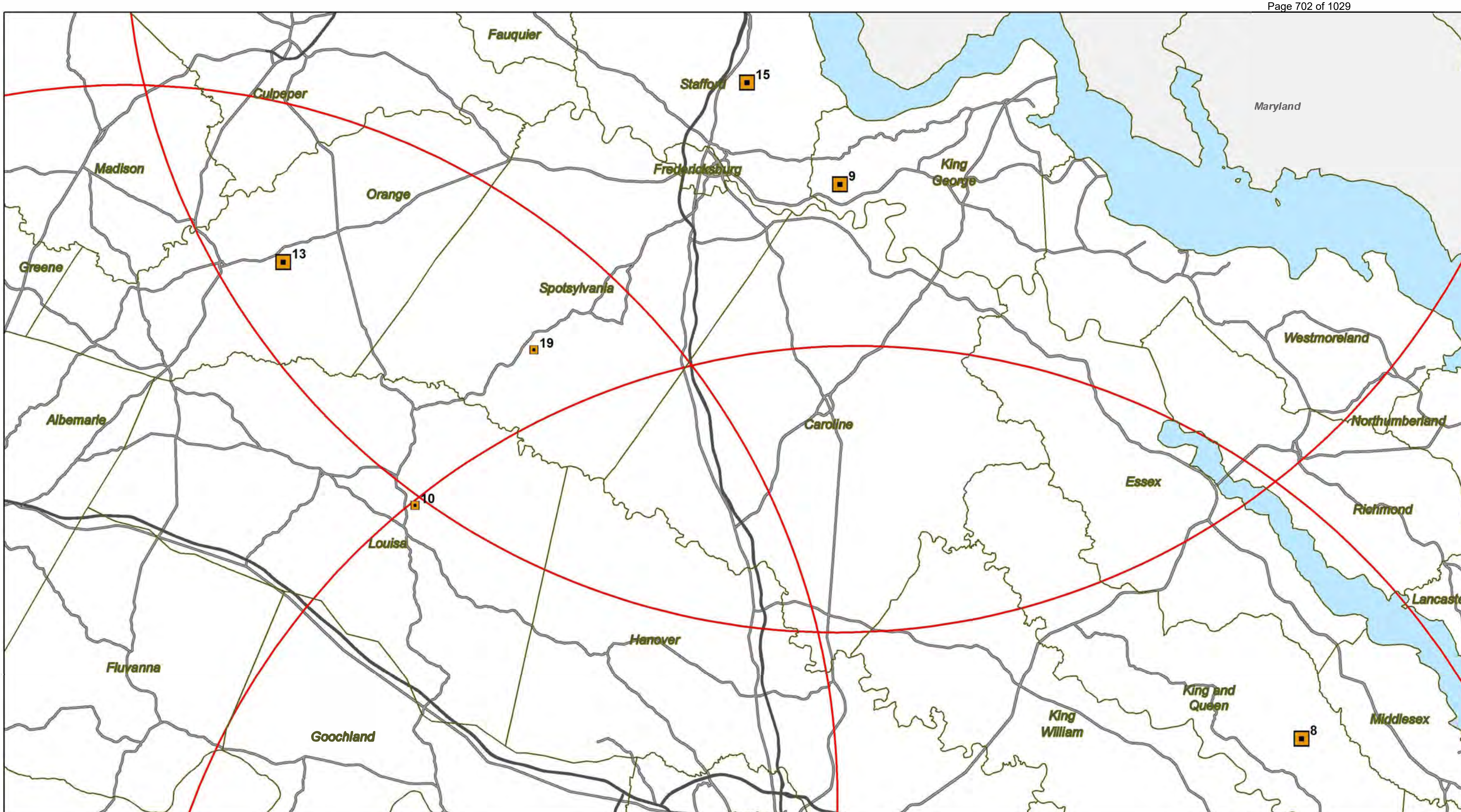

LEGEND
- Railroad
- Limited Access
- High Occupancy Vehicle (HOV) Lane
- US Primary Highway
- 50 Mile Radius
- Virginia County

Landfill Location (remaining life)
- 10 - 25 yrs.
- 25 - 50 yrs.
- > 50 yrs.

N

0 2 4 8
Miles

AECOM

Figure TM4-6
New Landfill Target Search Area

DRAWN BY	REVIEWED BY	APPROVED BY	REVISION NUMBER
MPS	JAB	DOS	REV. 0

DATE	DEPT
10/25/2017	Environment

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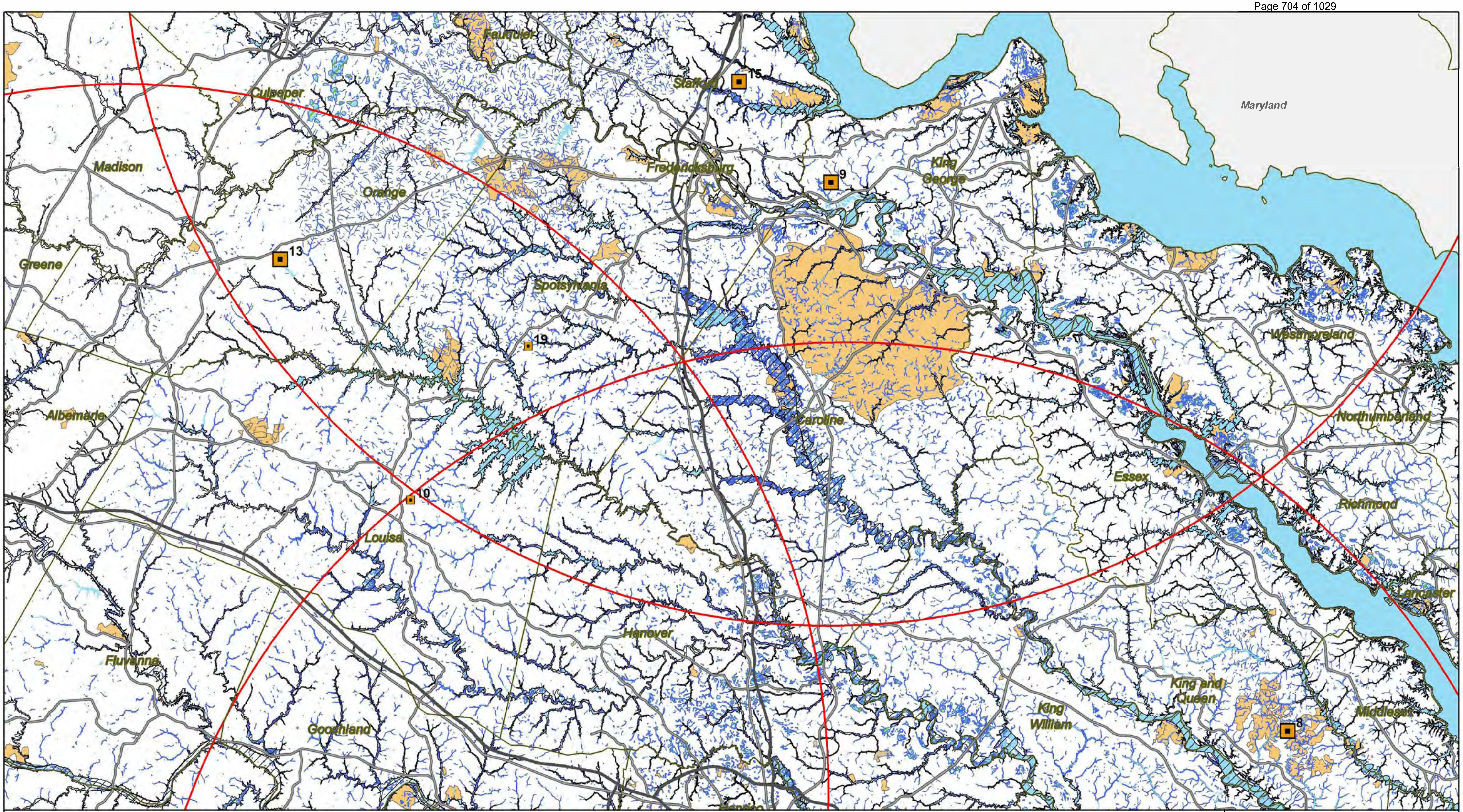

LEGEND

- Railroad
- Limited Access Highway
- High Occupancy Vehicle (HOV) Lane
- US Primary Highway
- 50 Mile Radius
- 100 yr. Flood Zone
- Wetland
- National Park Land
- US Forest Service Land
- Federal/State/Local Owned Land
- Virginia County

Landfill Location (remaining life)

- 10 - 25 yrs.
- 25 - 50 yrs.
- > 50 yrs.

N

0 2 4 8
Miles

AECOM

Figure TM4-7
New Landfill Target Search Area with Siting Restrictions Applied

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MPS	JAB	DOS	REV. 0

DATE	DEPT
10/26/2017	Environment

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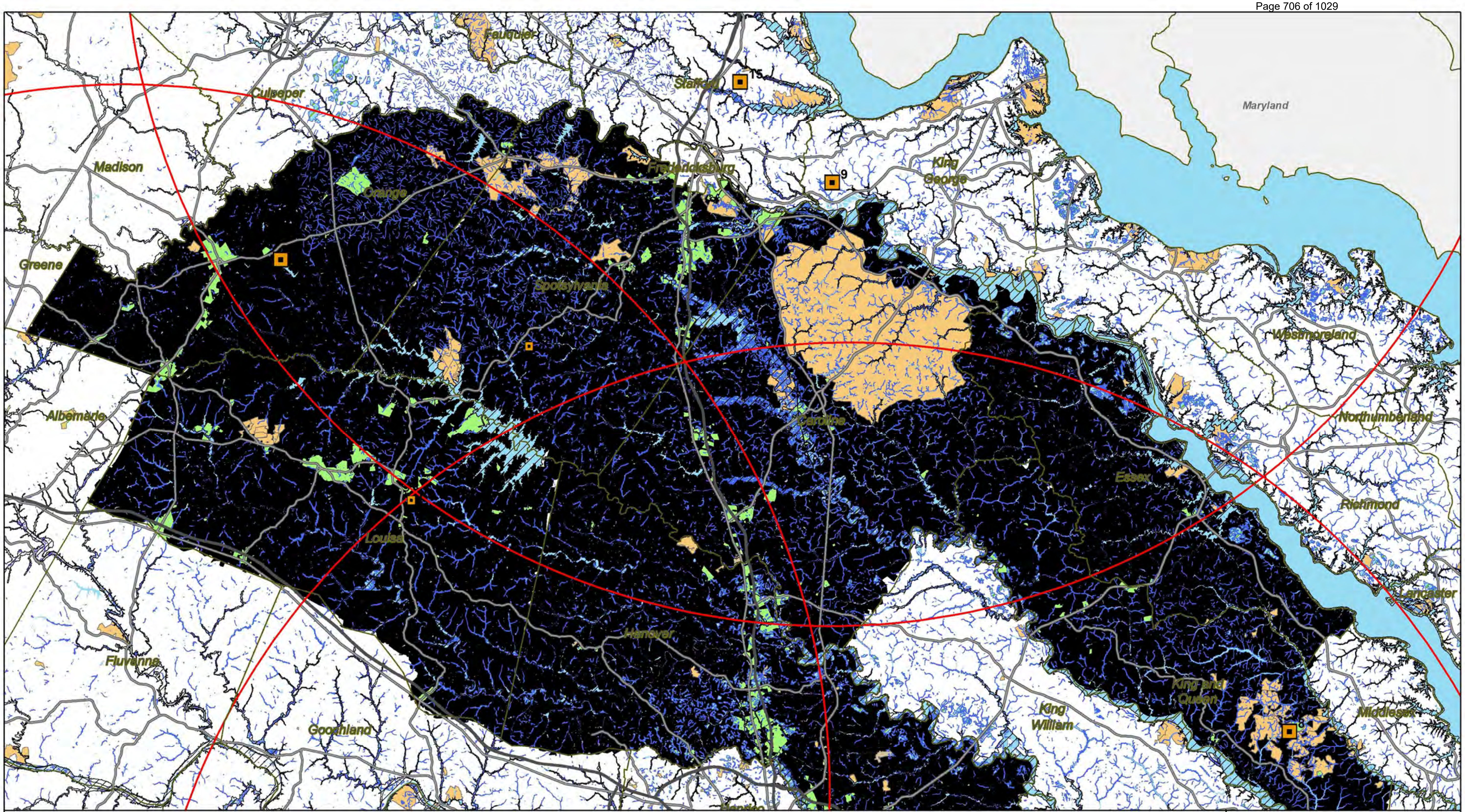

LEGEND

- Railroad
- Limited Access Highway
- High Occupancy Vehicle (HOV) Lane
- US Primary Highway
- 50 Mile Radius
- 100 yr. Flood Zone
- Wetland
- National Park Land
- US Forest Service Land
- Federal/State/Local Owned Land
- Virginia County

Landfill Location (remaining life)

- 10 - 25 yrs.
- 25 - 50 yrs.
- > 50 yrs.

Zoning

- Non-Residential
- Residential and Agricultural

N

0 2 4 8
Miles

AECOM

Figure TM4-8
New Landfill Target Search Area with Siting Restrictions and Zoning Applied

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
MPS	JAB	DOS	REV. 0

DATE:	DEPT:
11/27/2017	Environment

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Senate Bill 1398 Response

Coal Combustion Residuals Ash Pond Closure Assessment

TECHNICAL MEMORANDUM 5

Closure-in-Place

November 2017

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Senate Bill 1398 Response:
Coal Combustion Residuals Ash Pond Closure Assessment

Technical Memorandum 5: Closure-in-Place

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Appendices

Tables

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1. Introduction and Summary of Findings

Virginia Senate Bill 1398 (SB 1398) requires "that every owner or operator of a coal combustion residuals (CCR) surface impoundment that is located within the Chesapeake Bay watershed … conduct an assessment of each such CCR surface impoundment (CCR unit) regarding the closure of any such unit." The assessment must include describing groundwater and surface water conditions surrounding the surface impoundments (ash ponds) and evaluating corrective measures to restore water quality (if needed), evaluating the clean closure (closure by removal) of the CCR unit by recycling/reusing the ash or moving it to a landfill and demonstrating the long-term safety of the CCR unit if it is closed in place.

SB 1398 is applicable to eleven CCR surface impoundments (referred to as ash ponds in this report) at four Dominion Energy (Dominion) power stations. On behalf of Dominion, AECOM conducted an evaluation of the groundwater and surface water on all eleven ponds and an assessment of closure options on the five ponds that have been slated for closure. Ash has been removed or is in the process of being removed from the other six ponds; therefore, these ponds are being closed by removal. Table TM5-1 provides information on the Dominion power stations and ash ponds that were included in the study.

Table TM5-1: Ash Ponds included in the Study

Power Station	CCR Units	Remaining CCR Volume (CY)(1)	Operating Status	Area (acres)
Bremo Power Station	North Ash Pond(2)	4,800,000	Slated for closure	68
	East Ash Pond	1,400,000	Ash being actively removed and transported to North Ash Pond	27
	West Ash Pond	0	Ash removed	22
Chesapeake Energy Center(3)	Bottom Ash Pond(2)	60,000	Committed to closure by removal	5
Chesterfield Power Station	Lower Ash Pond(2)	3,600,000	Slated for closure	101
	Upper Ash Pond(2)	11,300,000	Slated for closure	112
Possum Point Power Station	Ash Pond A Ash Pond B Ash Pond C	40,000	Residual ash to be removed from Ash Ponds A, B, and C and transported to Ash Pond D	18
	Ash Pond D(2)	4,009,250	Slated for closure	70
	Ash Pond E	2,250	Residual ash to be removed and transported to Ash Pond D	38
	Total Volume	**25,211,500**		

(1) CCR volumes are based on Dominion estimates as of July 10, 2017

(2) Assessed for closure options

(3) While not subject to the assessment required by SB 1398, the CCR landfill at the Chesapeake Energy Center is slated for closure in accordance with VSWMR. Virginia DEQ issued a draft solid waste permit in June 2016 for closure of the landfill, which process was later suspended at Dominion's request. The draft permit required Dominion to evaluate and propose alternative corrective measures to address groundwater impacts. In addition, in connection with a July 31, 2017, court order, Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, to include proposed additional corrective measures to address site-wide groundwater impacts.

CCR = coal combustion residuals; CY = cubic yards; DEQ = Department of Environmental Quality; VSWMR = Virginia Solid Waste Management Regulations

1.1 Study Objective

The objective of the study was to comply with the following SB 1398 requirements to ensure the long-term safety of the ash ponds while protecting public health and the environment:

- Evaluate closure by removal with recycling or reuse (beneficial use) of the CCR material
- Evaluate closure by removal with placement of CCR material in a permitted landfill
- Evaluate closure-in-place addressing long-term safety, structural, and extreme weather event resiliency
- Describe groundwater and surface water quality surrounding each ash pond, and evaluate corrective measures if needed

AECOM was tasked with critically reviewing existing information, identifying additional studies that may be needed, performing the studies, and preparing a report that addresses the requirements of SB 1398 for each of the eleven Dominion ash ponds listed in Table TM5-1.

The objective of the SB 1398 requirements is to provide members of the legislature, environmental regulators, local government officials, and the local communities with an assessment of ash pond closure options as set forth in the legislation. Specifically, the report describes how the various options could meet the objectives of safe closure, compliance with applicable federal and state rules, and protection of public health and the environment. This report is not intended, and must not be construed, to provide recommendations or conclusions regarding the selection of the options detailed herein.

AECOM developed a series of Technical Memoranda that provide a detailed analysis of the primary technical information needed to comply with SB 1398 requirements. The Technical Memoranda provide an assessment of closure by removal options (including recycling/beneficial use and landfilling); ash sampling results to supplement the beneficial use study; and evaluations of closure-in-place, groundwater and surface water conditions, and potential groundwater corrective measures. The memoranda are included as attachments to the report and are referenced as appropriate.

1.2 Technical Memorandum 5 Objective

Technical Memorandum 5 describes the closure-in-place analysis, including long-term resilience to extreme weather events such flooding, erosion, and storm surge. Structural stability under different loading conditions, including seismic (earthquake), is discussed. Impacts related to schedule and costs for the closure-in-place option for each of the sites are also presented.

This Technical Memorandum is presented in response to SB 1398 requirement 4:

> Demonstrate the long-term safety of the ash pond, addressing any long-term risks posed by the proposed closure plan and siting, including risks related to extreme weather events, flooding, hurricane, storm surges, and erosive forces. Ash has been removed or is in the process of being removed from seven of the ponds; therefore, the focus of this assessment is primarily on the four active ponds and subsequent closure options.

The remainder of this technical memorandum presents details of the closure-in-place assessments for:

- North Ash Pond located at the Bremo Power Station
- Bottom Ash Pond located at the Chesapeake Energy Center is not included in this evaluation, as Dominion has committed to removing the ash from the pond
- Lower and Upper Ash Ponds at the Chesterfield Power Station
- Ash Pond D at the Possum Point Power Station

For each of the ash ponds and stations, the following information is presented:

- Brief description of the power station
- Summary of construction and operational history of the ash ponds
- Assessment of long-term safety and resilience to extreme weather events (e.g., flooding/hurricanes), erosion, and storm surge for the proposed closure-in-place option
- Considerations related to other non-weather-related extreme events or factors that pertain to the siting of the facility and closure (e.g., unstable areas, active faults, seismic activity)
- Closure schedule and cost

1.3 Closure-in-Place Overview

The closure-in-place option for the ash ponds includes the following:

- Requires obtaining necessary permits and approvals.
- Removing and treating free liquids.
- Performing pore water removal as needed for construction, and treatment of the removed pore water.
- Stabilizing the remaining CCR materials sufficient to support the final cover system.
- Grading the CCR materials to promote effective surface water runoff.
- Installing a final cover system with appropriate stormwater management systems. The final cover system would be designed to reduce infiltration from rainwater, resist erosion, and meet or exceed the final cover system requirements in 40 CFR § 257.102(d)(3)(i).
- Conducting post-closure groundwater monitoring, maintaining the cover system and, maintaining compliance with dam safety regulations. Long-term management would be governed by the Virginia Department of Environmental Quality (DEQ) and federal and state CCR Rules, once issued. The embankments would continue to be regulated by the Virginia Department of Conservation and Recreation (DCR) under the Impounding Structure Regulations (4VAC50-20 et seq.).
- Groundwater corrective actions, to the extent required, are presented in Technical Memorandum 7.

1.4 Summary of Findings

The results of the assessment demonstrate that the closure-in-place option at the Bremo, Chesterfield, and Possum Point Power Stations would meet the requirements of federal and state CCR Rules by providing long-term safety of the ash ponds and addressing the long-term risks associated with the closure-in-place options, siting, and extreme weather events including flooding, hurricanes, storm surges, and erosive forces.

Table TM5-2 is a summary of the findings. The text box that follows provides definitions for terms used in this technical memorandum.

Table TM5-2: Summary of Long-Term Safety Assessment, Schedule, and Estimated Cost for Closure-in-Place Option

Category	Subcategory	Bremo Power Station (North Ash Pond)	Chesterfield Power Station (Lower and Upper Ash Ponds)	Possum Point Power Station (Ash Pond D)
Long-Term Safety Assessment	**Closure plan** (meets CCR Rule, DEQ and DCR regulations)	Meets Acceptance Criteria	Meets Acceptance Criteria	Meets Acceptance Criteria
	Siting (unstable areas, active faults, and earthquakes)	Meets Acceptance Criteria	Meets Acceptance Criteria	Meets Acceptance Criteria
	Flooding (final cover and dam integrity)	Meets Acceptance Criteria	Meets Acceptance Criteria	Meets Acceptance Criteria
	Hurricanes (final cover and dam integrity)	Meets Acceptance Criteria	Meets Acceptance Criteria	Meets Acceptance Criteria
	100-year storm surge (final cover and dam integrity)	Meets Acceptance Criteria	Meets Acceptance Criteria[1]	Meets Acceptance Criteria
	Erosive forces (final cover and dam integrity)	Meets Acceptance Criteria	Meets Acceptance Criteria	Meets Acceptance Criteria
Schedule (years)	—	3 years	3 years	3 years
Cost Estimate[(2)]	—	$96M	• $125M for Lower Ash Pond • $64M for Upper Ash Pond	$134M

The assessment summarized in this table is based on several documents about the ash ponds at each site provided by Dominion. The sources are cited in Technical Memorandum 5.

(1) The closure-in-place concept design for Chesterfield Lower Ash Pond would be supplemented by adding protection for the final cover for potential storm surge if needed.

(2) Costs do not include potential corrective measures

CCR = coal combustion residuals; DCR = Virginia Department of Conservation and Recreation; DEQ = Virginia Department of Environmental Quality; M = million; NA = not applicable

1.5 Definitions of Key Terms

Definitions of the key terms that are used in this report are as follows:

Inundation studies. Even though the ash ponds and their dams meet structural stability and other regulatory criteria, DCR dam safety regulations require the development of hypothetical breach scenarios, inundation mapping, hazard potential classification, and Emergency Action Plans (EAPs) as part of protecting the downstream areas against potential breach.

Liquefaction. Liquefaction occurs when loose saturated soil deposits are shaken by seismic events that exceed the liquefaction resistance of the soils (or ash). Liquefaction can lead to partial loss of strength and stiffness of soils (or ash). Calculations are performed to verify if the design seismic event will lead to adverse impacts related to potential liquefaction.

Long-term universal soil loss assessment. Assessment performed to verify that the closure design will protect the quality of the downstream water bodies by limiting the soil loss from the final cover and the long-term integrity of the final cover system.

Probable maximum flood (PMF). The theoretically largest flood resulting from a combination of the most severe rainstorm events that could conceivably occur in a given area.

Settlement calculations. Calculations performed to verify that the final cover system will function as designed under long-term conditions where settlements of the ash material may occur.

Slope stability calculations. Calculations performed to verify if the closed ash pond will remain stable in the long-term under the stated design loading events.

Spillway capacity. Calculations performed to verify that the spillway has adequate capacity to contain the design stormwater flows and route the water to drain appropriately.

Stormwater management system design calculations. Calculations performed to verify the long-term performance of the dam and the final cover system of the closed impoundment by routing the flows and resisting the forces from selected storm events.

Veneer slope stability analysis. Analysis performed to evaluate whether the final cover system has the potential to slide as a wedge (i.e., veneer) down the slope, exposing the contained ash.

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2. Bremo Power Station

Bremo Power Station is located at 1038 Bremo Bluff Road, Bremo Bluff, Fluvanna County, VA. Dominion converted the station from a coal-fired power plant to a natural gas-fired power plant in 2014. CCR from past operations is stored in three on-site ash ponds (North Ash Pond, West Ash Pond, and East Ash Pond). See Figure TM5-1.

Under the closure-in-place option, the CCR from the West and East Ash Ponds would be excavated (i.e., closure by removal) and used to achieve closure-in-place final grades at the North Ash Pond. Therefore, the long-term safety assessment of the closure-in-place option for the Bremo station addresses the North Ash Pond only.

Section 2 contains background information, including construction and operations, on the ash ponds at Bremo Power Station.

2.1 Ash Ponds

The three ash ponds at Bremo Power Station are West Ash Pond, East Ash Pond, and North Ash Pond.

2.1.1 West Ash Pond

The West Ash Pond was constructed in 1978 and 1979. The power station has typically used the West Ash Pond to store a mixture of bottom and fly ash for periods of a few years, followed by dredging and hydraulically conveying the ash to the North Ash Pond after the North Ash Pond was commissioned in 1983.

CCR has been removed from the West Ash Pond; therefore, the closure-in-place option is not being considered for the West Ash Pond. CCR removed from the West Ash Pond was transferred to the North Ash Pond.

2.1.2 East Ash Pond

The original East Ash Pond was constructed in the late 1950s. The East Ash Pond is proposed to be closed by removal of CCR, so the closure-in-place option is not being considered for the East Ash Pond. CCR removed from the East Ash Pond is currently being transferred to the North Ash Pond.

2.1.3 North Ash Pond

The North Ash Pond was commissioned in 1983. All CCR materials from the West and East Ash Ponds are being consolidated into the North Ash Pond. CCR stored in the West Ash Pond has been periodically dredged and hydraulically transferred to the North Ash Pond.

The North Ash Pond covers approximately 68 acres, has a dam approximately 99 feet tall, and as of July 2017, contained approximately 4.8 million CY of CCR. When the transfer of CCR from the West and East Ash Ponds has been completed, the CCR volume in the North Ash Pond is anticipated to be 6.2 million CY.

Closure in place for the North Ash Pond in accordance with 40 CFR § 257.102(d) would include leaving CCR in place, removing free liquids, and installing an engineered final cover system. Embankments for the North Ash Pond would continue to be regulated by the DCR under the Impounding Structure Regulations (4VAC50-20).

Several engineering investigations and assessments have been completed for the ash ponds at the Bremo Power Station. They include the original design, subsequent assessments, U.S. Environmental Protection Agency (USEPA) dam safety assessment (2010), CCR Rule certifications, and closure plans. AECOM received the reports about the North Ash Pond listed below from Dominion and reviewed them:

- Closure plans
  - Closure and Post-Closure Plans for CCR Posting (Golder, 2016a; 2016b)
  - Closure Plan (Golder, 2017e; 2017d), which includes the following:
    - Settlement calculations for the final cover system
    - Liquefaction-triggering calculations for the dam embankment and sluiced ash in the pond for 2,500-year return period seismic event (earthquake)
    - Slope stability calculations for existing and closure conditions covering different loading cases such as long-term steady-state static, seismic, post-liquefaction, maximum pool in the surface water management ditches related to a 100-year storm event, maximum surcharge pool in the surface water management ditches related to a probable maximum flood (PMF) storm event, and rapid drawdown of the downstream dike slopes during the receding of a 100-year flood event
    - Veneer slope stability of the final cover system for static and seismic conditions
    - Long-term universal soil loss assessment for the final cover system
    - Stormwater management system design calculations for the closed condition for PMF and 2-, 10-, 25-, and 100-year, 24-hour storm events.
  - Impounding Structure Design Report, DCR submittal (Golder, 2017c). Addresses closure plan and outlet works modifications DCR Inventory #06520. Calculations include the above-mentioned calculations and the following additional calculations:
    - Spillway capacity: Closed condition outlet works for PMF storm event.
    - Inundation Study (Golder, 2017b; 2011): For closed condition under PMF breach and non-breach events.
    - Geotechnical Data Report (Golder, 2017) consisting of boring logs, cone penetration testing (CPT) logs, well logs, laboratory test data, and material properties assessments.
    - Temporary support of excavation design calculations to remove CCR from underneath the toe of the North Ash Pond dam as part of the closure construction (Schnabel Engineering, 2017).
- CCR Certification Reports for existing conditions (Golder, 2016c; 2016d; 2016e; 2016f)
  - Factor of safety
  - Structural stability

  - Hazard potential classification
  - History of construction
- Dam
  - Drawings for Phases I and II of Original Construction (J.K. Timmons & Associates; Schnabel Engineering, 1982)
  - Annual dam inspection reports for 2015 and 2016 (Dominion, 2015; Dominion, 2016)
  - Dam Safety Assessment of CCW Impoundments (O'Brien and Gere, 2010)
  - Emergency Action Plan (EAP) and Downstream Inundation (Golder, 2017a; 2017b)

2.2 Extreme Weather Events and Long-Term Safety of the Closure Plan for North Ash Pond

Section 2.2 addresses SB 1398 Item 4, the long-term safety and resilience to extreme weather events (e.g., flooding/hurricanes), erosion, and storm surge for the proposed closure-in-place option. Considerations related to other non-weather-related extreme events or factors that pertain to the siting of the facility and closure (e.g., unstable areas, active faults, seismic activity) are covered in Section 2.3.

2.2.1 Flooding/Hurricane

Federal solid waste regulations (40 CFR § 258.11) referenced by the CCR Rule require that solid waste units in 100-year floodplains demonstrate that the unit will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment.

2.2.1.1 Location of North Ash Pond Relative to Floodplain

The proposed North Ash Pond closure-in-place would not have adverse impacts, such as the ones covered under 40 CFR § 258.11, as a result of its location relative to floodplains. The North Ash Pond dam is approximately 1,000 feet from the James River. Due to the station's proximity to the James River, most of the area downstream of the North Ash Pond is subject to flooding from the 1-percent-annual-chance event (100-year event) and is classified as Zone AE on the Flood Insurance Rate Map (FIRM). The elevations shown on the FIRM indicate that floodwater levels from the James River during the 100-year event would overtop the railroad embankment by several feet and flood the area downstream of the North Ash Pond embankment (Golder, 2017e). However, the closed North Ash Pond and dam would remain above the flood elevations. The 2009 *Dam Safety Assessment of CCW Impoundments,* developed by the USEPA contractor (O'Brien and Gere, 2010), states that overtopping would not occur and that no impacts of flood loading on the North Ash Pond embankment dam are anticipated from the 100-year flood.

2.2.1.2 Run-on and Final Cover Integrity

The closure plan (Golder, 2016c; 2017e) for the closure-in-place option demonstrates that run-on would be managed adequately and final cover integrity would be maintained.

The direct drainage area for the North Ash Pond consists mainly of the pond cap and some ancillary areas that formerly drained into the pond. Following the completion of closure activities, stormwater from the final cover system would be collected through the use of stormwater conveyance channels that would collect runoff along the perimeter of the pond. Each channel would be grass- or riprap-lined with soil stabilization matting to reduce erosion. The two perimeter channels would merge and ultimately discharge into the proposed stormwater management pond located outside the closed ash pond via a concrete box culvert through the dam and fabric-formed concrete channel over the downstream slope of the dam. The inlet of the box culvert is located such that water would not be impounded permanently behind the embankment after closure. A small amount of ponding would occur during the most extreme storm event (i.e., 6-hour probable maximum precipitation [PMP]) for a brief period.

The stormwater systems to be used in the closure of the ash ponds were selected and sized to convey stormwater resulting from the 2-, 10-, 25-, and 100-year, 24-hour storm events as required by the Virginia Stormwater Management Program (VSMP) Regulations (9VAC25-870) and the Virginia Solid Waste Management Regulations (VSWMR). The ash ponds and stormwater structures were also analyzed for the PMF event, based on DCR's dam safety regulations, and are shown to convey the flows safely (Golder, 2016c; 2017e).

2.2.1.3 Design to Prevent Overtopping of Dam

Inflow Design Flood (IDF)

The IDF is the flood (or surface water flow) caused by the design storm event due to run-on and direct rainfall on the final cover system.

The closure plan (Golder, 2017c; 2017e) for closure-in-place includes design and calculations to demonstrate that the design flood would be routed appropriately over the closed ash pond, and uncontrolled overtopping of the dam would be prevented per Virginia dam safety regulations (or DCR dam safety regulations). The North Ash Pond dam would be regulated as a dam following closure. Therefore, the final cover stormwater management system would be designed to handle the inflow design flood (IDF) per the dam regulations and to prevent uncontrolled overtopping of the dam. As stated earlier, the design in the closure plan achieves the routing of IDF and preventing uncontrolled overtopping of the dam by conveying the stormwater via perimeter channels on the final cover system to the side of the dam where the water would be routed down via a culvert and a fabric-formed concrete channel. The stormwater management system for the closure, including the culvert that would route the flow from the final cover to downstream fabric-formed concrete channel, is designed for the full PMF event per Virginia dam safety regulations to prevent uncontrolled overtopping of the dam. Preventing uncontrolled overtopping of the dam is key to the stability of the dam and containment of ash.

2.2.1.4 Evaluation of Potential Downstream Impacts

The closure plan (Golder, 2017c; 2017e) for closure-in-place option demonstrates that there are no adverse downstream impacts related to stormwater. Flow from the fabric-formed concrete channel on the downstream toe of the dam would pass through three 42-inch reinforced concrete pipe (RCP) culverts and discharge into a proposed stormwater management pond. The pond is designed to attenuate flows to provide localized flood control for the culvert located beneath the CSX Corporation (CSX) railroad, which discharges into the James River.

Even though the ash ponds and their dams meet structural stability and other regulatory criteria as discussed in Sections 2.2 and 2.3, DCR dam safety regulations require the development of hypothetical breach scenarios, inundation mapping, hazard potential classification, and EAPs as part of protecting the downstream areas against potential breach. The DCR has determined that the North Ash Pond dam is a high hazard dam. The dam has been determined a significant hazard per CCR Rule requirements because the criteria for high hazard ranking under the CCR Rule is triggered only by the potential for loss of life, whereas DCR may classify a dam as high hazard based on the potential for economic impacts.

The DCR Division of Dam Safety requires that Dominion continue to maintain the closed North Ash Pond to meet the applicable dam safety requirements. An EAP was developed (Golder, 2017a) and includes protocols for contacting several stakeholders, including the DCR Division of Dam Safety, local emergency authorities, police and fire department, and the CSX railroad in the unlikely event of a dam breach. The EAP would be updated for the post-closure conditions, as required by the DCR.

Emergency Action Plan (EAP)
An EAP is formal document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize loss of life and property damage.

The March 2017 DCR submittal (Golder, 2017c) discusses the hypothetical dam breach and inundation scenario after closure and concludes that in the unlikely event that a breach occurred, the effect of the inflow into the James River at Bremo Bluff is anticipated to be minimal due to the short duration of the flow event and the magnitude of the breach flow in comparison to the normal volume of flow in the river.

2.2.1.5 Receding Floodwater or Drawdown Impacts

The closure plan (Golder, 2017c) for the closure-in-place option and the CCR Structural Stability Assessment certification report for existing conditions (Golder, 2016f) demonstrate that there are no adverse impacts to the closed ash pond related to receding floodwater or drawdown. Receding floodwater from adjacent water bodies may cause rapid drawdown conditions on the downstream slopes of dams and embankments. A rapid drawdown slope stability analysis can be performed to evaluate the slope stability under this condition.

As noted earlier, floodwater levels are insignificant for the North Ash Pond compared to the toe and crest elevations, and a rapid drawdown analysis would not typically be required. However, rapid drawdown analyses were completed conservatively to assess the stability of the North Ash Pond toe from the potential effects of the James River 100-year flood and were found to have calculated factor of safety values that meet the required factor of safety values for dams (Golder, 2016f). The 100-year floodwater levels do not rise to the level of the North Ash Pond cover system (Golder, 2017c).

2.2.1.6 Hurricane Impact

The closure plan (Golder, 2017c; 2017e) for the closure-in-place option demonstrates that the final cover would adequately address the concerns associated with wind uplift and flooding resulting from potential hurricanes. Hurricanes cause wind, flooding, and storm surges. The final cover system would consist of a 2-foot- thick soil component above the geosynthetics, which would provide adequate resistance to wind uplift. The North Ash Pond dam and the final cover system would be inspected and maintained to prevent the growth of vegetation that would be affected by wind forces. Impacts associated with flooding are addressed above, and wave runup, scour, and storm surge are discussed in Section 2.2.3.

2.2.2 Erosion

The flood levels do not extend into the toe areas of the North Ash Pond dam enough to cause potential for scour or undercutting that would impact the proposed closure-in-place system. In addition, the closure plan (Golder, 2017e) for closure-in-place demonstrates that long-term soil loss due to erosive forces is anticipated to be minimal.

Erosion considerations include (1) long-term loss of soil from the final cover due to erosive forces and (2) scour and undercutting potential for the earthen dams. Soil loss was calculated using the U.S. Department of Agriculture's (USDA's) Revised Universal Soil Loss Equation (RUSLE). The average annual soil loss is expected to be 0.38 ton/acre/year for the North Ash Pond, which is less than the DEQ's Solid Waste Permitting Submission Instruction No. 6. Instruction No. 6 requires less than 2 tons/acre/year to protect the quality of the downstream water bodies and the long-term integrity of the final cover system. In addition, as stated in Section 2.2.1, the flood levels do not extend enough into the toe areas of the North Ash Pond dam to cause potential for scour or undercutting.

2.2.3 Storm Surge

Due to the location of the Bremo Power Station relative to the coastal zone, storm surge and wave runup are not deemed to be a hazard for the closed North Ash Pond. Storm surge and wave runup assessments are presented in Appendix A of this memo.

2.3 Siting and Closure Plan Long-Term Safety for North Ash Pond

Section 2.3 addresses SB 1398 Item 4 - long-term safety of siting and closure of the facility as a result of issues such as unstable areas, active faults, and seismic activity (earthquake) for the proposed closure-in-place option.

2.3.1 Dam Stability for North Ash Pond

2.3.1.1 Construction History

The North Ash Pond is an engineered cross-valley zoned earthfill dam embankment structure. The embankment is 30 feet wide at the top and has a top elevation of 333 feet above mean sea level (msl). The downstream toe elevation is approximately 235 feet msl, giving an effective embankment height of 99 feet (Golder, 2017c). Crest length is approximately 1,350 feet. Engineering drawings and the Engineering Design Summary Report outlining the geotechnical and hydrologic design for the original dam design are available (Schnabel Engineering, 1982; J.K. Timmons and Associates, 1982; 1983).

The North Ash Pond Dam was constructed in two phases. It consists of 2.5H:1V downstream and upstream slopes. The downstream slope has a 40-foot-wide toe berm. The dam includes a drainage blanket and toe drains. The North Ash Pond has a toe drain that drains to a stormwater runoff pond, which ultimately discharges through permitted Virginia Pollutant Discharge Elimination System (VPDES) Outfall 002. Based on the original design documents, the North Ash Pond Dam seems to have been designed and constructed using good engineering standards. Additional details can be found in the History of Construction CCR Certification Report (Golder, 2016g).

2.3.1.2 Subsurface Conditions

The CCR Rule structural stability certification report (Golder, 2016e) summarizes the subsurface conditions at the North Ash Pond. According to the report, Bremo Power Station lies in a geologically stable area with no active (Holocene) faults, karst (limestone, dolomite, or marble) potential, or other geologic conditions of concern. The North Ash Pond is constructed on natural soils that consist of a typical Piedmont residual, saprolitic soil profile, formed from in-place weathering of rock.

Several areas in the dam foundation were excavated during the initial construction, exposing disintegrated rock, and used to construct the dikes. Historical aerial photographs indicate that when the East Ash Pond was operating, a finger of the East Ash Pond may have extended partially into the future footprint of the North Ash Pond Dam. Per the DCR submittal regarding closure, CCR located under the toe of the embankment would be excavated and a new blanket drain system would be installed at the toe as part of closure (Golder, 2016c).

The North Ash Pond Dam generally consists of a mix of fine sandy silt (ML) and silty fine sand (SM) materials that show consistencies that are in line with a well-compacted and competent fill material (Golder, 2016e). A geotechnical investigation was performed to evaluate the stability of the placed and compacted CCR and the existing North Ash Pond embankment (Golder, 2017e). No modifications to the embankment are proposed as part of closure other than excavating the toe to remove CCR. The embankment would remain in place except for excavation as needed to install the 10 x 10-foot box culvert outlet to route stormwater flows from the final cover along the perimeter channels so the flows cross the dam and reach the stormwater channels along the toe area (Golder, 2017e).

2.3.1.3 Structural Stability

Slope stability of the dam under existing and post-closure conditions was evaluated and found to have an acceptable factor of safety values (Golder, 2016d; Golder, 2017c). The existing pond embankments and proposed final cap were evaluated for global stability and found to have an acceptable factor of safety values. The existing North Ash Pond dam and proposed final cap were found to be stable under the wide range of conditions that were evaluated, including seismic conditions and post-liquefaction conditions.

Based on the liquefaction assessments in the project documents (Golder, 2017e), the foundation and embankment materials of the North Ash Pond dam and compacted CCR were determined as not susceptible to liquefaction under the design earthquake hazard. The stability of the embankment in its final configuration was evaluated and found to have an acceptable factor of safety during the design seismic event (Golder, 2017c).

2.3.2 Final Cover Stability

2.3.2.1 Closure System Stability

Golder analyzed post-closure conditions under different loading scenarios for the combined dam and final cover system configuration and concluded that the analyzed sections would comply with regulatory requirements for geotechnical stability, including those in the CCR Rule (Golder, 2017c; Golder, 2017e). The closure design involves reaching final cover elevations that are higher than the dam elevation by filling the North Ash Pond with compacted CCR material excavated from the East and West Ash Ponds. Achieving final cover elevations that are higher than the dam elevation is also necessary to provide effective surface water runoff from the final cover system and prevent impounding water behind the dam.

2.3.2.2 Veneer Stability

Veneer stability analysis is performed to evaluate whether the final cover system has the potential to slide as a wedge (i.e., veneer) down the slope, thereby exposing the contained ash. Based on the analysis for post-closure condition, veneer slope stability is adequate for the proposed 3H:1V slopes of the final cover system in the closure plan (Golder, 2017e). Design calculations cover long-term static, seismic (earthquake), and storm event conditions. Material parameters such as interface friction angles for the cover system and transmissivity for the cover drainage layer were developed. Construction Quality Assurance (CQA) testing would be performed during construction to verify that the specified material parameters will be met.

2.3.2.3 Liquefaction Triggering of CCR and Potential Impact to Final Cover System

Liquefaction is triggered when loose saturated soil deposits are shaken by seismic events that exceed the liquefaction resistance of the soils. Liquefaction can lead to partial loss of strength and stiffness of soils. As stated in the closure plan (Golder, 2017f), engineering controls are incorporated into the design of the final cover system to provide adequate factors of safety against its potential instability due to liquefaction of the ash during a design seismic event. Controls include undercutting and replacement with non-liquefiable ash fills or controlled soil and soil or densified ash buttresses on either side of the ditches to mitigate the potential for localized failures. The closure plan (Golder, 2017e) also recommends detailed inspections after an earthquake event.

2.3.2.4 Settlement Impacts to Cover

As described in the closure plan (Golder, 2017e), some settlement is expected to occur due to additional load resulting from active dewatering, stacking and grading of ash, final cover placement during closure activities, and gravity drainage from the CCR during and after closure. The final cover system is designed to accommodate settling and provide proper drainage.

Settlement of the North Ash Pond CCR was considered with respect to potential impacts on closure (e.g., changes in drainage slopes of the final cover system and drainage ditches). Calculations in Golder Associates (2017e) show that most of the settlements would occur during construction and would therefore be unlikely to impact the final cover system. An estimated 1 foot of settlement would be expected following the capping completion described in the closure plan.

2.4 Closure-in-Place Schedule

The time required to permit, design, and construct the closure-in-place option for the North Ash Pond is approximately 2 to 3 years. There are significant benefits for safety, environmental protection, and community in being able to implement a closure option within 2 to 3 years.

2.5 Closure-in-Place Costs

AECOM developed cost estimates for closure-in-place and closure by removal options as part of the project to compare cost estimates for different closure options using the same rates and assumptions. The estimated cost for the closure-in-place option for the North Ash Pond is approximately $96 million. Table TM5-3 provides a summary of the cost estimate. More details about the level-of-cost estimate and assumptions are provided in Section 6.

Table TM5-3: Cost Estimate for Closure-in-Place Option for North Ash Pond

Item	Cost[1]	Specifics/Comments
Mobilization, site preparation, and dewatering	$31M	Includes dewatering and water treatment throughout the project duration. Dewatering includes removal and treatment of contact water to meet VPDES requirements during the construction period.
Subgrade ash cut and fill	$13M	Includes grading the ash to prepare for cover system installation.
Cap system installation	$21M	Final cover system geosynthetics and soil installation.
Special remedial items	$2M	Dam toe to be retrofitted at the North Ash Pond.
Stormwater management and site restoration	$12M	Stormwater controls and access roads.
Post-closure monitoring	$17M	30 years of post-closure care.
Total	**$96M**	

All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained

[1] Costs do not include potential corrective measures

M = million

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3. Chesapeake Energy Center

Dominion has committed to removing the CCR materials from the Bottom Ash Pond, so closure-in-place is not an evaluated option at this station. The Bottom Ash Pond will be closed by dewatering and removing the CCR materials, which can either be recycled/beneficially reused or relocated to a lined, permitted landfill. Primary components in this process include materials handling to remove the CCR from the ash pond and load the materials into trucks, transporting it to an off-site reuse or landfill facility, restoring the former ash pond to design conditions, and monitoring the groundwater to ensure continued protectiveness as required by the CCR Rule.

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4. Chesterfield Power Station

The Chesterfield Power Station is located at 500 Coxendale Road, Chesterfield County, VA. The station is a coal and natural gas power plant that started operations in 1944. The station contains two ash ponds as defined by the CCR Rule: Lower Ash Pond and Upper Ash Pond (also referred to as Upper East Pond).

Figure TM5-3 is a site map showing the ash ponds. Under the proposed closure-in-place option discussed in this memo, both ash ponds are proposed to be closed-in-place.

Section 4 contains background information, including construction and operations, on the ash ponds at the Chesterfield Power Station.

4.1 Ash Ponds

4.1.1 Lower Ash Pond

The Lower Ash Pond is bounded by the Old Channel of the James River and Upper Ash Pond on the south, Henricus Park Road and Aiken Swamp on the east, Coxendale Road to the north, and the station's thermal channel to the west. The Lower Ash Pond was constructed by Dominion in 1964 as a diked ash pond with earthen dikes with a crest elevation of approximately 15 feet. The dikes were raised to 20 feet during the second phase of construction, which was completed in 1968. The area bounded by the top of the dikes is approximately 101 acres.

CCR settled in the Lower Ash Pond and a portion of the ash was excavated and transferred over time to the Upper Ash Pond based on a 2003 closure plan that was modified in 2015 and incorporated into the station's DEQ VPDES Permit No. VA0004146.

The Lower Ash Pond is classified as a dam (DCR Inventory #00823) and is regulated by DCR), Division of Dam Safety and Floodplain Management (Geosyntec Consultants, 2017).

Based on information provided by Dominion, as of July 2017, the Lower Ash Pond contained an estimated 3.6 million CY of CCR. The closure plan for the Lower Ash Pond (Geosyntec Consultants, 2016b) states that 2.35 million CY as the planned-in-place CCR volume at time of closure as CCR is being transferred to the Upper Ash Pond at this time. A final cover system will be installed as part of closure. Dikes will continue to be regulated as dams after closure.

4.1.2 Upper Ash Pond

The Upper Ash Pond is bounded by the Old Channel of the James River on the south, Henricus Historical Park on the east, and Aiken Swamp on the north. The Upper Ash Pond is southeast of the Lower Ash Pond. The Upper Ash Pond was constructed by Dominion in 1984 as a diked ash pond with earthen dikes with a crest elevation of approximately 41 feet. The area bounded by the top of the dikes is approximately 112 acres (GAI Consultants, 2017b).

The Upper Ash Pond was operated initially as a wet sluiced ash pond until the CCR reached the dike crest elevation. Since 1996, the ash pond has been operated by placing the CCR dredged and/or excavated from the Lower Ash Pond that has been dried and compacted in order to facilitate construction of the compacted CCR grades above the crest elevation of the dikes. The pond has been operated to achieve planned closure grades based on a 2003 closure plan that was modified in 2015 and incorporated into the station's DEQ VPDES Permit No. VA0004146.

The Upper Ash Pond is classified as a dam (DCR Inventory # 04145) and is regulated by the DCR, Division of Dam Safety and Floodplain Management (GAI Consultants, 2017b).

Based on information provided by Dominion, as of July 2017, the Upper Ash Pond contained an estimated 11.3 million CY of CCR. The total volume of material in the pond at the time of final closure under the closure-in-place option is estimated to be 14.3 million CY. A final cover system will be installed as part of closure. Dikes will continue to be regulated as dams after closure.

Features of the closure-in-place option are summarized in Section 1.3.

Several engineering investigations and assessments have been completed for the ash ponds at the Chesterfield Power Station. They include the original design, subsequent assessments, USEPA dam safety assessment (O'Brien and Gere, 2010), CCR Rule certifications, and closure plans. AECOM received the reports listed below from Dominion and reviewed them. Refer to the text box on page 2-2 for explanations of terms and phrases.

- Closure plan:
  - Closure and Post-Closure Plans for CCR Posting
    - Lower Ash Pond (Geosyntec Consultants, 2016b, 2016c)
    - Upper Ash Pond (GAI Consultants, 2016a)
  - Closure Plan for Upper Ash Pond (GAI Consultants, 2017b) and for Lower Ash Pond (Geosyntec Consultants, 2017), which include the following:
    - Settlement calculations for the final cover system
    - Liquefaction triggering calculations for the dam embankment and CCR in the pond for 2,500-year return period seismic event (earthquake)
    - Slope stability calculations for existing and closure conditions covering different loading cases such as long-term steady-state static and seismic
    - Veneer slope stability of the final cover system for static and seismic conditions
    - Long-term universal soil loss assessment for the final cover system
    - Stormwater management system design calculations for the closed condition for PMF and smaller storm events
- CCR Certification Reports for existing conditions for Upper Ash Pond (GAI Consultants, 2016c; 2016d; 2016e, 2016f) and for Lower Ash Pond (Geosyntec Consultants, 2016a; 2016d; 2016e; 2016f)
  - Factor of safety
  - Structural stability
  - Hazard potential classification

   - History of construction
- Dam
   - Design drawings
      - Lower Ash Pond (J.K. Timmons and Associates, 1983 and 1984; Stone and Webster Engineering, 1966)
      - Upper Ash Pond: Phase I and Phase II (J.K. Timmons and Associates, 1983; 1985)
   - Annual dam inspection reports for 2015 and 2016 (Dominion, 2015; Dominion, 2016)
   - USEPA Dam Assessment Report (O'Brien & Gere, 2010)
   - EAP and downstream inundation
      - Lower Ash Pond: Dam inundation study, breach analysis, and EAP (Schnabel Engineering, 2015; Geosyntec Consultants, 2016g)
      - Upper Ash Pond: EAP (GAI Consultants, 2017a) and Dam Break Inundation Zone Mapping Report (Golder, 2010)

4.2 Extreme Weather Events and Long-Term Safety of the Closure Plan for Lower and Upper Ash Ponds

Section 4.2 addresses SB 1398 Item 4 - the long-term safety and resilience to extreme weather events such as flooding/hurricanes, erosion, and storm surge for the proposed closure-in-place option. Considerations related to other non-weather related extreme events or factors that pertain to the siting of the facility and closure (e.g., unstable areas, active faults, seismic activity) are covered in Section 4.3.

4.2.1 Flooding/Hurricane

Federal solid waste regulations referenced by the CCR Rule require that solid waste landfill units located in 100-year floodplains demonstrate that the unit will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment. Engineering design and calculations could be performed to demonstrate that safe closure is possible regardless of a closed landfill or ash pond being surrounded by a floodplain or floodway.

4.2.1.1 Location Relative to Floodplain

Based on the closure plans referenced in this section, the proposed Lower Ash Pond and Upper Ash Pond closure-in-place options do not have any adverse impacts as a result of their locations relative to floodplains. Due to the station's proximity to the James River and its old channels, most of the areas surrounding the ponds are subject to flooding from the 1-percent-annual-chance event (100-year event), per the FIRM. The 100-year flood elevation in the areas of the Lower and Upper Ash Ponds is 15.9 feet msl.

Both ash ponds are surrounded by perimeter dikes. The dike crest elevations at both ponds are above the 100-year flood elevation. The perimeter dike crest elevation of the Lower Ash Pond varies from 18 to 20 feet msl and is proposed to be at least at 19 feet after closure (Geosyntec, 2017). The perimeter dike crest elevation of the Upper Ash Pond is 40 feet msl (GAI Consultants, 2017b).

As stated earlier, these dikes will continue to be regulated as dams after closure of the ash ponds. They will also serve as flood protection barriers for the closed ash ponds. The proposed final covers for the closure-in-place option will connect to the dike crest and will be located above the 100-year floodplain elevation. Although the areas surrounding the perimeter dikes of the closed ash ponds will be within the 100-year floodplain, the final cover will be above the floodplain.

4.2.1.2 Run-on and Final Cover Integrity

The closure plans (Geosyntec, 2017; GAI Consultants, 2017b) for the closure-in-place option for the Lower and Upper Ash Ponds demonstrate that run-on would be managed adequately and that final cover integrity would be maintained. Perimeter dikes and the surrounding topography would prevent run-on from adjacent areas entering the closed Lower Ash Pond. The Upper Ash Pond is surrounded by perimeter dikes, which would prevent run-on entering the final cover system.

The closure plans for the Lower and Upper Ash Ponds show that runoff from the closed ash ponds would be routed via lined drainage channels and discharged through a storm drainage system, minimizing the potential for erosion of the cover system. The closed ash ponds were analyzed for the PMF event based on DCR’s dam safety regulations (Geosyntec, 2017; GAI Consultants, 2017b). The final cover system, which includes a geomembrane liner in addition to the soil cover, would prevent stormwater runoff from coming into contact with the contained CCR material.

4.2.1.3 Flood Routing to Prevent Overtopping of Dam

The closure plans (Geosyntec, 2017; GAI Consultants, 2017b) for the closure-in-place option for the Lower and Upper Ash Ponds include design and calculations to demonstrate that the design flood would be routed appropriately over the closed ash pond, and that uncontrolled overtopping of the dam would be prevented per Virginia dam safety regulations. The perimeter dikes for both ash ponds would continue to be regulated as dams after closure. Therefore, the final cover system stormwater management system would need to be designed to handle the IDF per dam regulations and to prevent uncontrolled overtopping of the dam (refer to text box on page 2-5 for explanation of IDF). Preventing uncontrolled overtopping of the dam is key to the stability of the dam and containment of ash.

As stated earlier, the design in the closure plans would achieve routing the IDF and preventing overtopping by conveying the stormwater via perimeter channels on the final cover system to the upstream side of the dam where the water would be routed through engineered conveyance systems (buried pipes for the Lower Ash Pond and lined downchute for the Upper Ash Pond) to the downstream side. The stormwater management systems for the closures are designed for the full PMF event to prevent uncontrolled overtopping of the dam.

A small area of the final cover of the Lower Ash Pond would sheet flow to existing culverts crossing under Henricus Park Road and discharge directly to the swamp area (backwater of the James River) to the south via existing culverts (Geosyntec, 2017). These outfalls are permitted under VPDES. The culverts underneath the Henricus Park Road would be required to pass the 10-year, 24-hour storm event without overtopping the road because the road is designed to act as an emergency spillway during higher return period storm events. An upgrade to the existing Henricus Park Road culverts is proposed as part of the closure to meet this requirement. Henricus Park Road would be overtopped during a full PMP event without adversely impacting the final cover system or the road embankment per the closure plan (Geosyntec, 2017).

4.2.1.4 Evaluation of Potential Downstream Impacts

The closure plans (Geosyntec, 2017; GAI Consultants, 2017b) for the closure-in-place option for the Lower and Upper Ash Ponds demonstrate that there are no adverse downstream impacts related to water quality or flow resulting from closure-in-place. The Lower and Upper Ash Ponds are surrounded by several water bodies and swampy areas, including the thermal channel, Old Channel (oxbow) of the James River, and the Dutch Gap Conservation Area comprising wetland and forested areas. Henricus Park Road and Coxendale Road are adjacent to the Lower Ash Pond; Coxendale Road is not downstream of the regulated dam. Henricus Park Road, Henricus Historical Park area, and public walking trails are adjacent to the Upper Ash Pond. Noncontact surface water from the final cover systems would be discharged via permitted VPDES outfalls for both ponds and would meet water quality requirements.

The DCR Division of Dam Safety considers the Lower and Upper Ash Pond dams a high hazard The dams has been determined a significant hazard per the CCR Rule because the criteria for high hazard ranking under the CCR Rule is triggered only by the potential for loss of life, whereas DCR may classify a dam as high hazard based on potential for property damage.

Dominion would continue to maintain the closed ponds to meet the applicable dam safety requirements. EAPs have been developed for both ponds (Geosyntec, 2016g; GAI Consultants, 2017a), and they include protocols for contacting several stakeholders, including the DCR Division of Dam Safety, local emergency authorities, and the police and fire departments in the unlikely event of a dam breach. The EAPs would be updated for the post-closure conditions, as required by the DCR.

Even though the ash ponds and their dams meet structural stability and other regulatory criteria as explained in Section 4.2 and 4.3, dam safety regulations require development of hypothetical breach scenarios, inundation mapping, hazard potential classification, and EAPs as part of protecting the downstream areas against potential breach.

The *Dam Breach Analyses and Inundation Mapping* report by Schnabel (2015) refers to the CCR Rule hazard potential classification report by Geosyntec (2016d), which analyzes dam breach scenarios for the existing conditions at the Lower Ash Pond. According to Geosyntec (2016d), Schnabel (2015) concluded that the breach scenarios that were evaluated would not result in impacts to roads, bridges, residences, or businesses. The EAP (Geosyntec, 2016g) states that there are no occupied parcels in the dam break inundation zone of the Lower Ash Pond dam. A breach would lead to economic and environmental damage, but loss of life would be unlikely.

The Dam Breach Analyses and Inundation Mapping report by Golder (2010) analyzes dam breach scenarios for the existing conditions at the Upper Ash Pond. Golder (2010) concluded that the effect of the breach flows into the Old Channel of the James River would be minimal and within the normal range of river flows. A breach would lead to economic and environmental damage, but loss of life would be unlikely.

4.2.1.5 Receding Floodwater or Drawdown Impacts

The closure plans (Geosyntec Consultants, 2017; GAI Consultants, 2017b) for closure-in-place options and the CCR structural stability certification reports for existing conditions (GAI Consultants, 2016e; Geosyntec Consultants, 2016e) demonstrate that there are no adverse impacts to the closed ash ponds related to receding floodwater or drawdown.

Receding floodwater from adjacent water bodies may cause rapid drawdown conditions on the downstream slopes of dams and embankments that provide structural stability for closed ash ponds. A rapid drawdown slope stability analysis could be performed to evaluate the slope stability under the above mentioned condition. Rapid drawdown analyses have been completed as part of the CCR Rule structural stability certification to assess the stability of the Lower Ash Pond dam and Upper Ash Pond dam from the potential effects of the old James River channel 100-year flood and were found to be satisfactory (GAI Consultants, 2016e; Geosyntec Consultants, 2016e).

4.2.1.6 Hurricane Impact

The closure plan (Geosyntec Consultants, 2017; GAI Consultants, 2017b) for the closure-in-place option demonstrates that the final cover would adequately address the concerns associated with wind uplift and flooding resulting from potential hurricanes. Hurricanes cause wind, flooding, and storm surges. The final cover systems would consist of a 2-foot-thick soil component above the geosynthetics, which would provide adequate resistance to wind uplift. The dams and the final cover systems would be inspected and maintained to prevent the growth of vegetation that would be affected by wind forces. Impacts associated with flooding are addressed above, and wave runup, scour, and storm surge are discussed in Sections 4.2.2 and 4.2.3.

4.2.2 Erosion

Although the 100-year flood levels extend partially into the downstream slopes of the dikes, they do not extend into the proposed final cover systems of the Lower and Upper Ash Ponds, and there is no potential for scour or undercutting that would impact the proposed closure-in-place systems. In addition, the closure plans (Geosyntec Consultants, 2017; GAI Consultants, 2017b) for the closure-in-place option demonstrate that long-term soil loss due to erosive forces is anticipated to be minimal.

Erosion considerations include (1) long-term loss of soil from the final cover due to erosive forces and (2) scour and undercutting potential for the earthen dams. The soil loss was calculated using the USDA's RUSLE. The average annual soil losses for the Lower and Upper Ash Ponds after closure are expected to be 0.01 and 0.09 ton/acre/year, respectively (Geosyntec Consultants, 2017; GAI Consultants, 2017b). These calculated values are less than the DEQ's Solid Waste Permitting Submission Instruction No. 6, requiring less than 2 tons/acre/year to protect the quality of the downstream water bodies and the long-term integrity of the final cover system. In addition, as stated in Section 4.1.1.1, the 100-year flood levels do not extend into the final cover systems.

4.2.3 Storm Surge

The Upper and Lower Ash Pond dams meet the DCR design requirements and CCR Rule hydraulic and structural stability requirements as explained in Sections 4.2 and 4.3. Although SB 1398 requests that potential impacts of storm surges be considered for closure-in-place resiliency, there are no prescribed storm surge design criteria for closed ash ponds. Appendix A provides a screening-level assessment of a potential design consideration of storm surge and wave runup.

The proposed final cover of the Upper Ash Pond would be above the water level impacted by storm surge and wave action. The current design for the proposed closure-in-place option could be considered adequate since the impacts related to 100-year flood elevations are addressed in the CCR Rule structural stability certifications.

Based on a screening-level analysis, there is the potential for storm surge and wave action related water levels to exceed the dam crest elevation at the Lower Ash Pond. Therefore, water levels exceeding the perimeter dike crest elevation due to storm surge and/or wave runup for a closed ash pond would need to be considered in the final cover system design.

The final cover system would include a geomembrane layer and a geocomposite drainage layer that would underlie the 2-foot soil layer. The use of geosynthetics would provide protection against the potential for washout of the underlying CCR even if the final cover soil is impacted by scour. Various erosion control and energy dissipation engineering controls such as riprap protection for a section of the final cover could be adopted to protect the final cover system below a certain elevation.

The screening-level analyses also indicate that the potentially impacted areas at the Lower Ash Pond are likely to be within a few feet of the dike crest, thus limiting the extent of the final cover areas that may need to be reinforced against the surge is discussed. The entire closure final cover is not expected to be submerged. Given the limited nature of the screening-level analysis, AECOM recommends a more advanced analysis as part of the final cover design at the Lower Ash Pond, first to obtain more site-specific surge elevations, and then to include engineering controls such as riprap protection. In the event that water levels exceeded the dam crest elevation, the impacts could be readily mitigated using the engineering controls as discussed above.

4.3 Siting and Closure Plan Long-Term Safety for Lower and Upper Ash Ponds

Section 4.3 addresses SB 1398 Item 4 - long-term safety of siting and closure of the facility, such as unstable areas, active faults, and seismic activity (earthquakes) for the proposed closure-in-place option.

4.3.1 Dam Stability

4.3.1.1 Construction History

Lower Ash Pond

The first phase of the Lower Ash Pond was constructed by Dominion in 1964 as a diked ash pond with earthen dikes with a crest elevation of approximately 15 feet. The dikes were raised to 20 feet during the second phase of the construction, which was completed in 1968. Stone and Webster Engineering designed the dams and oversaw the construction (O'Brien and Gere, 2010). Earthen dikes were constructed on the eastern, southern, and western boundaries of the Lower Ash Pond using material excavated from the footprint of the Lower Ash Pond (Schnabel, 2009).

The average downstream slope of the west embankment is 2H:1V and approximately 2,525 feet long. The downstream slopes of the south and east embankments range from 3H:1V to 4H:1V. The south and east embankments are approximately 1,715 and 2,900 feet long, respectively (Schnabel, 2015). The dike crest elevation ranges from 18.5 to 22 feet (Geosyntec, 2017).

The north side of the Lower Ash Pond was constructed by excavating a cut slope along a road (Geosyntec, 2016f). The southern half stretches across the Old Channel of the James River. The dam has toe drains that use force main pumping systems. Additional details and original drawings are in the History of Construction CCR Certification Report (Geosyntec, 2016f).

Upper Ash Pond

The Upper Ash Pond was constructed by Dominion in 1984 as a diked ash pond with earthen dikes with crest elevation of approximately 41 feet msl. O'Brien and Gere (2010) states that based on the design drawings by Timmons and Associates (1983) the inboard slopes of the dikes were designed at 2H:1V, and the outboard slopes range from 2.5H:1V to 3H:1V. The area bounded by the top of the dikes is approximately 112 acres.

Upper Ash Pond was operated initially as a wet sluiced ash pond until the CCR reached dike crest. Since 1996, the ash pond has been operated by placing the CCR dredged and/or excavated from the Lower Ash Pond and dry and compacting, which facilitated the construction of the compacted CCR grades above the crest elevation of the dikes (GAI Consultants, 2017b). The dam has toe drains that use force main pumping systems. Pore pressure relief wells are located in the Upper Ash Pond dam. Additional details can be found in the geotechnical report by Schnabel (2014) and the History of Construction CCR Certification Report (GAI Consultants, 2016f).

4.3.1.2 Subsurface Conditions

Lower Ash Pond

Geosyntec (2016) describes geotechnical information related to the perimeter dikes of the Lower Ash Pond. A geotechnical investigation was performed for the Lower Ash Pond to support the closure design (Geosyntec, 2017). The investigation covered the dikes and accessible areas of the ash pond. The report summarizes previous geotechnical investigations of the Lower Ash Pond (e.g., Schnabel, 2009). Geosyntec (2016f) states that the site's principal geologic features are Petersburg Granite, Cretaceous sediments, Quaternary/Tertiary/Cretaceous sand, and Quaternary alluvium.

According to Geosyntec (2016e), the dikes consist of Sandy Silt (ML), Silty Sand (SM), lean Clay (CL), and fat Clay (CH). Very soft to soft, fine-grained alluvium (CL and CH) was found at depths of approximately 20 to 40 feet below the base of the dikes and ash pond. Loose, coarse-grained alluvium (SM and SC) was found interlayered with the fine-grained alluvium to approximately the same depths. Dense or stiff fine and coarse-grained Cretaceous sediments were predominantly found below the alluvial soils. The CCR structural stability certification report (Geosyntec, 2016e) states that the foundations are stable. The report also states that the pond embankment was constructed and maintained to be stable.

Upper Ash Pond

Schnabel (2014) provides geotechnical information related to the perimeter dikes of the Upper Ash Pond. Schnabel (2014) also states that field explorations and testing programs have been conducted several times during the past 30 years and that Schnabel served as the original geotechnical engineer for the dam design.

Schnabel (2014) also states that the fill materials in the dikes generally include lean clay, clayey sand, silty sand, and poorly graded sand. Although sluiced ash is below the dike elevation, the slopes that are built up like a landfill above the dike crest consist of compacted ash with an average Standard Penetration Test (SPT) N-value of approximately 8 to 10 blows per foot, indicating good compaction.

The underlying natural soils consist of recent alluvial and terrace sands, silts and clays, and Cretaceous-age sands and gravels. The Cretaceous-age soils of the Patuxent Formation were encountered below the alluvial and terrace deposits to the maximum depth of exploration in most of the deep borings. SPT N-values indicate these soils are generally dense to very dense sands and gravels classified as clayey sand (SC), silty sand (SM), clayey gravel (GC), and silty gravel (GM). Phreatic water levels were considered to be generally about the level of the top of the sluiced ash fill at an elevation of approximately 35 feet msl.

The CCR structural stability certification report (GAI Consultants, 2016e) states that the foundations are stable and that the pond embankment was constructed and maintained to be stable.

4.3.1.3 Structural Stability

The slope stability of the Lower and Upper Ash Pond dams under existing and post-closure conditions were evaluated and found to have acceptable factor of safety values (GAI Consultants, 2016c; 2017; Geosyntec Consultants, 2016a; 2017b). The existing pond embankments and proposed final cap were evaluated for global stability and found to have acceptable factor of safety values. The Lower and Upper Ash Pond dams and proposed final cap were found to be stable under the wide range of conditions that were evaluated, including seismic conditions and post-liquefaction conditions.

Based on the liquefaction assessments in the project documents (GAI Consultants, 2016e; 2017b; Geosyntec Consultants, 2016e; 2017), the foundation and embankment materials of the Lower and Upper Ash Ponds and the contained CCR were calculated to not be susceptible to liquefaction under the design earthquake hazard. The stability of the embankment in its final configuration was evaluated and found to have an acceptable factor of safety during a seismic event with a probability of occurrence of 2% in 50 years (2,475-year return period) (GAI Consultants, 2016e; 2017b; Geosyntec Consultants, 2016e; 2017). Closure and capping of the ponds would result in continued gradual reduction in pore water levels post-closure, which would result in gradual improvement in stability factors of safety compared to the conditions considered in the analyses.

4.3.2 Final Cover Stability

4.3.2.1 Closure System Stability

The closure plans (GAI Consultants, 2017b; Geosyntec Consultants, 2017) analyzed post-closure conditions under different loading scenarios for the combined dam and final cover system configuration and concluded that the analyzed sections would comply with regulatory requirements for geotechnical stability, including those in the CCR Rule. The closure design involves reaching final cover elevations that are higher than the dam elevation by filling the ponds with compacted CCR material to achieve final grades. Achieving final cover grades above the dam elevation would also be necessary to provide effective surface water runoff from the final cover system and prevent impounding water behind the dam.

The parking areas of the Upper Ash Pond allocated for use by the Henricus Historical Park would be constructed with a vegetated, reinforced paver surface to protect the final cover system (GAI Consultants, 2017b).

4.3.2.2 Veneer Stability

Veneer stability analysis is performed to evaluate whether the final cover system has the potential to slide as a wedge (i.e., veneer) down the slope, thereby exposing the contained ash. Based on the analysis for post-closure condition, veneer slope stability would be adequate for the proposed final cover systems in the closure plans for the Lower and Upper Ash Ponds (GAI Consultants, 2017b; Geosyntec Consultants, 2017). The design calculations cover long-term conditions. Material parameters such as interface friction angles for the cover system and transmissivity for the cover drainage layer were developed. CQA testing would be performed during construction to verify that the specified material parameters would be met.

4.3.2.3 Liquefaction Triggering of CCR and Potential Impact to Final Cover System

Liquefaction is triggered when loose saturated soil deposits are shaken by seismic events that exceed the liquefaction resistance of the soils. Liquefaction can lead to partial loss of strength and stiffness of soils. Based on the analysis of post-closure conditions, liquefaction triggering is not likely to occur for the dike materials, subsurface, or CCR for the Lower and Upper Ash Ponds (GAI Consultants, 2017b; Geosyntec Consultants, 2017) for the design seismic event.

4.3.2.4 Settlement Impacts to Cover

The closure plans for the Lower and Upper Ash Ponds (GAI Consultants, 2017b; Geosyntec Consultants, 2017), conclude that the anticipated settlement amounts would not be expected to inhibit the proper functioning of the proposed final cover or stormwater conveyance systems. Some settlement is expected due to additional load resulting from active dewatering, stacking and grading of ash, final cover placement during closure activities, and gravity drainage from the CCR during and after closure. The grading design has taken these settlements into account such that adverse slopes would not occur on the final cover or in drainage ditches in the event such settlement occurs (Geosyntec Consultants, 2017; GAI Consultants, 2017b).

Calculations in Geosyntec (2017) indicate that for the Lower Ash Pond, most of the settlements would occur during construction; less than 1.5 feet of settlement is estimated following capping completion. Less than 2 inches of settlement is estimated for the Upper Ash Pond (GAI Consultants, 2017b) because of placement of compacted material from the Lower Ash Pond and has been undergoing settlement already. As stated earlier, grading designs have taken these settlements into account, such that adverse slopes would not occur on the final cover or in drainage ditches in the event such settlements occur.

4.4 Closure-in-Place Schedule

The time required to permit, design, and construct the closure-in-place option for the Lower and Upper Ash Ponds is approximately 2 to 3 years following regulatory approval. There are significant benefits for safety, environmental protection, and the community in being able to implement a closure option within 2 to 3 years.

The closure plans (GAI Consultants, 2017b; Geosyntec, 2016) posted to meet the CCR Rule requirements stated that December 2019 is the target date to complete the closure-in-place option for both ponds. This date is subject to regulatory developments and pending approvals. A benefit of the closure-in-place option is the already available closure designs, shortening the schedule for implementing the option.

4.5 Closure-in-Place Costs

The estimated cost for the closure-in-place option for the Lower and Upper Ash Ponds are approximately $125 million and $64 million, respectively. Table TM5-4 summarizes the closure-in-place cost estimate for the Lower Ash Pond, and Table TM5-5 provides a summary of the cost estimate for the Upper Ash Pond. More details about the level-of-cost estimate and assumptions are provided in Section 6.

Table TM5-4: Cost Estimate for Closure-in-Place Option for the Lower Ash Pond

Item	Cost(1)	Specifics/Comments
Mobilization, site preparation, and dewatering	$62M	Includes dewatering and water treatment throughout the project duration. Dewatering includes removal and treatment of contact water to meet VPDES requirements during the construction period.
Subgrade ash cut and fill	$8M	Includes grading the ash to prepare for cover system installation.
Cap system installation	$23M	Final cover system geosynthetics and soil installation.
Stormwater management and site restoration	$12M	Stormwater controls and access roads.
Post-closure monitoring	$20M	30 years of post-closure care.
Total	**$125M**	

All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained

(1) Costs do not include potential corrective measures

M = million

Table TM5-5: Cost Estimate for Closure-in-Place Option for the Upper Ash Pond

Item	Cost(1)	Specifics/Comments
Mobilization, site preparation, and dewatering	$1M	Includes dewatering and water treatment throughout the project duration. Dewatering includes removal and treatment of contact water to meet VPDES requirements during the construction period.
Subgrade ash cut and fill	$1M	Includes the ash grading to prepare for cover system installation.
Cap system installation	$25M	Final cover system geosynthetics and soil installation.
Stormwater management and site restoration	$15M	Stormwater controls and access roads.
Post closure monitoring	$22M	30 years of post-closure care.
Total	**$64M**	

All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained

(1) Costs do not include potential corrective measures

M = million

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5. Possum Point Power Station

The Possum Point Power Station is located on Possum Point Road in Prince William County near Dumfries, VA. The station no longer burns coal to generate power. The two coal burning units were retired in 2003, and no CCR has been generated since then. Two active units burn natural gas, one unit burns oil, and two combined cycle units burn a combination of natural gas and oil to generate power. Figure TM5-4 is an aerial view of the Possum Point Power Station with CCR management units identified.

While in active operation, CCR was sluiced into a series of five ash ponds (Ponds A, B, C, D, and E). Dominion has initiated closure by removal of Ponds A, B, C and E by relocating the CCR to Pond D.

Section 5 contains background information, including construction and operations, on the CCR surface ash ponds at Possum Point Power Station.

5.1 Ash Ponds

5.1.1 Ash Ponds A, B, and C

Ash Ponds A, B, and C were constructed in 1955 and cover a combined 18 acres. CCR was removed from these ponds in 2015 and 2016 and relocated to Pond D. According to Dominion, approximately 40,000 CY of CCR remain in place adjacent to these ash ponds and will be relocated to Pond D once regulatory approvals are received. For purposes of this report, AECOM assumes that CCR has been removed from these ponds and no separate assessment was made.

5.1.2 Ash Pond D

Ash Pond D was constructed in 1988 and covers approximately 70 acres. The ash pond was constructed on the site of a former ash pond and was in active operation until 2003. Pond D was designed to discharge into Pond E when both ponds were in active operation. Ash Pond D currently contains CCR that was hauled there during the closure by removal activities for Ponds A, B, C and E.

For purposes of this report, AECOM assumes that the closure-in-place assessment will focus on the CCR currently in Pond D.

5.1.3 Ash Pond E

Ash Pond E was constructed in 1967 and covers approximately 38 acres. This pond was in active service until 2003. CCR was removed from Pond E in 2015 and 2016 and relocated to Pond D. According to Dominion, approximately 2,500 CY remain in Pond E beneath temporary water storage tanks. The CCR will be relocated to Pond D once regulatory approval is received. For purposes of this report, AECOM assumes that CCR will be removed from Pond E and no separate assessment was made.

5.1.3.1 Closure Plan (2016)

GAI Consultants prepared a closure plan as part of a Solid Waste Permit Application dated December 2016 for submittal to DEQ (GAI Consultants, 2016a). The closure plan addresses closure of Ponds A, B, C, and E by closure by removal and Pond D by closure-in-place. Final cover plans and engineering analyses for Pond D are provided.

Engineering investigations and assessments have been completed for the ash ponds at the Possum Point Power Station. They include the original design, subsequent assessments, the 2010 USEPA dam safety assessment (O'Brien & Gere, 2010), CCR Rule certifications, and closure plans. AECOM received the reports listed below from Dominion and reviewed them. Refer to the text box on page 2-2 for explanations of terms and phrases.

- Closure Plan (GAI Consultants, 2016a) including the following:
  - Settlement calculations for the Pond D final cover system
  - Liquefaction triggering calculations for the dam embankment and CCR in the pond for 2,500-year return period seismic event (earthquake)
  - Slope stability calculations for Pond D closure conditions covering different loading cases such as long-term steady-state static, and seismic activity (earthquakes)
  - Veneer slope stability of the Pond D final cover system for static and seismic conditions
  - Long-term universal soil loss assessment for the final cover system
  - Stormwater management system design calculations for the closed condition for the 25-year, 24-hour storm event
- Closure and Post Closure Plans for CCR Posting (GAI Consultants, 2016b)
- Impounding Structure Modification Report, Possum Point Ash Dam D, DCR submittal, GAI Consultants (2015), DCR Inventory #15320
  - Spillway capacity: Closed condition outlet works for PMF storm event
  - Drainage and erosion controls
  - Geotechnical analyses of final cover system and slope stability
  - Modifications to the dam
  - Emergency spillway stability
- Inundation Study (Golder, 2012): For operating conditions of Pond D condition under sunny day, spillway design flood, and PMF breach events.
- CCR certification reports for the Pond D dam existing conditions:
  - Factor of safety (GAI Consultants, 2016c)
  - Structural stability (GAI Consultants, 2016d)
  - Hazard potential classification (GAI Consultants, 2016e)
  - History of construction (GAI Consultants, 2016f)
- Pond D Dam
  - As-Built Drawings, Ash Pond D Expansion (Virginia Power, 1988)
  - Annual dam inspection reports for 2015 and 2016 (Dominion, 2015; Dominion, 2016)
  - EAP and Downstream Inundation(Golder, 2012; Golder, 2017)

5.2 Extreme Weather Events and Long-Term Safety of the Closure Plan for Ash Pond D

Section 5.2 addresses SB 1398 Item 4 - the long-term safety and resilience to extreme weather events such as flooding/hurricanes, erosion, and storm surge for the proposed closure-in-place option. Considerations related to other non-weather-related extreme events or factors that pertain to the siting of the facility and closure (e.g., unstable areas, active faults, seismic activity) are covered in Section 5.3.

5.2.1 Flooding/Hurricane

Federal and state solid waste regulations referenced by the CCR Rule require that solid waste landfill units located in 100-year floodplains demonstrate that the unit would not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment. Engineering design and calculations could be performed to demonstrate that safe closure is possible regardless of a closed landfill or ash pond being surrounded by a floodplain or floodway.

5.2.1.1 Location of Pond D Relative to Floodplain

Closure-in-place would not impact the 100-year floodplain due to its location above Quantico Creek and the Potomac River. Due to the station's proximity to Quantico Creek, the area downstream of Pond D is subject to flooding from the 1-percent-annual-chance event (100-year event), per the FIRM.

5.2.1.2 Run-on and Final Cover Integrity

The closure plan (GAI Consultants, 2016a) for the Pond D closure-in-place option demonstrates that run-on would be managed adequately and that final cover integrity would be maintained. The direct drainage area for Pond D consists primarily of the pond cap and some ancillary areas that formerly drained into the pond. Following completion of closure activities, stormwater from the final cover system would be collected through the use of stormwater conveyance channels that would collect runoff along three main stormwater channels that run generally from north to south. These channels drain to a single discharge channel that conveys runoff to culverts that run beneath Possum Point Road and eventually to Quantico Creek.

Main channels on the final cover would be lined with grass or turf reinforcement matting to reduce erosion. The main discharge channel would be lined with riprap, articulated concrete block (ACB) and grout-filled fabric-formed revetment.

The stormwater systems to be used in the closure of the ash ponds were selected and sized to convey stormwater resulting from the 25-year, 24-hour storm events as required by VSMP Regulations (9VAC25-870) and the VSWMR. Based on DCR's dam safety regulations, the ash ponds and stormwater structures were also analyzed for the PMF event and shown to pass the flows safely.

5.2.1.3 Flood Routing to Prevent Overtopping of Dam

The plan for Pond D closure-in-place includes design and calculations to demonstrate that the design flood would be routed appropriately over the closed ash pond and that uncontrolled overtopping of the dam would be prevented (GAI Consultants, 2016a) per Virginia dam safety regulations. The Pond D dam would be regulated as a dam following closure. Therefore, the final cover stormwater management system would be designed to handle the IDF per dam regulations and prevent uncontrolled overtopping of the dam. Preventing uncontrolled overtopping of the dam is key to the stability of the dam and containment of ash. The stormwater management system for the closure is designed for a 1/2 PMF event to prevent uncontrolled overtopping of the dam.

5.2.1.4 Evaluation of Potential Downstream Impacts

The plan for the Pond D closure-in-place option demonstrates that there are no adverse downstream impacts related to water quality or flow resulting from closure-in-place (GAI Consultants, 2016a). Flow from Ponds D would be discharged via an ACB-lined spillway through three 42-inch diameter culverts beneath an on-site access road and into a fabric-formed concrete channel located with the existing Pond E. This channel conveys flow from both the former Pond E and the Pond D final cover to a low area adjacent to Possum Point Road. Flow exits to a tributary of Quantico Creek through two Virginia Department of Transportation (VDOT) 72-inch RCP culverts beneath Possum Point Road. GAI's DCR submittal (GAI Consultants, 2015) indicates that the existing VDOT culverts would pass the 10-year design storm without overtopping onto Possum Point Road. Furthermore, the flow from Pond D closure-in-place resulting from the 100-year design storm would not raise the flood elevation upstream of the VDOT culverts.

Even though the ash ponds and their dams meet structural stability and other regulatory criteria as explained in Sections 5.2 and 5.3, dam safety regulations require development of hypothetical breach scenarios, inundation mapping, hazard potential classification, and EAPs as part of protecting the downstream areas against potential breach. DCR dam safety currently considers the Pond D dam a significant hazard. GAI's DCR submittal (GAI Consultants, 2015) indicates that closure-in-place would include modifications to the existing embankment structure (much of the dam would be lowered). A new combined principal and emergency spillway would be constructed that would pass the PMF and prevent ponding of water behind the embankment.

The inundation study prepared by Golder (Golder, 2012) discusses the hypothetical dam breach and inundation scenario under Pond D operating conditions. The study did not evaluate conditions after closure. Since a hazard classification of “significant” was selected, analyses were completed for the 1/2 PMF. A sunny day breach as well as breaches during the spillway design flood (1/2 PMF) and PMF was evaluated assuming the Pond D was impounding liquid. The above-referenced report concludes that in the unlikely event a breach occurred, Possum Point Road would be overtopped in an area directly downstream of the principal spillway. The impacts downstream of Possum Point are expected to be minimal due to the proximity of Quantico Creek’s discharge to the Potomac River. Although the volume of flow associated with a structural breach would be significantly lower than that expected during the same design events after the Pond D final cover is in place, the inundation study (Golder, 2012) is not representative of the closure-in-place scenario.

5.2.1.5 Receding Floodwater or Drawdown Impacts

According to the inundation study prepared by Golder (Golder, 2012) and the closure plan (GAI Consultants, 2016a), flooding of adjacent waterways would not impinge on the downstream slopes of the Pond D dam during the 100-year design event. Rapid drawdown analyses and analyses of receding floodwater were not conducted due to the location of the pond.

5.2.1.6 Hurricane Impact

The Pond D closure plan (GAI Consultants, 2016a) for closure-in-place indicates that the final cover would adequately address the concerns associated with wind uplift and flooding resulting from potential hurricanes. Hurricanes cause wind, flooding, and storm surges. The final cover system would consist of a 2-foot-thick soil component above the geosynthetics, which would provide adequate resistance to wind uplift. The Pond D dam and the final cover system would be inspected and maintained to prevent the growth of vegetation such as trees that would be affected by wind forces. Impacts associated with flooding are addressed above, and wave runup, scour, and storm surge are discussed in Sections 5.2.2 and 5.2.3.

5.2.2 Erosion

The flood levels do not extend into the toe areas of the Pond D dam enough to cause potential for scour or undercutting that would impact the proposed closure-in-place system. In addition, the closure plan (GAI Consultants, 2016a) for closure-in-place demonstrates that long-term soil loss due to erosive forces is anticipated to be minimal.

Erosion considerations include (1) long-term loss of soil from the final cover due to erosive forces; and (2) scour and undercutting potential for the earthen dams. Soil loss was calculated using the USDA's RUSLE. The average annual soil loss is expected to be 0.30 ton/acre/year for the Pond D closure once fully stabilized with vegetation, which is less than the DEQ's Solid Waste Permitting Submission Instruction No. 6. Instruction 6 requires less than 2 tons/acre/year to protect the quality of the downstream water bodies and the long-term integrity of the final cover system. In addition, as stated in Section 5.1.2.1, the flood levels do not extend to the toe areas of the North Ash Pond dam enough to cause potential for scour or undercutting.

5.2.3 Storm Surge

The Pond D dam meets the DCR design requirements and CCR Rule hydraulic and structural stability requirements as explained in Sections 5.2 and 5.3. Although SB 1398 requests that potential impacts of storm surges be considered for closure-in-place resiliency, there are no prescribed storm surge design criteria for closed ash ponds. Appendix A provides a screening-level assessment of a potential design consideration of storm surge and wave runup.

The proposed final cover of the Pond D would be located above the water levels impacted by storm surge and wave action. The current design for the proposed closure-in-place option could be considered adequate since the impacts related to 100-year flood elevations are addressed as part of the CCR Rule structural stability certifications.

5.2.3.1 Run-on and Final Cover Integrity

The Pond D plan for the closure-in-place scenario (GAI Consultants, 2016a) demonstrates that run-on would be managed adequately and that final cover integrity would be maintained. The direct drainage area for Pond D consists mainly of the pond cap and some ancillary areas that formerly drained into the pond. Following the completion of closure activities, stormwater from the final cover system would be collected through the use of stormwater conveyance channels that would collect runoff within three main channels running generally north-south. Each channel would be grass lined with soil stabilization matting to reduce erosion. Main channels on the final cover would be lined with grass or turf reinforcement matting to reduce erosion. The main discharge channel would be lined with riprap, ACB, and grout-filled fabric-formed revetment.

The stormwater systems to be used in the closure of the ash ponds were selected and sized to convey stormwater resulting from the 25-year, 24-hour storm events as required by VSMP Regulations (9VAC25-870) and the VSWMR. Based on DCR's dam safety regulations, the ash ponds and stormwater structures were also analyzed for the PMF event and shown to pass the flows safely.

5.2.3.2 Flood Routing to Prevent Overtopping of Dam

Pond D is the only ash pond at the Possum Point Power Station to be considered as having the potential to impound CCR under the closure-in-place option. According to the Impounding Structure Modification Report (GAI Consultants, 2015), the adopted design criteria for the hydraulic structures associated with the Pond D dam embankment are to be designed to convey the PMF. During closure of Pond D, the embankment crest would be lowered significantly. Runoff from the final cover would be conveyed by several drainage channels beyond the limits of the remaining portions of the Pond D embankment and into the former Pond E area before discharge. No spillway would remain in place for Pond D. According to GAI (2015), Pond D would have enough volume to store runoff from the PMF without overtopping the dam during closure construction.

According to GAI (2015), the only hydraulic structure that could impact the integrity of the dam during the post-closure period is the armored channel that conveys runoff from the Pond D final cover area to Pond E. This channel is designed to manage the PMF and conveys runoff beyond the limits of the Pond D dam.

5.3 Siting and Closure Plan Long-Term Safety for Ash Pond D

Section 5.3 addresses SB 1398 Item 4 - the long-term safety of siting and closure of the facility, such as unstable areas, active faults, and seismic activity (earthquakes), for the proposed closure-in-place option.

5.3.1 Dam Stability

5.3.1.1 Construction History

GAI Consultants prepared a history of construction report (GAI Consultants, 2016f) as part of CCR Rule compliance in October 2016. This report indicates that Pond D was developed by constructing a new embankment across a natural valley on the site of a former ash pond (also known as Pond D) that was removed from service in 1971. As-built drawings dated December 1988 prepared by Virginia Electric and Power Company (VEPCO, 1988) indicate that the 1,700-foot-long zoned embankment was constructed with a 20-foot-wide crest at elevation 150 feet msl, an upstream slope of 2.5H:1V, and 2.7H:1V downstream slope. A horizontal drainage blanket and toe drain were constructed in portions of the embankment near the downstream toe of slope adjacent to Possum Point Road. The principal spillway is a concrete decant riser with a 30-inch-diameter concrete discharge pipe. An emergency spillway was constructed at elevation 144 feet msl.

The as-built drawings (VEPCO, 1988) indicate that soft, unconsolidated alluvial soils were removed by over-excavation before embankment construction. GAI's history of construction (GAI Consultants, 2016g) states that ash encountered was also removed before embankment construction.

The embankment was constructed using on-site soils containing a mixture of fine to medium sands with minor amounts of clayey sand and sandy clay meeting VEPCO specifications. GAI's history of construction (GAI Consultants, 2016f) provides data on the engineering properties of the embankment. The report concludes, based on 1986 design information and 1988 as-built information provided by Dominion, that the embankment was constructed in accordance with the plans and specifications.

According to the as-built drawings (VEPCO, 1988), the Pond D dam was constructed with a blanket drain near the downstream toe of the embankment slope using a 3-foot-thick layer of VDOT # 57 crushed stone aggregate within a layer of VDOT "Class A Fine Aggregate." It terminates in a 6-foot-thick toe trench filled with VDOT # 57 crushed stone aggregate. The toe trench terminates 10 feet upstream of the downstream toe of the embankment slope. As originally designed, the toe drain discharges into a storm drain structure and it discharges to Outfall S-107.

5.3.1.2 Subsurface Conditions

Pond D was developed over the site of a former ash pond that had been used to manage sluiced ash. The Pond D abutment soils consist of stiff to very stiff reddish brown sandy Clay (CL), very stiff to very hard grey silty or sandy Clay (CH), Clayey Sand (SC), Silty Sand (SM), and medium dense to very dense gray clayey to silty fine to medium Sand (SC-SM) (GAI Consultants, 2016g). The original material found beneath Pond D included soft alluvial soils and CCR. These materials were removed before construction of the embankment (VEPCO, 1988; GAI Consultants, 2016g).

GAI prepared a Factor of Safety Assessment for the Pond D dam in compliance with the CCR Rule in October 2016 (GAI Consultants, 2016c). In the assessment, GAI conducted slope stability analyses using soil properties for the embankment and foundation soil developed by VEPCO, Civil Engineering Department, as part of the 1986 Final Design Report for the Pond D dam (Virginia Power, 1986). GAI's slope stability analyses modeled the foundation beneath the embankment as "clay soil."

5.3.1.3 Structural Stability

The slope stability of the dam under operating conditions was evaluated as part of the GAI Factor of Safety Assessment for the Pond D dam as part of the required CCR Rule postings in October 2016 (GAI Consultants, 2016d) and found to have acceptable factor of safety values. The slope stability under the proposed closure-in-place conditions, including the modified embankment and the in-place final cover, was assessed by GAI in the Pond D Closure Plan (GAI Consultants, 2016a) and also found to have acceptable factors of safety under the wide range of conditions that were evaluated, including seismic and post-liquefaction conditions.

Based on the post-closure liquefaction assessments presented in the Pond D Closure Plan (GAI Consultants, 2016a), the foundation and embankment materials of the Pond D dam and compacted CCR were calculated to not be susceptible to liquefaction under the design earthquake hazard.

5.3.2 Final Cover Stability

5.3.2.1 Closure System Stability

GAI (2016a) analyzes post-closure conditions under different loading scenarios for the combined Pond D dam (with proposed dam modifications) and final cover system configuration and concludes that the analyzed sections comply with regulatory requirements for geotechnical stability, including those in the CCR Rule.

5.3.2.2 Veneer Stability

Veneer stability analysis is performed to evaluate whether the final cover system has the potential to slide as a wedge (i.e., veneer) down the slope, thereby exposing the contained ash. Based on the analysis for post-closure condition, veneer slope stability is adequate for the proposed 4H:1V slopes of the final cover system in the closure plan (GAI Consultants, 2016a). Design calculations incorporate long-term static, seismic (earthquake), and storm event conditions. Material parameters such as interface friction angles for the cover system and transmissivity for the cover drainage layer were developed. CQA testing will be performed during construction to verify that the specified material parameters would be met.

5.3.2.3 Liquefaction Triggering of CCR and Potential Impact to Final Cover System

Liquefaction is triggered when loose saturated soil deposits are shaken by seismic events that exceed the liquefaction resistance of the soils. Liquefaction can lead to partial loss of strength and stiffness of soils. As stated in the closure plan, engineering controls have been incorporated into the design of the final cover system to provide adequate factors of safety against potential instability. Based on information in VEPCO (1988) on the design and construction of Pond D dam, undercutting of ash and soft alluvial soils was completed before construction of the existing embankment. The embankment was constructed using controlled compacted fill. According to GAI (2016a), the only material identified as having potential for liquefaction is the saturated CCR. Foundation and embankment soils were determined not to be susceptible to liquefaction using CPT data obtained by GAI.

Placement of the final cover system would result in a significant decrease in the saturation level of the CCR over time, thereby substantially reducing the liquefaction risk in Pond D. In addition, it is anticipated that dewatering would be conducted as part of the CCR grading in Pond D that would be required to achieve final cover lines and grades. Dewatering could further remove pore water from the CCR.

In the event that CCR liquefied within the closed ash pond, some isolated pockets of movement could occur. However, this movement is not anticipated to lead to a significant impact on the cover or the direct release of CCR beyond the closure boundary.

5.3.2.4 Settlement Impacts to Cover

Based on the closure plan (GAI Consultants, 2016a), minor amounts of settlement (less than 6 inches) is expected to occur due to additional load resulting from active dewatering, stacking and grading of ash, final cover placement during closure activities, and gravity drainage from the CCR during and after closure. The design of the final cover and drainage channel lines and grades has taken these settlements into account, such that adverse slopes on the final cover would not occur or in drainage ditches in the event such settlement occurs (GAI Consultants, 2016a). Based on the above, the closure plan concludes that the anticipated settlement amounts are not expected to inhibit the proper functioning of the proposed final cover or stormwater conveyance systems.

5.4 Closure-in-Place Schedule

According to the closure schedule in the Pond D closure plan (GAI Consultants, 2016a), the time required to permit, design, and construct the closure-in-place option for Pond D is approximately 2 to 3 years following regulatory approval.

Implementing a closure option within 2 to 3 years has significant benefits in safety, environmental protection, and community.

5.5 Closure-in-Place Costs

AECOM developed cost estimates for closure-in-place and closure by removal options as part of the project to compare cost estimates for different closure options using the same rates and assumptions. The estimated cost for the closure-in-place option for the Ash Pond D is approximately $134 million. Table TM5-6 provides a summary of the cost estimate. More details about the level-of-cost estimate and assumptions are provided in Section 6.

Table TM5-6: Cost Estimate for Closure-in-Place Option for Ash Pond D

Item	Cost[(1)]	Specifics/Comments
Mobilization, site preparation, and demolition	$72M	This includes dewatering and water treatment throughout the project duration. Dewatering includes removal and treatment of contact water to meet VPDES requirements during the construction period.
Subgrade ash cut and fill	$5M	This includes grading the ash to prepare for cover system installation.
Cap system installation	$23M	Final cover system geosynthetics and soil installation.
Special remedial items	$2M	Pond D channel and discharge improvements.
Stormwater management and site restoration	$14M	Stormwater controls and access roads.
Post-closure monitoring	$18M	30 years of post-closure care.
Total	**$134M**	

All costs in this report are Class 5 estimates (+100%, - 50%) and represent opinions of probable cost based on information available at the time of this study. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained

(1) Costs do not include potential corrective measures

M = million

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6. Assumptions

6.1 General Assumptions

AECOM developed this memo based on several reports prepared by other consultants for Dominion as they were made available at the time of preparation of this memo. These reports included original design documents for the ash ponds, subsequent assessments, USEPA dam safety assessments, CCR Rule certifications, and closure plans. AECOM conducted a review of the reports and relied on the information presented by others in preparation of this memo. AECOM understands that at the time of writing this report, detailed closure plans and designs are in various stages of development at different sites. However, the basic design elements and approaches have been developed to a stage that conclusions regarding feasibility, long-term resilience to extreme weather events, and structural stability can be drawn for the purposes of addressing the SB 1398 requirements.

6.2 Cost Assumptions

To support this assessment, AECOM developed cost estimates for various closure alternatives for each of the four power stations. These Opinions of Probable Cost are estimates of possible construction costs for informational purposes. The estimates are Class 5 Estimates (see Table TM5-7) and are limited to the conditions existing at issuance and not a guarantee of actual price or cost. Uncertain market conditions such as, but not limited to, local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions may affect the accuracy of these estimates. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

Table TM5-7: Cost Estimate Classification Matrix

Estimate Class	Primary Characteristic	Secondary Characteristic			
	Level of Project Definition[1]	End Usage[2]	Methodology[3]	Expected Accuracy Range[4]	Preparation Effort[5]
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: –20% to –50% H: +30% to +100%	1
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: –15% to –30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, authorization, or control	Semi-detailed unit costs with assembly level line items	L: –10% to –20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: –5% to –15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: –3% to –10% H: +3% to +15%	5 to 100

Source: AACE (2005)

(1) Expressed as percent of complete definition

(2) Typical purpose of estimate

(3) Typical estimating method

(4) Typical variation in low and high ranges. The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

(5) Typical degree of effort relative to least cost index of 1. If the range index value of “1” represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

H = high; L = low

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8. Abbreviations

ACB	articulated concrete block
CCR	coal combustion residuals
CFR	Code of Federal Regulations
CPT	cone penetration testing
CQA	Construction Quality Assurance
CSX	CSX Corporation
CY	cubic yards
DCR	Virginia Department of Conservation and Recreation
DEQ	Virginia Department of Environmental Quality
EAP	Emergency Action Plan
FIRM	Flood Insurance Rate Map
IDF	inflow design flood
msl	mean sea level
PMF	probable maximum flood
PMP	probable maximum precipitation
RCP	reinforced concrete pipe
RUSLE	Revised Universal Soil Loss Equation
SB 1398	Senate Bill 1398
SPT	standard penetration test
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
VAC	Virginia Administrative Code
VDOT	Virginia Department of Transportation
VEPCO	Virginia Electric and Power Company
VPDES	Virginia Pollutant Discharge Elimination System
VSMP	Virginia Stormwater Management Program
VSWMR	Virginia Solid Waste Management Regulations

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Figures

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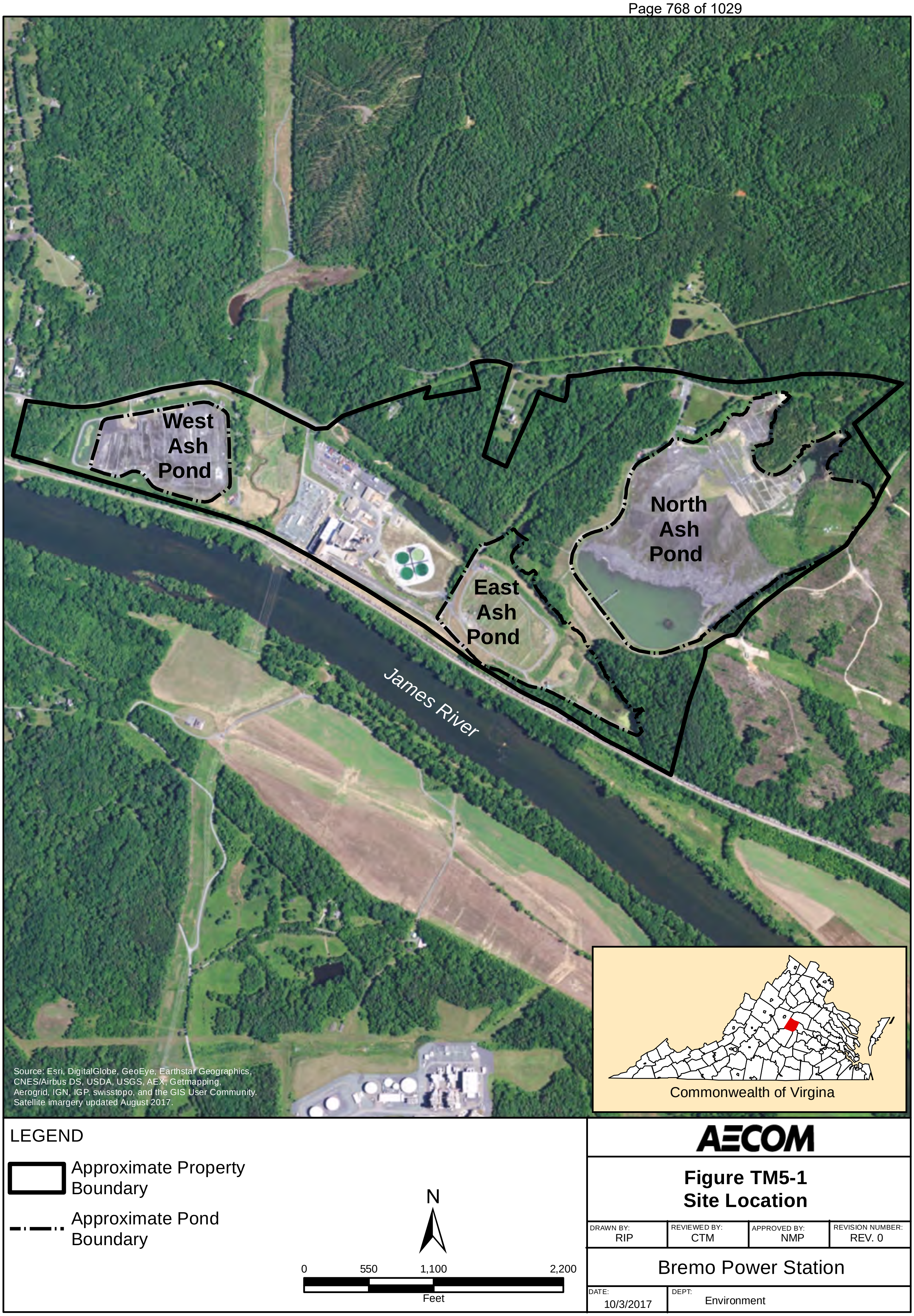

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Figure TM5-1
Site Location

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	NMP	REV. 0

Bremo Power Station

DATE:	DEPT:
10/3/2017	Environment

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LEGEND

Approximate Property Boundary

Limit of Waste

Approximate Pond Boundary

N

0 350 700 1,400

Feet

AECOM

Figure TM5-2
Site Location

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CAG	DFM	REV. 0

Chesapeake Energy Center

DATE:	DEPT:
10/3/2017	Environment

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LEGEND

Approximate Property Boundary

Approximate Pond Boundary

N

0 1,000 2,000 4,000
Feet

AECOM

Figure TM5-3
Site Location

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Chesterfield Power Station

DATE:	DEPT:
10/3/2017	Environment

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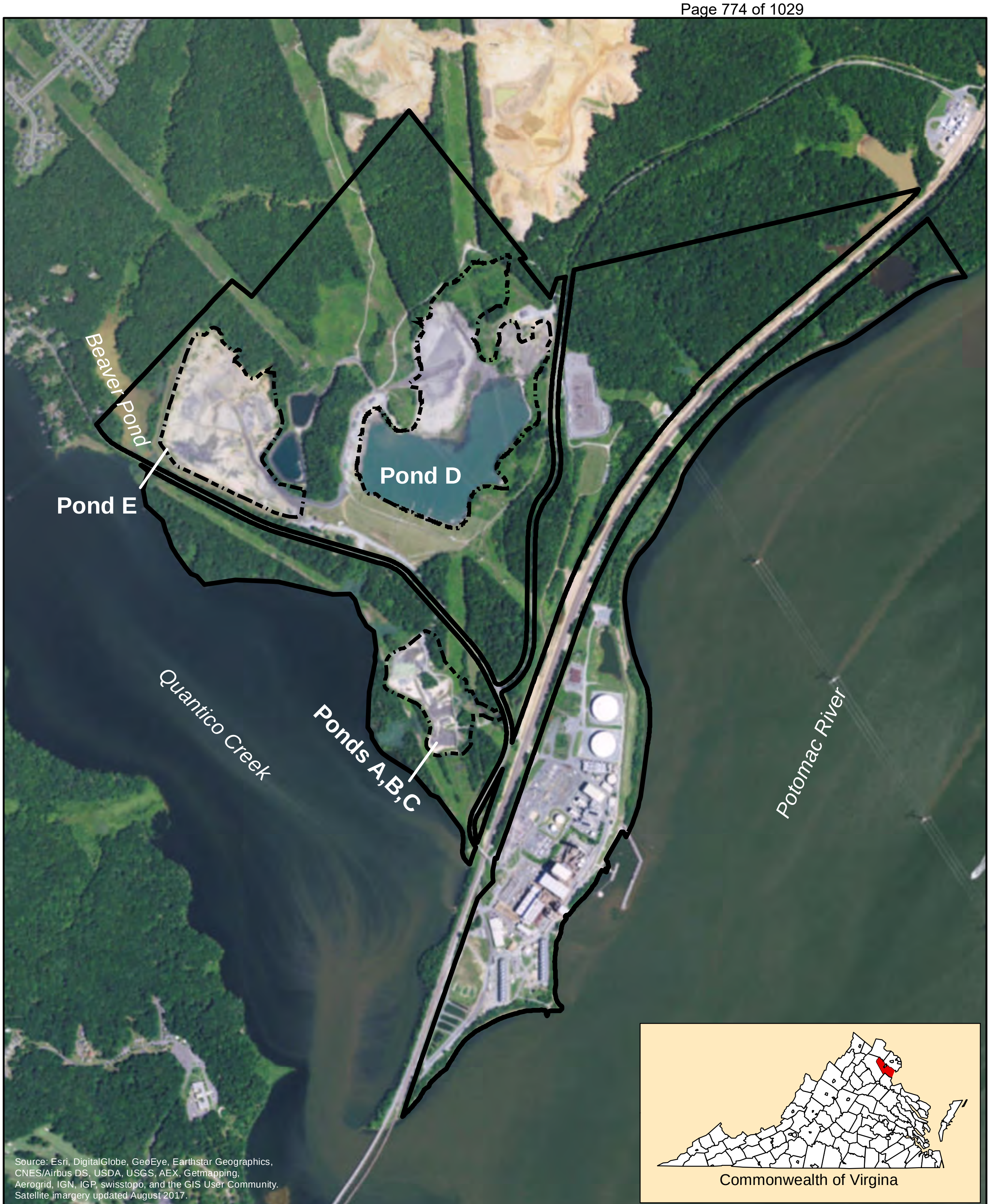

LEGEND

Approximate Property Boundary

Approximate Pond Boundary

N

0 750 1,500 3,000
Feet

AECOM

Figure TM5-4
Site Location

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CKS	DFM	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/3/2017	Environment

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Appendix A: Storm Surge Analysis

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Storm Surge Analysis

A.1 Background

SB 1398 is applicable to eleven CCR surface impoundments (ash ponds) at four Dominion Energy (Dominion) power stations. On behalf of Dominion and in compliance with SB 1398, AECOM conducted an evaluation of the groundwater and surface water on all eleven ponds. At seven ponds, ash has been removed, is in the process of being removed, or is planned to be removed, and the closure-in-place option is therefore not applicable to these ponds.

The purpose of this appendix is to provide an assessment of potential storm surge at four Dominion coal combustion residual (CCR) surface impoundments (ash ponds) in Virginia, where long-term safety assessments of closure-in-place options were performed. This appendix is an attachment to Technical Memorandum 5, which discusses the long-term safety of the closure-in-place option for four ash ponds. The memo and this appendix were both prepared on behalf of Dominion and in compliance with Virginia Senate Bill (SB) 1398.

The subject ash ponds have dams that are regulated under the Virginia Department of Conservation and Recreation (DCR). The dams meet the DCR design requirements and the hydraulic and structural stability requirements in the CCR Rule. Although SB 1398 requests that the potential impacts of storm surge be considered for closure-in-place resiliency, there are no prescribed storm surge design criteria for closed ash ponds. This appendix provides a screening-level evaluation to address the potential storm surge design consideration.

The four ash ponds are at three Dominion power stations as listed below. See Figures 1, 13, and 21 in the body of the Ash Pond Closure Assessment for a map showing the locations of the power stations and ash ponds.

1. Bremo Power Station, North Ash Pond
2. Chesterfield Power Station, Lower and Upper Ash Ponds
3. Possum Point Power Station, Pond D

According to the National Oceanic and Atmospheric Administration (NOAA), “storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tide” (NOAA, 2017a). Storm surge is caused by strong wings during a tropical storm or hurricane and generally occurs where winds are blowing onshore. Storm surge is one component of what causes water levels to rise during a hurricane. In addition to storm surge, the total water level during a hurricane can also be attributed to tides, waves, and freshwater input. In Virginia, storm surge can be caused by tropical storms, hurricanes, and nor’easters.

The screening-level assessment involved reviewing the information associated with the subject ash pond locations, including Federal Emergency Management Agency (FEMA) Flood Insurance Studies (FISs), FEMA Flood Insurance Rate Maps (FIRMs), National Storm Surge Hazard Maps, and Virginia Hurricane Storm Surge Maps. The purpose of the review was to assess the adequacy of the existing dams to protect against storm surge.

Frequency-based flood elevations provided in FEMA FISs are typically used for engineering design and analysis and may incorporate storm surge and other coastal analyses, depending on study location. As such, the assessment was based primarily on a review of FISs and FIRMs (see Section A.2). Other sources of storm surge estimates were also reviewed (see Section A.3).

A.2 FEMA Flood Insurance Studies and Flood Insurance Rate Maps

The current FIS and FIRM for each ash pond site were obtained from the FEMA Flood Map Service Center (https://msc.fema.gov/portal/). FEMA 100-year base flood elevations (BFEs) for water bodies adjacent to each ash pond were obtained from the FISs and FIRMs. Table TM5-A-1 provides a summary of the BFEs at each ash pond site along with FIS and FIRM references and a description of the analysis that was conducted to determine the BFEs. All elevations are reported in feet North American Vertical Datum of 1988 (NAVD88) and were converted to this datum as noted in Table TM5-A-1.

As shown in Table TM5-A-1, the 100-year BFEs are below the dike crest elevations for all of the ash pond sites that were considered.

Storm surge is included in the BFE estimates for the Possum Point Power Station. However, storm surge was not incorporated by FEMA in the estimated BFEs for the Bremo and Chesterfield Power Stations because these sites are too far inland for coastal analysis and for storm surge to be a primary BFE factor.

Although FEMA may not consider storm surge along the James River at the Chesterfield Power Station, the effects of wave action for the Lower Ash Pond at the Chesterfield Power Station could be a factor in light of the potential expansive fetch during flooding and relatively lower freeboard from the BFE (2.6 feet). Preliminary estimates conducted by AECOM indicate that wave setup and runup during a 100 mph wind could be between 1 and 6 feet for the Lower Ash Pond, indicating a potential for storm surge and associated wave action to overtop the dike crest. These initial estimates were calculated using methods provided in the U.S. Bureau of Reclamation's *Design Standards No. 13, Embankment Dams, Chapter 6 Freeboard, September 2012* (USBR, 2012). Simplifying assumptions were made regarding fetch, wind velocity, and dike configuration; the assumptions and design criteria could result in changes to the above estimates.

A.3 Other Sources of Storm Surge Estimates

Other sources of storm surge estimates include the National Storm Surge Hazard Maps (http://www.nhc.noaa.gov/nationalsurge/) developed by NOAA (NOAA, 2017b) and the Hurricane Storm Surge Maps for Virginia developed and published by the Virginia Department of Emergency Management (http://www.vaemergency.gov/prepare-recover/threats/hurricane-storm-surge-maps/) (VDEM, 2017). However, these products are intended to be informational and for emergency management purposes and are not typically used for engineering design or analysis.

The National Surge Hazard Maps provide an estimated storm surge height above ground for the coverage area, while Hurricane Storm Surge Maps for Virginia graphically depict storm surge risk. Each product presents estimates or risk according to the Saffir–Simpson Hurricane Wind Scale Categories 1 through 4. Storm surge due to Category 5 hurricanes was not developed for Virginia for either product because Category 5 hurricanes are not likely to occur in Virginia.

Table TM5-A-1: FEMA Base Flood Elevations

Power Station	Pond	Dike Crest Elev. (feet NAVD88)(1)	Adjacent Water Body	100-year BFE (feet NAVD88)	Description of Analysis for BFE
Bremo	North Ash Pond	333	James River	229(2)	Considers only riverine flooding due to freshwater input
Chesterfield	Lower Ash Pond	18.5 – 20	James River	15.9(3)	Considers only riverine flooding due to freshwater input
	Upper Ash Pond	41	James River	15.9(3)	Considers only riverine flooding due to freshwater input
Possum Point	Pond D	98	Quantico Creek	10.0(4)	Incorporates tidal, storm surge, setup, and wave height and runup analysis

(1) Dike crest elevations were obtained from documents provided by Dominion and are referenced in the main CCR Study Report and Technical Memorandum 5, Closure-in-Place.

(2) BFE associated with Bremo Power Station is based on information in FIS Number 51003CV000C, May 16, 2016, and FIRM Number 51065C0260C, effective date May 16, 2008.

(3) BFE associated with Chesterfield Power Station is based on information provided in FIS Number 51041CV000A, December 18, 2012, and FIRM Number 51041C0190D, effective date December 18, 2012. BFE value was converted to feet NAVD88 using NOAA's Vertical Datum Transformation (VDatum) tool at https://vdatum.noaa.gov/vdatumweb).

(4) BFE associated with Possum Point Power Station is based on information provided in FIS Number 51153CV001A, August 3, 2015, and FIRM Number 51153C0316E, effective date August 3, 2015.

BFE = base flood elevation

FEMA = Federal Emergency Management Agency

NAVD88 = North American Vertical Datum of 1988

The coverage area for the National Surge Hazard Maps includes the Chesterfield Power Station and the Possum Point Power Station but not the Bremo Power Station. The area covered by the Hurricane Storm Surge Maps for Virginia includes the Possum Point Power Station but not the other two stations. The data in the National Surge Hazard Maps cannot be compared directly or compared to the data in the FEMA FISs because they were developed for different purposes, but it can be concluded that both the National Surge Hazard Maps and Hurricane Storm Surge Maps for Virginia indicate some risk of storm surge for the adjacent water bodies at the Possum Point Power Station during high winds, which is consistent with the FISs for these locations (in that storm surge was estimated).

The National Surge Hazard Maps indicate some risk of storm surge for the James River, which is the adjacent water body to the Chesterfield Power Station. This information is not consistent with the information in the FIS for this site, in which storm surge is not accounted for in the FEMA 100-year BFE. This inconsistency in storm surge predictions should be reconciled as part of the design for the final cover of the Lower Ash Pond at the Chesterfield Power Station.

A.4 Conclusions

The final covers of three of the four existing ash ponds would be above the water level potentially subjected to storm surge and wave action (North Ash Pond at Bremo Power Station, Upper Ash Pond at Chesterfield Power Station, and Pond D at Possum Point Power Station). The current designs for the proposed closure-in-place options for the above-mentioned three ash ponds are adequate because the impacts to the dams related to the 100-year flood elevations were addressed in the CCR Rule structural stability certifications and the water levels do not exceed the crest elevations of the dams.

Based on a screening-level analysis, there is the potential for storm surge- and wave action-related water levels to exceed the dam crest elevation at the Chesterfield Lower Ash Pond. To protect against this potential storm surge condition, erosion control and energy-dissipation engineering controls such as riprap protection for a section of the final cover could be implemented to protect the final cover system below a certain elevation. Additionally, the final cover system would include a geomembrane layer and a geocomposite drainage layer that underlie the 2-foot soil layer. Geosynthetics provide protection against the potential for washout of the underlying CCR even if the final cover soil is eroded by scour.

The screening-level analyses also indicate that the potentially flooded areas at the Chesterfield Lower Ash Pond are likely to be within a few feet of the dike crest, thus limiting the extent of the final cover areas that may need to be reinforced against storm surge impacts. The final cover is not expected to be completely submerged.

Given the limited nature of this screening-level analysis, AECOM recommends more advanced analyses as part of the final cover design at the Chesterfield Lower Ash Pond. In the event that water levels exceed the dam crest elevation, the impacts could be readily mitigated using the engineering controls discussed above.

A.5 References

NOAA (National Oceanic and Atmosphere Administration) 2017a. Introduction to Storm Surge, National Hurricane Center, Storm Surge Unit. http://www.nhc.noaa.gov/surge/surge_intro.pdf.

NOAA. 2017b. National Storm Surge Hazard Maps – Version 2. http://www.nhc.noaa.gov/nationalsurge/ (accessed August 31, 2017).

USBR (U.S. Bureau of Reclamation). 2012. Design Standards No. 13, Embankment Dams, Chapter 6: Freeboard.

VDEM (Virginia Department of Emergency Management. 2017) Hurricane Storm Surge Maps, http://www.vaemergency.gov/prepare-recover/threats/hurricane-storm-surge-maps/ (accessed September 1, 2017).

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Senate Bill 1398 Response

Coal Combustion Residuals Ash Pond Closure Assessment

TECHNICAL MEMORANDUM 6

Groundwater/Surface Water Evaluation

November 2017

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Senate Bill 1398 Response:
Coal Combustion Residuals Ash Pond Closure Assessment

Technical Memorandum 6: Groundwater/Surface Water Evaluation

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1. Introduction and Summary of Findings

Virginia Senate Bill 1398 (SB 1398) requires “that every owner or operator of a coal combustion residuals (CCR) surface impoundment that is located within the Chesapeake Bay watershed … conduct an assessment of each such CCR surface impoundment (CCR unit) regarding the closure of any such unit.” The assessment must include describing groundwater and surface water conditions surrounding the surface impoundments (ash ponds) and evaluating corrective measures to restore water quality (if needed), evaluating the clean closure (closure by removal) of the CCR unit by recycling/reusing the ash or moving it to a landfill and demonstrating the long-term safety of the CCR unit if it is closed in place.

SB 1398 is applicable to eleven CCR surface impoundments (referred to as ash ponds in this report) at four Dominion Energy (Dominion) power stations. On behalf of Dominion, an evaluation of the groundwater and surface water was conducted for all eleven ponds and an assessment of closure options of the five ponds that have been slated for closure was conducted. Ash has been removed or is in the process of being removed from the other six ponds; therefore, these ponds are being closed by removal. Table TM6-1 provides an overview of the size and status of the units that were included in the study.

Table TM6-1: Ash Ponds included in the Study

Power Station	CCR Units	Remaining CCR Volume (CY)(1)	Operating Status	Area (acres)
Bremo Power Station	North Ash Pond(2)	4,800,000	Slated for closure	68
	East Ash Pond	1,400,000	Ash being actively removed and transported to North Ash Pond	27
	West Ash Pond	0	Ash removed	22
Chesapeake Energy Center(3)	Bottom Ash Pond(2)	60,000	Committed to closure by removal	5
Chesterfield Power Station	Lower Ash Pond(2)	3,600,000	Slated for closure	101
	Upper Ash Pond(2)	11,300,000	Slated for closure	112
Possum Point Power Station	Ash Pond A Ash Pond B Ash Pond C	40,000	Residual ash to be removed from Ash Ponds A, B, and C and transported to Ash Pond D	18
	Ash Pond D(2)	4,009,250	Slated for closure	70
	Ash Pond E	2,250	Residual ash to be removed and transported to Ash Pond D	38
	Total Volume	**25,211,500**		

(1) CCR volumes are based on Dominion estimates as of July 10, 2017

(2) Assessed for closure options

(3) While not subject to the assessment required by SB 1398, the CCR landfill at the Chesapeake Energy Center is slated for closure in accordance with VSWMR. Virginia DEQ issued a draft solid waste permit in June 2016 for closure of the landfill, which process was later suspended at Dominion’s request. The draft permit required Dominion to evaluate and propose alternative corrective measures to address groundwater impacts. In addition, in connection with a July 31, 2017, court order, Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, to include proposed additional corrective measures to address site-wide groundwater impacts.

CCR = coal combustion residuals; CY = cubic yards; DEQ = Department of Environmental Quality; VSWMR = Virginia Solid Waste Management Regulations

1.1 Study Objective

The objective of the study was to comply with the following SB 1398 requirements to ensure the long-term safety of the ash ponds while protecting public health and the environment:

- Evaluate closure by removal with recycling or reuse (beneficial use) of the CCR material
- Evaluate closure by removal with placement of CCR material in a permitted landfill
- Evaluate closure-in-place addressing long-term safety, structural, and extreme weather event resiliency
- Describe groundwater and surface water quality surrounding each ash pond, and evaluate corrective measures if needed

AECOM was tasked with critically reviewing existing information, identifying additional studies that may be needed, performing the studies, and preparing a report that addresses the requirements of SB 1398 for each of the eleven Dominion ash ponds listed in Table TM6-1.

The objective of the SB 1398 requirements is to provide members of the legislature, environmental regulators, local government officials, and members of the local communities with an assessment of ash pond closure options as set forth in the legislation. Specifically, the report describes how the various options could meet the objectives of safe closure, compliance with applicable federal and state rules, and protection of public health and the environment. This report is not intended, and must not be construed, to provide recommendations or conclusions regarding the selection of the options detailed herein.

AECOM developed a series of Technical Memoranda that provide a detailed analysis of the primary technical information needed to comply with SB 1398 requirements. The Technical Memoranda provide an assessment of closure by removal options (including recycling/beneficial use and landfilling); ash sampling results to supplement the beneficial use study; and evaluations of closure-in-place, groundwater and surface water conditions, and potential groundwater corrective measures. The memoranda are included as attachments to the report and are referenced as appropriate.

1.2 Technical Memorandum 6 Objective

Technical Memorandum 6 addresses the first requirement of SB 1398, identifying and describing groundwater and surface water quality associated with each ash pond. Separate evaluations of surface water and groundwater were conducted for each of the four Dominion power generation stations: Bremo Power Station (Section 2), Chesapeake Energy Center (Section 3), Chesterfield Power Station (Section 4), and Possum Point Power Station (Section 5). This Technical Memorandum discusses the background, facility setting, geology and hydrogeology, groundwater quality, and surface water quality for each station.

This Technical Memorandum contains site-specific assessments and findings that are not applicable to the evaluation of other sites within or outside of this report. All facts contained herein are based on information available at the time of the study and should not be relied upon without independent verification.

1.3 Regulatory Framework

The ash ponds included in this study have been, and continue to be, monitored under both federal and state regulations. State programs applicable to the ash ponds include the Virginia Pollutant Discharge

Elimination System (VPDES) and the Virginia Solid Waste Management Regulations (VSWMR) as administered by the Virginia Department of Environmental Quality (DEQ). The Chesapeake Energy Center is also subject to a Corrective Action Plan (CAP) under the VSWMR. The ash ponds are also regulated by the federal CCR Rule (40 CFR Part 257).

Because of their discharge to surface water, each of the ash ponds is subject to the VPDES program. Groundwater monitoring has also been ongoing at Bremo, Chesterfield, and Possum Point pursuant to each site's permit. As described in greater detail in Sections 2, 4, and 5, each station has a specific set of monitored constituents that are sampled for on an annual or semi-annual basis. An annual report is prepared for each site to present the results of the sampling.

As an inactive industrial landfill undergoing corrective measures, the Chesapeake Energy Center site is subject to CAP monitoring under the solid waste permit (SWP) issued through VSWMR. The SWP requires groundwater to be monitored semi-annually to determine whether the landfill is impacting water quality. An annual report is prepared to present the results of the sampling (two events per report). Groundwater and surface water are also monitored in accordance with the CAP to verify the effectiveness of the approved corrective measure. CAP samples are collected semi-annually, and reported every 3 years.

Active ash ponds (Bremo North Ash Pond, Chesterfield Upper and Lower Ash Ponds, and Possum Point Ash Pond D) were subject to background CCR monitoring that was completed by October 2017. The inactive ponds, including the Chesapeake Bottom Ash Pond, are required to complete CCR background monitoring by April 2019. After collection of background data, CCR monitoring occurs in two phases: detection monitoring and assessment monitoring. The constituents analyzed during these phases are shown in Table TM6-2.

Table TM6-2: CCR Rule Constituents

Detection Monitoring Constituents		Assessment Monitoring Constituents			
• Boron • Calcium • Chloride • Fluoride	• pH • Sulfate • Total Dissolved Solids	• Antimony • Arsenic • Barium • Beryllium	• Cadmium • Chromium • Cobalt • Fluoride	• Lead • Lithium • Mercury • Molybdenum	• Selenium • Thallium • Radium 226 and 228 combined

The first course of action under the groundwater monitoring requirements of the CCR rule is to collect eight rounds of samples for both sets of constituents so that a baseline background value can be calculated. This activity has been completed for the five ash ponds that are slated for closure, and all of the ponds are expected to be in the detection monitoring phase once background values have been calculated. Background monitoring data will be submitted in accordance with the CCR Rule. The background values calculated for this report are considered preliminary results, and this report is not intended to provide data or assessments as required by the CCR Rule.

During the detection monitoring phase, samples will be collected semi-annually for the detection monitoring constituents, which are considered indicators of potential impacts. If any of these constituents are detected above the calculated background during this phase, the station will be required to perform assessment monitoring.

During the assessment monitoring phase, samples will be collected semi-annually for both detection and assessment monitoring constituents, and results compared to the Maximum Contaminant Level (MCL), or the background level for constituents without an MCL. The U.S. Environmental Protection Agency (USEPA) established MCLs as drinking water quality standards developed as part of the Safe Drinking Water Act. While the groundwater at these sites is not used for drinking water, the MCL is a conservative, federally accepted water quality standard, and is the standard applied by the CCR Rule. If an assessment monitoring constituent is detected above an MCL (or background level for constituents without MCLs), the ash pond will be directed into corrective measures.

To complete the baseline groundwater monitoring, groundwater wells were installed on both the upgradient and downgradient side of the monitored ash ponds. Groundwater generally moves from high hydraulic head to low as controlled by local geologic and topographic conditions. Each site has different geologic and topographic settings, and therefore different groundwater flow dynamics, which is discussed in detail in the station-specific sections.

Upgradient wells are located uphill of the monitored ash pond or at a separate (background) location believed to represent groundwater that does not have the potential to be impacted by CCR units. Downgradient wells are positioned to intercept groundwater that has passed beneath or through the ash ponds, and are therefore most likely to exhibit any potential impacts stemming from the ash pond. The results of the downgradient groundwater sampling are compared to the results of the background sampling to see if there are any significant differences between the two datasets that would potentially suggest CCR-related impacts. To determine preliminary background values, upgradient (background) well data from the eight sampling events were pooled and loaded into a statistical program. The program assesses the pooled data of each constituent and determines if the data set follows a probability distribution (i.e., how random the data are) based on a fixed set of parameters (parametric) or a probability distribution based on a changing set of parameters (non-parametric). From this information, an upper tolerance limit (background value) is calculated.

Surface water samples have also been collected at each of the sites and screened against water quality criteria in accordance with 9VAC25-260-140, including aquatic life (acute and chronic), human health-public water supply, and human health-all other surface waters. Surface water immediately downstream of the sites is not used for drinking water; however, all surface water sample results meet the public water supply human health criteria, as detailed in Sections 2 through 5.

1.4 Summary of Findings

The groundwater and surface water assessments for each of the four power stations are summarized in Sections 2 through 5.

Groundwater at Bremo, Chesterfield, and Possum Point Power Stations is currently being monitored under both the CCR Rule and individual VPDES permits. The Chesapeake Energy Center has historically been monitored for groundwater constituents in compliance with the SWP. In addition, surface water sampling has been performed around each site to assess potential impacts.

CCR constituent concentrations were detected above the USEPA MCLs or background levels in groundwater monitoring wells associated with the ash ponds at all four stations. However, these detections were isolated to areas adjacent to the ash ponds and do not affect drinking water supplies. Additionally, surface water data indicate that all constituent concentrations are below Virginia Surface

Water Quality Standards (aquatic and human health) at each of the four stations. Based on the groundwater data and site-specific conditions, various potential corrective measure technologies could be implemented in conjunction with closure-in-place to address the groundwater conditions surrounding the ash ponds. Corrective measure options are discussed in detail in Technical Memorandum 7.

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2. Bremo Power Station

2.1 Location and Background

2.1.1 Facility Location

Bremo Power Station is located at 1038 Bremo Road in Bremo Bluff, Fluvanna County, VA. The station is situated on approximately 290 acres along the northern bank of the James River, separated from the river by a CSX Corporation (CSX) railroad track and easement. Bremo Road parallels the northern boundary of the station. A station map with ash pond locations and other site features is provided as Figure TM6-1.

The station property is zoned industrial, while properties surrounding the station are zoned agricultural. Land immediately adjacent to the station consists predominantly of wooded parcels and a few single-family residences. The James River parallels the southern boundary of the station; the river is used for recreational purposes.

2.1.2 Coal Combustion Residuals Background

In 2014, Bremo Power Station converted its boilers from coal-fired to natural gas-fired and decommissioned the coal and coal ash handling infrastructure. The station no longer generates CCR, but continues work toward closure of three existing CCR ash ponds (North, East, and West Ash Ponds). CCR from the East and West Ash Ponds is being consolidated into the North Ash Pond. Once the consolidation is completed, approximately 6.2 million CY of CCR will be stored in the North Ash Pond. All process water and contact stormwater from the three ash ponds is directed to the centralized source water treatment system.

The North Ash Pond is impounded by an earthen berm that is approximately 96 feet tall, and the impounded area covers approximately 68 acres. The historic boring logs indicate that most of the pond is underlain by 15 to 50 feet of native soils (predominantly clay and silt).

The East Ash Pond is impounded by an earthen berm that is approximately 24 feet tall, and the impounded area covers approximately 27 acres. Historical boring logs indicate the East Ash Pond is underlain predominantly by clay and silt alluvium (approximately 25 feet thick), with a thin gravel layer just above the bedrock surface.

The West Ash Pond is impounded by an earthen berm that is approximately 18 feet tall, and the impounded area covers approximately 22 acres. Historic boring logs indicate that the West Ash Pond is underlain by clay, silt, and sand alluvium, with a thin gravel/cobble layer present immediately above the bedrock surface.

2.2 Physical Setting

Bremo Power Station is located within the Chesapeake Bay watershed along the northern shore of the James River. Previous investigations indicated that the groundwater within and downgradient of the station is not used as drinking water, and no residential or other supply wells were identified immediately downgradient of the station (Haley & Aldrich, 2015).

In 2015, Environmental Data Resources, Inc. (EDR) prepared a Radius Map Report for the public water supply wells within a 1-mile radius of the station boundary (EDR, 2015) using the U.S. Geologic Survey's Federal Reporting Data System Public Water System and Commonwealth of Virginia data resources. The report identified two water wells within the 1-mile radius. The first water well, listed as "closed," is located near the station entrance on Bremo Road. Anecdotal accounts from Dominion personnel indicate that this well is likely a former non-potable water supply well for the Bremo Power Station that was closed in the early 1980s. The second water well is located across the James River from the station.

An active on-site water supply well is located in the central portion of the station (Golder, 2017). This well is pumped at approximately 2 gallons per minute and is used as part of the station's sanitary wastewater treatment system. Well construction information is not available; however, visual observations by Golder indicate the well is cased with 6-inch-diameter polyvinyl chloride (PVC) casing, which is expected to extend to bedrock, with an open borehole below the casing.

2.3 Geology and Hydrogeology

2.3.1 Geology

The station is located in the central part of the Piedmont Physiographic Province. As such, the geology underlying the site vicinity is dominated by relatively old and highly deformed igneous and metamorphic rock formations. The bedrock formations have been highly weathered, leaving a thick sequence (generally 50 to 100 feet) of saprolite (a term for the residual product of thorough weathering of igneous and/or metamorphic bedrock), somewhat less weathered bedrock (weathered bedrock), and finally fractured bedrock overlying the relatively unweathered/unfractured bedrock below.

The bedrock formations, including the overlying weathered materials, have been cut into valleys by multiple periods of stream erosion. Some of the older, deeper valleys became filled with sand, gravel, silts, and other alluvial deposits that were themselves cut by later streams. The result is a series of alluvial terraces adjacent to major streams. Bremo Power Station and the lower-elevation ash ponds are situated on one such terrace, and are therefore underlain by 20 to 30 feet of alluvial deposits. The alluvial deposits are overlying a layer of weathered bedrock materials that is not as thick as in the adjacent upland area.

2.3.2 Hydrogeology

The uppermost aquifer at Bremo Power Station is found in two different geologic settings, depending on the location on the property.

In the lower, terrace areas of the site occupied by the plant and the East Ash Pond, the uppermost aquifer is generally found in a gravelly zone near the base of the terrace deposits (described above) at depths of 20 to 30 feet below ground surface (bgs). Groundwater flow in this aquifer generally follows the topographic slope, flowing from northeast to southwest.

In the upland area where the North Ash Pond is located, the uppermost aquifer is represented by the porosity and permeability found in the saprolite/weathered rock/fractured rock sequence above competent bedrock. As noted above, this sequence may extend to depths of 50 to 100 feet bgs. Groundwater flow in this aquifer tends to roughly mimic the topography of the pre-construction ground surface, flowing in a downhill direction because of the dynamic of flow from upland recharge areas to lowland discharge. In the North Ash Pond area, this direction is generally to the southwest with local deviation depending on the influence of localized topographic relief. A groundwater potentiometric surface map for the bedrock aquifer in the vicinity of the North Ash Pond is included as Figure TM6-2.

Slug test data from 2012, 2016, and 2017 have characterized the hydraulic conductivity of the uppermost aquifer at the North Ash Pond as approximately 7.37E-05 cm/s to 2.23E-04 cm/s. The effective porosity of the aquifer has not been measured on site but is expected to be on the order of 2.5% based on the characteristics of similar tested materials (Fetter, 1998). Recent groundwater contours for the North Ash Pond monitoring network suggest a generalized hydraulic gradient of 0.039 ft/ft. Based on these values, the estimated horizontal rate of groundwater flow in the uppermost aquifer at the North Ash Pond is expected to average approximately 119.0 ft/year to 359.9 ft/year.

Downward vertical hydraulic gradients have been observed at the MW-27S/MW-27D and OW-32S/OW-32D well pairs, while upward vertical hydraulic gradients have been observed at the MW-29S/MW-29D, MW-26S/OW-26D, MW-25S/OW-25D, and MW-20S/MW-20D well pairs. These observed vertical gradients suggest downward groundwater flow in the upland recharge areas and upward groundwater flow within the James River floodplain, where deeper bedrock groundwater recharges the overlying alluvial materials.

2.4 Groundwater and Surface Water Evaluations

2.4.1 Groundwater Monitoring Programs

The Bremo Power Station is currently under two separate compliance monitoring programs, the VPDES permit program and the CCR Rule program. The North, East, and West Ash Ponds have historically been regulated under the VPDES program, and the station has been monitoring groundwater in accordance with the VPDES permit. In late 2012, the VPDES monitoring program was expanded with the installation of 13 monitoring wells. Sampling was conducted on a quarterly basis from March 2013 to October 2014 to collect a minimum of eight samples per well to evaluate background water quality. Since this background monitoring period, sampling has been conducted annually, and a report is submitted to DEQ annually. As part of the VPDES compliance monitoring program, the monitoring wells are sampled for the analytes and parameters listed in Table TM6-3.

Table TM6-3: Bremo Power Station VPDES Monitoring Constituents

Dissolved Metals			Water Quality Parameters		Field Measurements	
• Arsenic • Barium • Cadmium • Chromium • Hexavalent chromium	• Copper • Iron • Lead • Manganese • Mercury	• Molybdenum • Selenium • Silver • Vanadium • Zinc	• Ammonia • Chloride • Nitrate • Sulfate	• Total Dissolved Solids • Total Hardness	• Conductivity • Turbidity • Groundwater elevation	• pH • Temperature • Sample time

CCR Rule compliance monitoring for the North Ash Pond has been underway since October 2016. Modifications have been made to the standard CCR Rule sampling protocol to comply with anticipated VSWMR and DEQ requirements. This sampling will be conducted semi-annually after completion of the eight background sampling events (completed in October 2017). CCR reports will be submitted annually, and VSWMR reports will be submitted semi-annually upon permit issuance. At this time, there are 12 wells monitoring the North Ash Pond as shown in Table TM6-4 (refer to Figure TM6-2 for well locations).

Table TM6-4: Bremo Power Station North Ash Pond CCR Monitoring Well Network

Background CCR Compliance Monitoring Wells	Downgradient CCR Compliance Monitoring Wells	Downgradient VSWMR Sentinel Wells
MW-11	MW-24	MW-25S
MW-29S	MW-27D	MW-26S
MW-29D	MW-33	MW-27S
	MW-34	MW-28
	MW-35	

The CCR monitoring networks for the East and West Ash Ponds were installed in September 2017. Monitoring at these ponds will be completed according to CCR Rule timelines for inactive ponds. Because CCR material is being removed from the East and West Ash Ponds, the groundwater evaluations were not as detailed as for the North Pond.

For the CCR baseline monitoring period, the monitoring wells were sampled for CCR detection and assessment monitoring constituents, along with VSWMR assessment constituents. The metals constituents for the CCR baseline monitoring were analyzed as total metals, as opposed to the VPDES program, which monitors dissolved metals.

2.4.2 Groundwater Quality

Several VPDES groundwater sampling parameters were detected at concentrations greater than station background, and arsenic has been detected greater than the MCL downgradient of the East Ash Pond (URS, 2015). Based on the results of the background sampling, a CAP was submitted to DEQ on April 14, 2015 (Dominion Generation, 2015). The CAP included plans for an East Ash Pond assessment and for corrective measures for all three ash ponds at the station (in conformance with the CCR Rule).

In accordance with the CAP, Haley & Aldrich completed the additional arsenic site characterization activities downgradient of the closed East Ash Pond in 2015, which included sampling of existing wells, installation of a new shallow monitoring well and two new deep monitoring wells downgradient of the East Ash Pond, a surface water investigation, and risk characterization. The risk characterization concluded that constituents detected downgradient of the East Ash Pond do not pose risks in excess of regulatory levels to human health or the environment (Haley & Aldrich, 2015). In addition, Haley & Aldrich determined that several previously sampled wells were screened in CCR and therefore not suitable for downgradient monitoring requirements at the East Ash Pond.

Groundwater analytical results for CCR wells are summarized in Table TM6-5 located at the end of Section 2. The CCR baseline data set includes eight monitoring events dating back to October 2016. For the purposes of this discussion, a preliminary background value has been calculated from background data for each constituent.

The quantitative evaluation provided below summarizes groundwater quality using CCR compliance data (as opposed to the VPDES dataset) for the following reasons:

- CCR groundwater data are analyzed for total metals, which is a more conservative measure of constituent concentrations than the dissolved metals analysis used for VPDES data.
- The CCR groundwater data set is more representative of current conditions.
- Many of the VPDES network wells were installed during early investigations of site conditions and not for the explicit function of monitoring ash pond impacts to groundwater. The monitoring well network used for the CCR compliance sampling was designed and constructed to meet the requirements of the CCR Rule.

The data provided in Table TM6-5 show that chloride, a detection monitoring constituent, has been detected at levels consistent with preliminary background. Detection monitoring constituents have been observed in downgradient wells above preliminary background. If these detections are validated during future events, the CCR Rule will direct the North Ash Pond into assessment monitoring.

All constituents are below MCLs; however, several CCR assessment monitoring constituents have been detected above preliminary background levels. If these detections are validated during future sampling events, the CCR Rule will direct the North Ash Pond into corrective measures. Two VSWMR constituents (nickel and silver) have been detected in downgradient wells at concentrations above background levels.

As discussed in Section 2.2, historical investigations indicate there are no water supply wells immediately downgradient of the North Ash Pond or the station.

2.4.3 Surface Water Monitoring

Nine surface water sampling events were conducted along the James River between April 2016 and March 2017. These events included two upstream locations and two downstream locations. One of the samples for the first event (April 26, 2016), was planned approximately 900 feet upstream of the James Madison Highway Bridge crossing the James River. Due to access and safety issues, this location was relocated approximately 1.7 miles upstream for each subsequent event. Surface water sampling locations are shown on Figure TM6-3.

2.4.4 Surface Water Quality

Samples were analyzed for field parameters and metals constituents. As summarized in Table TM6-6 at the end of Section 2, laboratory-analyzed constituents were all below applicable Virginia Surface Water Quality Standards for aquatic life and human health.

2.5 Summary of Findings

The Bremo Power Station, located in Bremo Bluff, VA, converted its boilers from coal-fired to natural gas-fired in 2014. The station no longer generates CCR, but continues to work toward closure of three existing CCR ash ponds (North Ash Pond, East Ash Pond, and West Ash Pond). CCR materials from the East and West Ash Ponds are being consolidated into the North Ash Pond. Due to the inactive status of the East and West Ash Ponds and in accordance with the CCR Rule, groundwater assessment activities at these ponds are subject to later deadlines, so baseline monitoring activities will be completed in 2018. As a result, the evaluation is limited primarily to conditions at the North Ash Pond.

The North Ash Pond is situated in a former stream valley and is underlain by saprolite, weathered bedrock, and fractured bedrock. The uppermost aquifer at the North Ash Pond is represented by the porosity and permeability found in the saprolite/weathered rock/fractured rock sequence above competent bedrock. Groundwater flow within the uppermost aquifer near the North Ash Pond generally mimics surface topography, traversing the site in a northeast to southwest direction.

Historic VPDES monitoring indicated several parameters at concentrations greater than station background and limited detections of arsenic above the MCL. However, a subsequent risk assessment concluded that constituents detected downgradient of the East Ash Pond did not pose risks in excess of regulatory levels to human health or the environment.

CCR groundwater sampling has demonstrated that there are detections above background levels of several detection and assessment monitoring constituents downgradient of the North Ash Pond. However, no constituents have been detected above an MCL during the CCR groundwater sampling program.

Samples were collected from the James River upstream and downstream of the station between April 2016 and March 2017 and compared to Virginia Surface Water Quality Standards for aquatic life and human health. Concentrations of monitored constituents were below laboratory detection limits and/or the applicable surface water standards.

Tables

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Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-11 (Background)							
			10/27/2016	12/6/2016	1/18/2017	2/28/2017	4/10/2017	5/11/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.303	0.0129J	0.0150B	<0.250	0.0144J	<0.250	0.0060J	<0.0500	<0.0500
Calcium	---	58.9	22.8	20.9	23.7	20.7	17.8	19.1	19.4	20.5
Chloride	---	60.3	8.3	7.3	8.5	8.1	8.0	8.2	8.8	8.2
Fluoride	NA	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.44-8.32	5.13	5.12	5.21	4.93	4.49	5.03	5.36	5.64
Sulfate	---	179	6.5	7.0	7.1	7.1	6.1	7.4	8.2	6.6
TDS	---	570	148	360	127	134	150	132	148	129
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0036	0.0036	0.0030J	0.0031	0.0030	0.0032	0.0021J	0.0031
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0012J+
Cobalt	---	0.0070	0.00089J	0.0026	0.0013	0.00088J	0.00042J	0.00066J	0.00038J	0.00022J
Fluoride	4.0	---	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0010J	0.0035B	<0.0250	<0.0250	<0.0250	0.0039J+	<0.0250	0.00079J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<2.49	<0.983	<1.26	<1.94	<0.932	<1.24	<2.01	<1.69
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	<0.0050	0.0055	0.0024J	0.0032J	<0.0050	0.0023J	<0.0050	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tin	---	0.0128	<0.0050	0.0080J	0.0032B	<0.0050	<0.0050	0.0010J+	<0.0050	<0.0050
Vanadium	---	0.0225	0.0121	0.0225	0.015	0.0128	0.0107	0.0117	0.0104	0.0091
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-29S (Background)							
			10/27/2016	12/6/2016	1/18/2017	2/28/2017	4/10/2017	5/11/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.303	0.0162J	<0.250	<0.250	<0.250	0.0095J	0.0367J+	<0.0500	<0.0500
Calcium	---	58.9	15.5	11.1	19.8	19.5	20.1	20.9	23.6	20.8
Chloride	---	60.3	7.8	11.8	24.3	30.0	31.8	38.9	44.0	42.4
Fluoride	NA	0.1	0.064J	0.034J	0.041J	0.040J	0.025J	<0.10	<0.10	<0.10
pH (std units)	---	3.44-8.32	6.26	5.49	5.70	5.56	5.64	5.64	5.73	5.82
Sulfate	---	179	35.2	13.5	24.2	28.1	29.7	35.0	40.3	37.2
TDS	---	570	199	142	161	194	209	200	220	211
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0540	0.0269	0.0443	0.0456	0.0424	0.0473	0.0510	0.0458
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.0010	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	0.0017J	<0.0050	<0.0050	0.0012J	0.0019J+	<0.0050	<0.0050	0.0013J
Cobalt	---	0.0070	0.0065	0.0043	0.0054	0.0043	0.0034	0.0031	0.0027	0.0020
Fluoride	4.0	---	0.064J	0.034J	0.041J	0.040J	0.025J	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0023J	<0.0250	<0.0250	0.00086B	<0.0250	0.0023J	0.0012J	0.0013J
Mercury	0.002	---	<0.00020	0.00010J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	0.0076	0.0020J	0.0017J	0.0013J	0.0014J	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<2.19	<1.81	<1.21	<2.00	<0.847	<0.990	<1.93	<0.969
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00026J	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	0.0069	<0.0050	<0.0050	0.0032J	<0.0050	0.0015J	<0.0050	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	0.0045J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tin	---	0.0128	<0.0050	0.0012J	0.0026B	<0.0050	<0.0050	0.0018J+	<0.0050	<0.0050
Vanadium	---	0.0225	0.0064	<0.0050	<0.0050	0.00085J	0.00088J	0.00086J	<0.0050	<0.0050
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-29D (Background)							
			10/27/2016	12/6/2016	1/18/2017	2/28/2017	4/10/2017	5/11/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.303	0.0256J	0.0649J	0.0607J	0.0338J	0.0517J+	0.0458J+	0.0372J	0.0294J
Calcium	---	58.9	41.3	56.0	51.4	48.0	49.3	52.3	58.9	57.8
Chloride	---	60.3	32.9	40.1	44.4	44.3	27.1	58.3	60.3	59.8
Fluoride	NA	0.1	0.067J	0.075J	0.090J	0.034J	0.10	0.10	0.10	<0.10
pH (std units)	---	3.44-8.32	6.52	6.82	6.48	6.87	6.98	6.78	6.91	6.98
Sulfate	---	179	64.2	169	179	152	134	128	138	118
TDS	---	570	179	540	518	544	549	525	570	542
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	0.0013J	0.0012J	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	0.0012	0.00099J	0.0013	0.0038	0.0024	0.0030	0.0032
Barium	2	---	0.0335	0.0457	0.0413	0.0342	0.0283	0.0359	0.0356	0.0347
Beryllium	0.004	---	<0.0010	0.00035J	0.00021J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00098	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	0.0012J	<0.0050	<0.0050	0.0011J+	<0.0050	<0.0050
Cobalt	---	0.0070	0.0014	0.0015	0.0016	0.0011	0.00024J	0.00099J	0.00086J	0.00079J
Fluoride	4.0	---	0.067J	0.075J	0.090J	0.034J	0.10	0.10	0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0028J	0.0076B	0.0052J	0.0029J	<0.0250	0.0042J	0.0037J	0.003J
Mercury	0.002	---	<0.00020	0.00014J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	0.0461	0.0157	0.0164	0.0128	0.0035J	0.0055	0.0038J	0.0033J
Radium 226/228 (pCi/L)	5	---	<2.28	<2.27	<1.47	<3.48	1.28	<1.34	<1.51	<0.736
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	0.00032J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	0.0112	0.0014J	<0.0050	0.0027J	<0.0050	0.0023J	<0.0050	<0.0050
Nickel	---	0.0079	0.0079	0.0064	0.0065	0.0047J	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	0.0018J	<0.0050	0.0015J	<0.0050	<0.0050
Tin	---	0.0128	0.00085J	0.0019J	0.0128	0.0025J	<0.0050	0.0030J	0.0012J	0.0010J
Vanadium	---	0.0225	0.0026J	<0.0050	0.00096J	0.00099J	0.0012J	0.00086J	<0.0050	<0.0050
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-24 (Downgradient CCR Well)							
			10/27/2016	12/6/2016	1/18/2017	2/28/2017	4/11/2017	5/11/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.303	0.130J	0.141J	0.127J	0.115J	0.112J	0.159J+	0.162	0.173
Calcium	---	58.9	37.7	40.7	48.3	44.8	46.9	46.0	38.9	46.6
Chloride	---	60.3	7.5	21.9	30.2	39.3	47.9	32.1	28.7	27.0
Fluoride	NA	0.1	0.090J	0.10	0.091J	0.040J	0.099J	0.053J	0.053J	<0.10
pH (std units)	---	3.44-8.32	7.64	7.06	7.31	7.12	7.07	7.19	7.21	7.28
Sulfate	---	179	26.3	36.0	36.0	41.2	46.3	27.1	25.2	24.6
TDS	---	570	176	224	247	277	320	275	252	254
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	0.00080J	0.00079J	0.00075J	0.00062J	0.00065J	0.00075J	0.00076J
Barium	2	---	0.0284	0.0364	0.0477	0.0465	0.0455	0.0475	0.0390	0.0484
Beryllium	0.004	---	<0.0010	0.00022J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0041J+	<0.0050	<0.0050
Cobalt	---	0.0070	0.0018	0.0012	0.00060J	0.00055J	0.00069J	0.00067J	0.00071J	0.0010
Fluoride	4.0	---	0.090J	0.10	0.091J	0.040J	0.099J	0.053J	0.053J	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0026J	0.0048B	0.0037J	0.0025J	<0.0250	0.0030J+	0.0011J	<0.0250
Mercury	0.002	---	<0.00020	0.00011J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	0.0141	0.0228	0.0409	0.0341	0.0220	0.0299	0.0231	0.0264
Radium 226/228 (pCi/L)	5	---	<1.90	<1.61	<1.86	2.24	<1.61	<1.20	<1.17	<1.35
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	<0.0050	<0.0050	0.0030J	0.0033J	<0.0050	0.0028J+	<0.0050	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0016J	<0.0050	<0.0050
Tin	---	0.0128	<0.0050	0.0021J	0.0034B	0.00095J	<0.0050	<0.0050	<0.0050	0.00076J
Vanadium	---	0.0225	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-25S (Downgradient Sentinel Well)						
			12/6/2016	1/18/2017	3/2/2017	4/11/2017	5/11/2017	6/20/2017	7/24/2017
CCR Detection Constituents									
Boron	---	0.303	<0.250	0.0112B	0.0278J	0.0431J+	0.0473J+	0.0320J	<0.0500
Calcium	---	58.9	29.2	53.7	52.3	50.7	52.0	3.94	48.0
Chloride	---	60.3	10.1	17.0	18.1	16.4	16.7	16.4	13.0
Fluoride	NA	0.1	0.060J	0.074J	0.063J	0.067J	0.094J	0.087J	<0.10
pH (std units)	---	3.44-8.32	7.08	6.63	6.50	6.61	6.52	6.54	6.66
Sulfate	---	179	50.0	111	116	95.2	101	90.2	71.7
TDS	---	570	245	376	433	388	394	364	343
CCR Assessment Constituents									
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Arsenic	0.010	---	<0.0010	0.00064J	0.00070J	0.00096J	0.00064J	<0.00010	<0.0010
Barium	2	---	0.0208	0.0424	0.0379	0.0424	0.0449	0.0035	0.0435
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	0.00028J	<0.0010	<0.00010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.000080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Cobalt	---	0.0070	0.0070	0.0054	0.0022	0.0019	0.0016	0.00012	0.00095J
Fluoride	4.0	---	0.060J	0.074J	0.063J	0.067J	0.094J	0.087J	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.0010
Lithium	---	0.025	<0.0250	<0.0250	0.0015J	<0.0250	0.0019J+	<0.0025	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	0.0039J	0.0057	0.0049J	0.0051	0.0050J	0.00034J	0.0050J
Radium 226/228 (pCi/L)	5	---	<1.51	<1.63	<2.58	<1.35	<1.05	<2.10	<1.84
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	0.00028J	<0.0010	<0.00010	<0.0010
Pertinent VSWMR Phase II Constituents									
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	0.0033J+	<0.00050	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Tin	---	0.0128	0.0015J	0.0012B	0.00075J	<0.0050	0.0010J+	<0.00050	<0.0050
Vanadium	---	0.0225	<0.0050	<0.0050	<0.0050	0.0010J	<0.0050	<0.00050	<0.0050
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0050	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-26S (Downgradient Sentinel Well)							
			10/27/2016	12/6/2016	1/18/2017	3/1/2017	4/10/2017	5/11/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.303	0.0269J	<0.250	<0.250	<0.250	0.0058J	0.0100J	<0.0500	<0.0500
Calcium	---	58.9	39.2	14.2	16.3	12.6	14.9	14.2	14.2	14.6
Chloride	---	60.3	5.0	3.1	3.8	3.2	3.3	3.2	3.3	2.7
Fluoride	NA	0.1	0.020J	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.44-8.32	5.56	5.59	5.26	5.56	5.51	5.65	5.81	5.85
Sulfate	---	179	17.7	9.7	10.3	8.6	11.6	12.9	13.8	11.6
TDS	---	570	147	130	114	121	147	124	116	125
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.108	0.0408	0.0456	0.0345	0.0405	0.0432	0.0372	0.0390
Beryllium	0.004	---	<0.0010	0.00031J	<0.0010	<0.0010	0.00026J	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0021J+	<0.0050	<0.0050
Cobalt	---	0.0070	0.0021	0.0013	0.00076J	0.00024J	0.00040J	0.00038J	0.00026J	<0.0010
Fluoride	4.0	---	0.020J	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0051J	0.0020B	0.00080J	0.0019J	<0.0250	0.0024J	0.0018J	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	0.0013J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.79	<1.54	<1.65	<1.88	<1.25	<1.31	<1.43	<0.900
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	0.00043J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0019J+	<0.0050	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tin	---	0.0128	<0.0050	0.0045J	<0.0050	<0.0050	<0.0050	0.0019J+	<0.0050	<0.0050
Vanadium	---	0.0225	0.0011J	<0.0050	<0.0050	<0.0050	0.0012J	0.00085J	<0.0050	<0.0050
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-27S (Downgradient Sentinel Well)							
			10/27/2016	12/7/2016	1/19/2017	3/1/2017	4/10/2017	5/11/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.303	**1.57**	**1.32**	**1.70**	**1.51**	**1.60**	**1.68**	**1.74**	**1.67**
Calcium	---	58.9	**116**	**98.3**	**121**	**110**	**120**	**109**	**105**	**70.6**
Chloride	---	60.3	13.2	12.2	13.8	13.6	13.8	13.8	14.6	13.2
Fluoride	NA	0.1	0.030J	0.042J	0.057J	0.031J	0.039J	0.063J	<0.10	<0.10
pH (std units)	---	3.44-8.32	6.41	6.46	5.91	6.21	6.14	6.25	6.35	7.06
Sulfate	---	179	**194**	**181**	**199**	178	**187**	155	172	156
TDS	---	570	**632**	**624**	**644**	**644**	**651**	552	**605**	**582**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.119	0.0952	0.106	0.0924	0.0942	0.0949	0.0916	0.0675
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cobalt	---	0.0070	0.0020	0.00099J	0.00062J	0.00050J	0.00050J	0.00030J	0.00036J	0.00027J
Fluoride	4.0	---	0.030J	0.042J	0.057J	0.031J	0.039J	0.063J	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0070J	0.0051B	0.0073J	0.0064J	<0.0250	0.0086J+	0.0053J	0.0039J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	0.0016J	0.0012J	0.0013J	0.0012J	0.0014J	0.0012J	0.0011J	<0.0050
Radium 226/228 (pCi/L)	5	---	<2.22	<1.64	<1.42	<2.32	1.18	<1.44	<1.64	<1.80
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	0.0012J+	0.0013J+	<0.0050	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**0.0051**	<0.0050
Tin	---	0.0128	<0.0050	0.0016J	0.0032B	<0.0050	<0.0050	0.0014J+	<0.0050	<0.0050
Vanadium	---	0.0225	0.0020J	0.00070J	0.0019J	0.0012J	0.0068	0.0025J	0.0022J	0.0015J
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-27D (Downgradient CCR Well)							
			11/1/2016	12/7/2016	1/19/2017	3/1/2017	4/10/2017	5/11/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.303	0.0827J	0.0924J	0.136J	0.158J	0.196J+	0.272J+	**0.499**	**0.519**
Calcium	---	58.9	39.3	49.9	**60.2**	48.1	45.8	46.2	48.0	41.9
Chloride	---	60.3	18.9	16.2	14.8	12.8	12.4	12.1	13.0	11.9
Fluoride	NA	0.1	**0.15**	**0.20**	**0.17**	0.10	**0.16**	**0.19**	**0.18**	0.10
pH (std units)	---	3.44-8.32	7.16	7.26	6.52	6.68	6.34	6.55	6.52	7.51
Sulfate	---	179	**694**	**870**	**808**	**654**	**698**	**572**	**554**	**480**
TDS	---	570	**1150**	**1550**	**1380**	**1200**	**1310**	**1160**	**1220**	**1090**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.00089J	0.0011	0.0011	0.00077J	0.00099J	0.00089J	0.00067J	0.00062J
Barium	2	---	0.0885	0.0730	0.0977	0.0745	0.0648	0.0626	0.0551	0.0502
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.000080	<0.00080
Chromium	0.1	---	0.0062	0.0016J	<0.0050	0.0011J	<0.0050	0.0016J	<0.0050	0.0010J
Cobalt	---	0.0070	0.00076J	0.00012J	0.00010J	0.00015J	0.00010J	0.00014J	0.00013J	<0.0050
Fluoride	4.0	---	0.15	0.20	0.17	0.10	0.16	0.19	0.18	0.10
Lead	---	0.001	**0.0015**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0086J	**0.0880**	**0.0940**	**0.0859**	**0.0762**	**0.0957J+**	**0.0833**	**0.0662**
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	**0.161**	**0.0840**	**0.0729**	**0.0506**	0.0392	0.0384	0.0297	0.0257
Radium 226/228 (pCi/L)	5	---	<2.13	<1.84	<1.41	<1.38	1.07	<1.43	<1.67	<1.57
Selenium	0.05	---	<0.0050	0.0040J	<0.0050	<0.0050	<0.0050	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	0.0096	0.0030J	0.0035J	<0.0050	0.0033J	0.0050J	<0.0050	<0.0050
Nickel	---	0.0079	**0.0096**	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	**0.0078**	0.0020J	<0.0050	0.00096J	0.0015J	0.0030J	<0.0050	<0.0050
Tin	---	0.0128	0.0017J	0.0020J	0.0035B	<0.0050	<0.0050	0.0024J+	0.00076J	<0.0050
Vanadium	---	0.0225	0.0035J	0.0012J	0.00083J	0.00081J	0.00072J	0.0011J	<0.0050	<0.0050
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-28 (Downgradient Sentinel Well)							
			10/27/2016	**12/7/2016**	**1/19/2017**	**3/2/2017**	**4/10/2017**	**5/11/2017**	**6/19/2017**	**7/24/2017**
CCR Detection Constituents										
Boron	---	0.303	**2.20**	**0.84**	**1.10**	**1.09**	**1.09**	**1.11**	**1.11**	**1.09**
Calcium	---	58.9	**199**	**84.9**	**109**	**109**	**115**	**105**	**106**	**100**
Chloride	---	60.3	14.5	13.0	14.4	13.9	13.6	13.8	14.4	13.4
Fluoride	NA	0.1	0.022J	0.021J	0.034J	<0.10	0.051J	<0.10	<0.10	<0.10
pH (std units)	---	3.44-8.32	5.66	5.90	5.95	6.05	5.54	5.90	6.00	6.50
Sulfate	---	179	**255**	**228**	**245**	**228**	**252**	**213**	**221**	**200**
TDS	---	570	**603**	**621**	**638**	**611**	**820**	508	**635**	**606**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.161	0.0700	0.0866	0.0830	0.0952	0.0870	0.0803	0.0791
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0013J+	<0.0050	0.0015J+
Cobalt	---	0.0070	0.0042	0.0010	0.00043J	0.00046J	0.00044J	0.00045J	0.00027J	0.00026J
Fluoride	4.0	---	0.022J	0.021J	0.034J	<0.10	0.051J	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0057J	0.00098B	0.00097J	0.0019J	<0.0250	0.0038J	0.0018J	0.0022J
Mercury	0.002	---	<0.00020	0.00013J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<2.06	<1.48	<1.32	<2.08	<1.67	<1.22	<1.59	<1.44
Selenium	0.05	---	0.0062	0.0046J	0.0048J	0.0042J	0.0054	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0015J+	<0.0050	<0.0050
Nickel	---	0.0079	**0.0200**	**0.0083**	**0.0150**	**0.0136**	**0.0132**	**0.0108**	**0.0125**	**0.0095**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tin	---	0.0128	<0.0050	0.0016J	<0.0050	<0.0050	0.0104J+	0.0015J+	<0.0050	<0.0050
Vanadium	---	0.0225	0.0035J	<0.0050	0.0016J	0.0020J	0.0025J	0.0022J	0.0020J	0.0019J
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-33 (Downgradient CCR Well)							
			10/27/2016	12/7/2016	1/19/2017	3/1/2017	4/10/2017	5/12/2017	6/20/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.303	**0.467**	**0.319**	**0.344**	0.260	0.253	0.233J	0.231	0.215
Calcium	---	58.9	**103**	58.6	**80.5**	**66.9**	**77.3**	**69.6**	**84.2**	**72.7**
Chloride	---	60.3	11.8	21.1	23.4	22.9	19.9	23.1	24.3	21.5
Fluoride	NA	0.1	0.077J	0.078J	0.095J	0.063J	0.076J	0.083J	0.068J	<0.10
pH (std units)	---	3.44-8.32	7.30	6.58	6.29	6.24	6.37	6.24	6.41	6.96
Sulfate	---	179	41.1	53.3	54.6	51.3	47.0	50.9	52.1	47.0
TDS	---	570	270	302	325	340	374	360	333	328
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	0.0014J	0.0013J	0.0012J	<0.0050	<0.0050	0.0011J	<0.0050
Arsenic	0.010	---	0.00073J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0696	0.0364	0.0472	0.0358	0.0420	0.0326	0.0340	0.0272
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	0.00028J	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0011J+	0.0028J+	<0.0050
Cobalt	---	0.0070	0.00030J	<0.0010	<0.0010	<0.0010	<0.0010	0.00013J	0.00015J	<0.0010
Fluoride	4.0	---	0.077J	0.078J	0.095J	0.063J	0.076J	0.083J	0.068J	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0071J	0.0048B	0.0030J	0.0034J	<0.0250	0.0038J	0.0021J	0.0019J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	0.0220	0.0131	0.0149	0.0105	0.0098	0.0079	0.0085	0.0071
Radium 226/228 (pCi/L)	5	---	<2.09	<1.78	<1.49	<1.46	<1.89	<1.28	<1.68	<1.57
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	0.0015JB	<0.0050	<0.0050	<0.0050	0.0024J+	0.0036J+	0.0023J	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	0.00097J	<0.0050	<0.0050	<0.0050	<0.0050
Tin	---	0.0128	0.00091J	0.0022J	0.0038B	0.0026J	<0.0050	0.0016J+	<0.0050	0.0012J
Vanadium	---	0.0225	0.0027J	0.00089J	0.0014J	0.0011J	0.0017J	0.0011J	0.0019J	0.0016J
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	0.0275J	0.0328J	0.0261J

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-34 (Downgradient CCR Well)							
			10/27/2016	12/7/2016	1/18/2017	2/28/2017	4/11/2017	5/12/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.303	**1.23**	**1.21**	**1.16**	**1.11**	**1.15**	**1.16**	**1.18**	**1.17**
Calcium	---	58.9	37.5	36.4	37.4	36.8	37.0	36.7	35.6	39.8
Chloride	---	60.3	16.1	14.0	14.9	13.9	13.8	13.8	14.2	13.1
Fluoride	NA	0.1	0.055J	0.055J	0.070J	0.049J	0.079J	0.077J	0.064J	<0.10
pH (std units)	---	3.44-8.32	5.80	5.91	6.03	5.90	6.04	5.94	6.03	7.16
Sulfate	---	179	31.7	30.0	31.4	29.5	29.8	29.3	30.7	28.2
TDS	---	570	226	226	192	284	240	239	227	234
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0666	0.0466	0.0436	0.0436	0.0412	0.0470	0.0412	0.0468
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0014J+	<0.0050	<0.0050
Cobalt	---	0.0070	0.00026J	<0.0010	<0.0010	0.0015J	<0.0010	<0.0010	<0.0010	<0.0010
Fluoride	4.0	---	0.055J	0.055J	0.070J	0.049J	0.079J	0.077J	0.064J	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0079J	0.099J	0.067J	0.077J	0.0081J+	0.0081J+	0.0064J	0.0069J
Mercury	0.002	---	0.00050	0.00053	0.00052	0.00045	<0.00020	0.00034	0.00038	0.00023
Molybdenum	---	0.0461	0.0019J	0.0042J	0.0021J	0.0019J	0.0012J	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<1.98	<1.57	<1.73	<2.96	<1.85	<0.802	<1.83	<1.24
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	0.0019B	<0.0050	<0.0050	<0.0050	<0.0050	0.0032J+	<0.0050	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	0.0022J	<0.0050	<0.0050	<0.0050
Tin	---	0.0128	<0.0050	0.00080J	<0.0050	0.0011J	0.00070J+	<0.0050	<0.0050	<0.0050
Vanadium	---	0.0225	0.0024J	0.0012J	0.00078J	<0.0050	<0.0050	0.00092J	0.00077J	0.00095J
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-5
CCR Compliance Data
North Ash Pond - Bremo Power Station

Parameter	MCL	Preliminary Background	MW-35 (Downgradient CCR Well)							
			10/27/2016	12/6/2016	1/18/2017	2/28/2017	4/11/2017	5/11/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.303	**0.528**	**0.322**	**0.265**	0.263	0.273	0.287	0.298	0.296
Calcium	---	58.9	**83.4**	54.7	56.6	53.8	55.5	54.0	58.2	**61.0**
Chloride	---	60.3	11.0	9.9	11.1	10.6	10.5	10.4	10.9	9.9
Fluoride	NA	0.1	0.050J	0.030J	0.035J	0.041J	0.061J	0.057J	<0.10	<0.10
pH (std units)	---	3.44-8.32	8.04	7.30	7.53	7.22	7.33	7.17	7.13	7.10
Sulfate	---	179	31.8	19.1	21.6	20.8	24.1	26.6	30.4	28.3
TDS	---	570	246	267	237	284	287	289	281	291
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.0012	0.0010	0.00072J	0.00074J	0.00085J	0.00067J	0.0011	0.0010
Barium	2	---	0.128	0.112	0.111	0.101	0.118	0.140	0.169	0.150
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	0.00021J	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	0.0013J	<0.0050	0.0018J+	0.0139J+	0.0013J
Cobalt	---	0.0070	0.00010J	0.00014J	<0.0010	<0.0010	0.00010J	0.00022J	0.00048J	0.00024J
Fluoride	4.0	---	0.050J	0.030J	0.035J	0.041J	0.061J	0.057J	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	**0.0571**	0.0218J	0.0187J	0.0221J	0.0189J	0.0249J	0.0239J	0.0202J
Mercury	0.002	---	<0.00020	0.00010J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0461	**0.0472**	0.010	0.0068	0.0048J	0.0046J	0.0042J	0.0040J	0.0037J
Radium 226/228 (pCi/L)	5	---	<1.75	1.59	<1.71	<2.91	1.86	<1.73	2.36	2.78
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	0.00028J	<0.0010	0.00038J	<0.0010
Pertinent VSWMR Phase II Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	0.0018J	<0.0050	0.0029J+	0.0016J	<0.0050
Nickel	---	0.0079	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tin	---	0.0128	<0.0050	0.00096J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Vanadium	---	0.0225	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration.
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				April 26, 2016 - Baseline				
	Aquatic Life		Human Health		Upstream			Downstream	
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	DUP-01 (BPS-UPS02)	BPS-DWS01	BPS-DWS02
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.071 J, B	ND	0.046 J, B	0.035 J, B	0.11 J, B
Arsenic	340	150	10	--	1.2	0.90 J	1.3	0.98 J	1.2
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	1.0 J	0.66 J	1.1 J	0.67 J	0.92 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.4 J	1.8 J	1.7 J	2.3	2.3
Lead[1]	120	14	15	--	0.14 J	0.17 J	0.20 J	0.15 J	0.20 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	0.90 J	0.79 J	0.90 J	0.81 J	0.97 J
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	3.6 J	4.0 J	4.8 J	6.1	4.5 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.

[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				May 16, 2016				
	Aquatic Life		Human Health		Upstream		Downstream		
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	BPS-DWS01	BPS-DWS02	DUP-01 (BPS-DWS01)
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.12 J	0.054 J	0.036 J	0.049 J	0.082 J
Arsenic	340	150	10	--	1.1	0.63 J	0.50 J	0.72 J	0.64 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	2.3	0.98 J	0.55 J	1.1 J	0.83 J
Chromium III[1]	570	74	--	--	2.3 J	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	2.5	1.3 J	1.5 J	1.0 J	1.5 J
Lead[1]	120	14	15	--	1.9	0.57 J	0.65 J	0.69 J	0.76 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	1.8	0.72 J	0.58 J	0.55 J	0.56 J
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	0.022 J	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	9.9	3.1 J	2.8 J	2.6 J	2.6 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio
[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.
[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.
NS = Not sampled
ND = Not detected at the reporting limit
J = Result is less than the reporting limit but greater or equal to the minimum detection limit
B = Compound was found in the blank and the sample

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				June 11, 2016				
	Aquatic Life		Human Health		Upstream		Downstream		
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	BPS-DWS01	BPS-DWS02	DUP-01 (BPS-DWS02)
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.094 J	0.094 J	0.17 J	0.15 J	0.12 J
Arsenic	340	150	10	--	0.45 J	0.39 J	0.41 J	0.43 J	0.43 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	ND	ND	ND	ND	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	0.95 J	0.69 J	0.95 J	1.4 J	0.92 J
Lead[1]	120	14	15	--	0.33 J	0.25 J	0.28 J	0.31 J	0.31 J
Mercury[1]	1.4	0.77	--	--	0.091 J, B	ND	0.14 J, B	0.12 J, B	0.15 J, B
Nickel[1]	180	20	610	4,600	0.68 J	0.51 J	0.57 J	0.73 J	0.60 J
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	2.1 J	1.2 J	1.5 J	3.3 J	1.8 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.

[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				June 13, 2016				
	Aquatic Life		Human Health		Upstream			Downstream	
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	DUP-01 (BPS-UPS01)	BPS-DWS01	BPS-DWS02
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.12 J	0.090 J	0.093 J	0.16 J	0.079 J
Arsenic	340	150	10	--	0.49 J	0.53 J	0.50 J	1.0	0.62 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	ND	0.38 J	ND	0.46 J	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	0.0031 J	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.1 J	1.1 J	1.1 J	2.8	1.5 J
Lead[1]	120	14	15	--	0.32 J	0.33 J	0.29 J	0.37 J	0.27 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	0.065 J	ND
Nickel[1]	180	20	610	4,600	0.56 J	1.3	0.56 J	1.2	0.45 J
Selenium[1]	20	5.0	170	4,200	0.67 J, B	0.53 J, B	0.37 J, B	ND	0.46 J, B
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	ND	2.6 J	ND	3.2 J	ND

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.

[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

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ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				July 14, 2016				
	Aquatic Life		Human Health		Upstream			Downstream	
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	DUP-01 (BPS-UPS02)	BPS-DWS01	BPS-DWS02
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.29 J, B	0.21 J, B	0.17 J, B	0.20 J, B	0.19 J, B
Arsenic	340	150	10	--	0.44 J	0.56 J	0.70 J	0.99 J	0.71 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	0.34 J	ND	0.35 J	0.37 J	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.9 J, B	1.5 J, B	1.5 J, B	4.3 B	2.6 B
Lead[1]	120	14	15	--	0.30 J	0.27 J	0.26 J	0.34 J	0.29 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	0.49 J	ND	ND	0.54 J	0.52 J
Selenium[1]	20	5.0	170	4,200	ND	0.36 J	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	ND	ND	3.2 J	3.3 J	2.6 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio
[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.
[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

NS = Not sampled
ND = Not detected at the reporting limit
J = Result is less than the reporting limit but greater or equal to the minimum detection limit
B = Compound was found in the blank and the sample

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				August 11, 2016				
	Aquatic Life		Human Health		Upstream		Downstream		
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	BPS-DWS01	BPS-DWS02	DUP-01 (BPS-DWS01)
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.23 J, B	0.15 J, B	0.15 J, B	0.31 J, B	0.17 J, B
Arsenic	340	150	10	--	0.63 J	0.55 J	0.61 J	0.62 J	0.59 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	0.48 J	0.51 J	0.53 J	0.54 J	0.49 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.3 J	1.1 J	1.2 J	1.4 J	1.2 J
Lead[1]	120	14	15	--	0.34 J	0.34 J	0.32 J	0.37 J	0.31 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	0.77 J	0.68 J	0.64 J	0.65 J	0.90 J
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	0.46 J	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	2.6 J	3.0 J	ND	ND	2.3 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.

[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

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J = Result is less than the reporting limit but greater or equal to the minimum detection limit

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Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				September 21, 2016				
	Aquatic Life		Human Health		Upstream		Downstream		
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	BPS-DWS01	BPS-DWS02	DUP-01 (BPS-DWS02)
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.86 J, B	0.29 J, B	0.36 J, B	0.31 J, B	0.32 J, B
Arsenic	340	150	10	--	0.53 J	0.51 J	1.2	0.99 J	0.91 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	ND	ND	ND	ND	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.1 J	0.83 J	0.98 J	0.89 J	1.0 J
Lead[1]	120	14	15	--	0.13 J	0.14 J	0.12 J	0.11 J	0.13 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	0.52 J	0.58 J	0.53 J	0.54 J	0.53 J
Selenium[1]	20	5.0	170	4,200	0.56 J, B	ND	ND	0.55 J, B	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	ND	ND	ND	ND	ND

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.

[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

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ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				December 8, 2016				
	Aquatic Life		Human Health		Upstream			Downstream	
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	DUP-01 (BPS-UPS01)	BPS-DWS01	BPS-DWS02
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	0.28 J	0.73 J	0.33 J	0.50 J	1.2 J
Arsenic	340	150	10	--	0.58 J	0.62 J	0.57 J	0.61 J	0.78 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	0.26 J
Chromium	--	--	100	--	1.6 J	1.5 J	1.5 J	1.6 J	1.8 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	2.8 B	2.7 B	2.8 B	3.4 B	3.2 B
Lead[1]	120	14	15	--	1.1	1.1	1.1	1.0	1.1
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	1.7	1.7	1.6	1.7	2.7
Selenium[1]	20	5.0	170	4,200	ND	ND	0.72 J	ND	0.48 J
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	0.25 J
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	0.17 J
Zinc[1]	120	120	7,400	26,000	6.1	6.1	5.7	6.4	7.7

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.

[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

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J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-6
Surface Water Sampling Results
Bremo Power Station

Parameter (ug/L)	Use Designation				March 27, 2017				
	Aquatic Life		Human Health		Upstream			Downstream	
	Freshwater[2]		Public Water Supply[3] (µg/L)	All Other Surface Waters (µg/l)	BPS-UPS01	BPS-UPS02	DUP-01 (BPS-UPS02)	BPS-DWS01	BPS-DWS02
	Acute (µg/l)	Chronic (µg/l)							
Antimony	--	--	5.6	640	ND	ND	ND	ND	ND
Arsenic	340	150	10	--	0.32 J	0.26 J	0.29 J	0.58 J	0.27 J
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND
Chromium	--	--	100	--	ND	ND	ND	ND	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	ND	ND	ND	ND	ND
Lead[1]	120	14	15	--	ND	ND	ND	ND	ND
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	0.36 J	0.30 J	2.3	2.2	ND
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	ND	ND	ND	5.1	ND

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the VADEQ VEGIS website, surface water sampling locations are within portions of the James River classified as Class III Nontidal Waters (Coastal and Piedmont Zones). As specified in 9VAC25-260-140, Class III waters are subject to Freshwater Aquatic Life water quality criteria.

[3] In addition to the Class III designation, the VADEQ VEGIS website specifies upstream sampling locations are within portions of the James River considered a public water supply.

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J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

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Figures

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LEGEND

Approximate Property Boundary

Approximate Pond Boundary

Topographic Contours, 20 ft intervals

Topography Source: U.S. Geological Survey, 2016, Topo TNM Style Template: USGS - National Geospatial Technical Operations Center (NGTOC), Rolla, MO and Denver, CO

N

0 550 1,100 2,200
Feet

AECOM

Figure TM6-1
Site Topography

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Bremo Power Station

DATE:	DEPT:
10/26/2017	Environment

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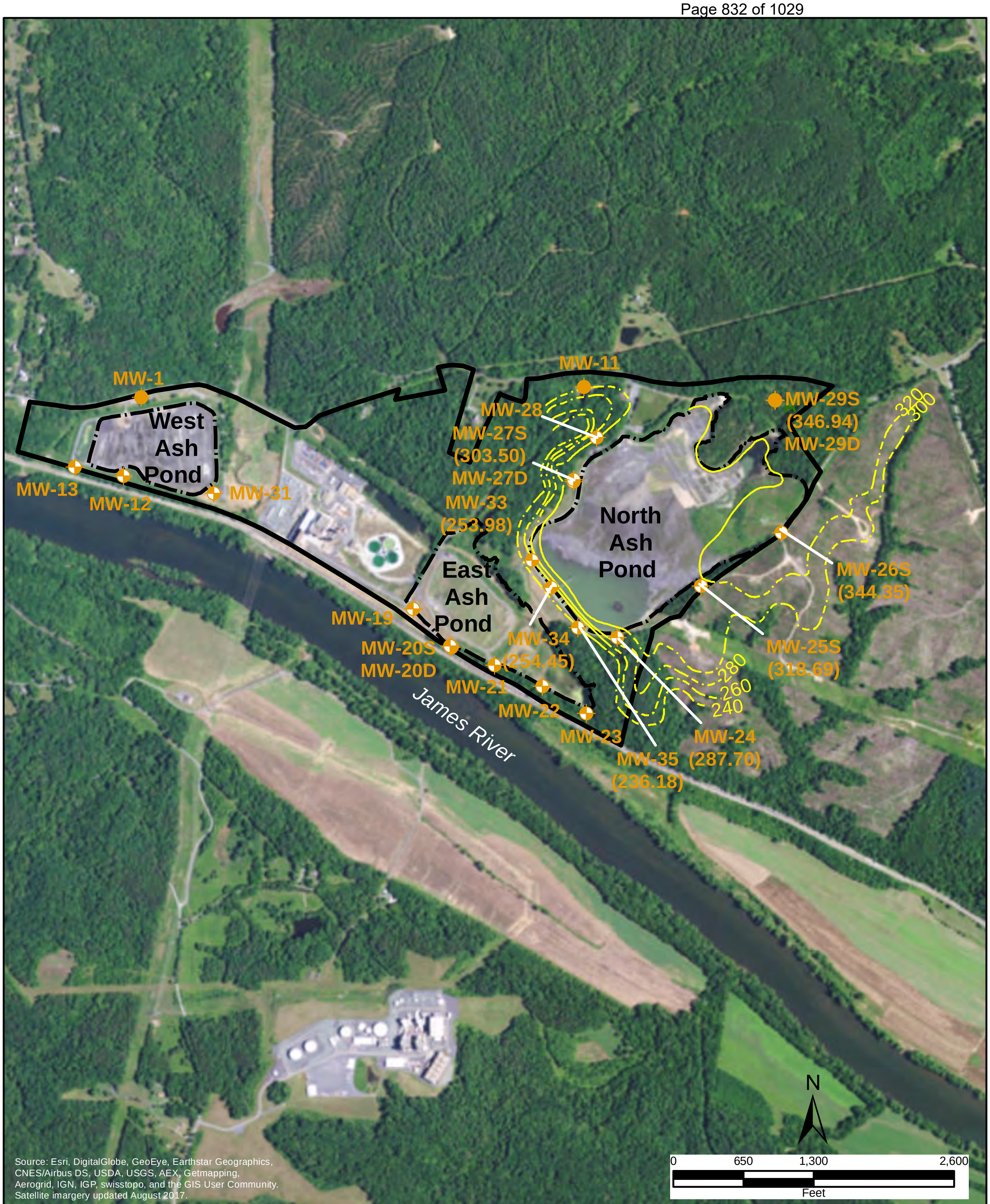

LEGEND

Approximate Property Boundary
Approximate Pond Boundary
Potentiometric Contours
Inferred Potentiometric Contours

Compliance Program
CCR Network Well
CCR Network Background Well

AECOM

Figure TM6-2
Potentiometric Surface
April 2017

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Bremo Power Station

DATE:	DEPT:
11/9/2017	Environment

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LEGEND

- Approximate Property Boundary
- Approximate Pond Boundary
- Surface Water Sample

AECOM

Figure TM6-3
Surface Water Sampling Locations

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Bremo Power Station

DATE:	DEPT:
10/26/2017	Environment

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3. Chesapeake Energy Center

3.1 Location and Background

3.1.1 Facility Location

The Chesapeake Energy Center is located at 2701 Vepco Street, Chesapeake, VA. The area subject to this report is located south of the former power production area. The property consists of a peninsula that contains an inactive (lined) ash landfill, a sedimentation pond, and the Bottom Ash Pond. The landfill and ponds were constructed in the early 1980s within the footprint of the station's original ash pond. The peninsula is approximately 6,000 feet from north to south and 1,200 to 4,000 feet from east to west. The lined landfill encompasses approximately 22 acres, the sedimentation pond is approximately 9.5 acres, and the Bottom Ash Pond footprint is approximately 5 acres. A station map with ash pond locations and other site features is provided as Figure TM6-4.

Most of the properties in the area are designated as General and Waterfront Industrial districts. The adjacent property to the north of the landfill is occupied by an industrial business with a 100-acre tank farm that handles distillates, fuel oil, fertilizer, and asphalt. A commercial deep-diving contractor is located to the west of the Chesapeake Energy Center. To the east, along the opposite bank on the Southern Branch of the Elizabeth River (SBER), there are multiple properties that use the direct river channel access for port-related activities.

3.1.2 Coal Combustion Residuals Background

The Chesapeake Energy Center formerly operated four coal-burning units, which were retired in late 2014. The plant decommissioning includes the planned closure of the landfill, and installing a temporary cover on the Bottom Ash Pond, which is classified as a surface impoundment and is subject to the requirements of SB 1398 and the CCR Rule. The Bottom Ash Pond is located just south of the CCR landfill on the peninsula. When the station was actively generating electricity, CCR was sluiced into the Bottom Ash Pond at the south end of the facility and excavated and hauled to the adjacent CCR landfill for disposal.

The Bottom Ash Pond contains approximately 60,000 CY of CCR. A temporary cover is currently in place, and the adjacent sedimentation basin is being used to actively manage landfill leachate and stormwater. A temporary cover is also in place over the landfill.

3.2 Physical Setting

The Chesapeake Energy Center is located within the Chesapeake Bay watershed. The facility's southward-pointing peninsula is bounded by a former cooling channel to the west, Deep Creek to the south, and the SBER runs along the eastern border. The SBER flows in a general south to north direction into the Chesapeake Bay at the mouth of the James River. Deep Creek, located immediately south of the peninsula, flows from west to east into the SBER. The SBER and Deep Creek are tidal waterways, and both fluctuate an average of 3 feet between high and low tides, twice daily (NOAA, 2013a).

DEQ classifies portions of the SBER and Deep Creek adjacent to the Chesapeake Energy Center as Class II Estuarine Waters (James Basin). The DEQ lists these portions of the SBER and Deep Creek as

Category 5 impaired waters for fish consumption due to PCBs and dioxin in fish tissue. The sources of these impairments are contaminated sediments and unknown sources (DEQ, 2017).

The ground surface on the peninsula is generally flat, ranging from approximately 0 to 25 feet above mean sea level (msl), with the exception of the landfill, which has an elevation of approximately 65 feet msl. The topography of the property is shown on Figure TM6-4. Tidal marshlands are assumed to have been present over the majority of the original, undisturbed surface of the peninsula.

There are no potable water supply wells within 1,000 feet of the property. The local community obtains its water from publicly supplied lines (AMEC, 2011a). Due to saltwater intrusion and the resultant high salinity, the shallow aquifer in this portion of the province is not expected to be used as a drinking water source.

3.3 Geology and Hydrogeology

3.3.1 Geology

The Coastal Plain is an eastward-thickening wedge of marine and fluvial sedimentary deposits overlying crystalline basement rock. Sediment thickness varies from extremely thin at the Fall Line (the line between the Piedmont and Coastal Plain provinces) to an accumulation of several thousand feet at the Atlantic Ocean. The province slopes gently toward the Atlantic Ocean and is characterized by little topographic relief and a dendritic drainage pattern, indicative of somewhat homogeneous, horizontally bedded sedimentary deposits.

The geology of Chesapeake Energy Center consists of a thick sequence of layered sedimentary deposits. The uppermost deposits (locally overlain by fill materials) consist of recent river-deposited sediments (sands, silts, and clays) preferentially located within or adjacent to wetland and stream channel areas. The relevant underlying deposits are identified as the Norfolk Formation and the Yorktown Formation, which overlie deeper sedimentary deposits. The sediments of the Norfolk are dominated by layers of silty sand, but the formation also contains some clay-rich zones. The Yorktown also has sandy layers but is distinguished by gray coloring (typically low-oxygen) and more interbedding of sandy and silty clay-rich zones.

3.3.2 Hydrogeology

The uppermost aquifer at Chesapeake Energy Center is found in the upper sandy zones of the Norfolk Formation. In general, the Norfolk is regarded as an aquifer, whereas the upper portions of the underlying Yorktown are regarded more as a confining unit or aquitard. The Norfolk uppermost aquifer is part of what is regionally referred to as the Columbia Aquifer, which is generally unconfined (hydraulically) but may be semi-confined where clayey deposits are properly positioned in the sequence. The Columbia Aquifer has been explored to depths of up to 35 feet bgs on site.

Depth to groundwater on site ranges from 4 to 13 feet above adjusted msl, significantly above the elevation of the adjacent river levels, and in some cases, above the original ground surface. This suggests that the uppermost groundwater may be hydraulically confined in places. As stated in the draft landfill Groundwater Monitoring Plan (Golder, 2016):

> The groundwater flow on the peninsula tends to be radial from the landfill to the west, south, and east. To the north, the groundwater gradient appears relatively flat. Accordingly, the wells used as "upgradient" wells are located several hundred feet to the northwest of the landfill and do not relate to the groundwater gradient at the facility. Although groundwater movement through the unconfined and confined aquifers is generally lateral through sediments, some groundwater movement may also occur vertically into deeper confined aquifers; however, this condition has not been verified at the facility.
>
> Hydraulic conductivity values of the uppermost aquifer have been developed using slug tests to be 6.48 x 10^{-4} feet per minute. The hydraulic gradient in the vicinity of well PO-10 has been measured at approximately 0.02 foot per foot. The calculated groundwater flow rate under the landfill is typically between 15 and 20 feet per year.

Groundwater in the uppermost aquifer tends to flow radially to the west, south, and east from the peninsula occupied by the facility (a potentiometric map is provided on Figure TM6-5). As a result, there is no true upgradient monitoring position on the peninsula, so background wells were established farther to the north. Hydraulic conductivity values for the uppermost aquifer were reported by others to be on the order of 6.48 x 10^{-4} feet/minute.

3.4 Groundwater and Surface Water Evaluations

3.4.1 Groundwater Monitoring Programs

Groundwater monitoring at the site has historically been performed in accordance with the station's SWP. All results of the first 10 years of routine monitoring were below background until indicator parameter pH was detected above background in 1994. This result initiated Phase II VSWMR groundwater monitoring at the Facility. In 2001, facility-specific Groundwater Protection Standards (GPS) were developed in accordance with the VSWMR.

In 2002, arsenic was reported at concentrations above the GPS in the uppermost water-bearing zone. The following year, concentrations of sulfide were detected above the GPS at non-risk-based levels. Additional groundwater monitoring wells were installed to obtain hydrogeologic data to support an evaluation of feasible remedial methods. A CAP for arsenic designed to provide a remedy protective of human health and the environment while complying with the federal and state standards of solid waste management (AMEC, 2011a) was accepted by DEQ in 2008.

Due to the favorable geochemistry beneath the Chesapeake Energy Center, adsorption-based monitored natural attenuation (MNA) was selected and approved by DEQ. These favorable conditions involve naturally occurring dissolved iron that reacts with high levels of dissolved oxygen to form iron oxides, which are known to strongly attenuate metals by adsorption. The abundance of iron oxides in the uppermost aquifer at the Chesapeake Energy Center produces oxide-dissolved metal reactions that drive the arsenic natural attenuation processes (AMEC, 2011a). Semi-annual sampling has verified the continued presence of favorable geochemical conditions, so the subsurface continues to provide a potential for arsenic in groundwater to be further attenuated by adsorption onto iron minerals.

After the first semi-annual sampling event in 2010, concentrations of cobalt and beryllium were detected above the GPS. By 2011, revisions had been made to the CAP, which included findings to support the use of MNA as a corrective measure for arsenic, beryllium, cobalt, and sulfide (AECOM, 2017). Based on the guidance provided by the DEQ, quarterly corrective action groundwater monitoring was implemented, to include MNA parameters to verify that the selected remedy is performing as designed (AMEC, 2011b).

The Corrective Action Site Evaluation (CASE) reports submitted to DEQ indicated that natural attenuation was occurring as expected and that the geochemical environment is conducive to the speciation-based groundwater remedy (AECOM, 2017).

Selenium was added to the CAP when concentrations were detected above the GPS during the first 2016 semi-annual sampling event. Dominion continues to monitor in accordance with the VSWMR Phase II and corrective action groundwater monitoring programs.

The Chesapeake Energy Center groundwater program monitoring well network consists of a permitted compliance network and a corrective action network. The VSWMR compliance monitoring and CAP performance monitoring networks are summarized in Table TM6-7; refer to Figure TM6-5 for well locations.

Table TM6-7: Chesapeake Energy Center Monitoring Well Network

Background VSWMR Compliance Monitoring Wells	Downgradient VSWMR Compliance Monitoring Wells		CAP Performance Monitoring Wells			CAP Sentinel Monitoring Wells
MW-4R	CECW-1	CECW-10R	MW-5	CECW-2	CECW-6I	CECW-6D
MW-5	CECW-2	PO-8	MW-5D	CECW-2D	PO-8	CECW-8
	CECW-4	PO-9	CECW-1	CECW-3	PO-8D	CECW-8D
	CECW-5	PO-10	CECW-1D	CECW-3D	PO-10	CECW-10R
	CECW-6I	PO-11			PO-10D	CECW-15

The CAP monitoring network was designed to provide data on the effectiveness of speciation in reducing the inorganic constituents. The sentinel wells are located to monitor any plume migration that may have an impact on sensitive receptors.

The landfill is monitored semi-annually using the point comparison statistical method, which consists of a direct comparison of the semi-annual compliance data for a given constituent and well to the GPS. With this method, a statistically significant increase above the GPS is indicated by at least one of the two semi-annual samples having a concentration above the GPS.

3.4.2 Groundwater Quality

Groundwater analytical results for CAP monitoring are summarized on Table TM6-8 located at the end of Section 3. Since remedy implementation, decreases in arsenic, beryllium, and cobalt have been observed. Arsenic levels in CECW-1 and CECW-3 have shown decreases in concentration, but remain above the GPS, and arsenic levels have decreased below the GPS in wells PO-8D and PO-10. CAP monitoring has shown that beryllium levels in all wells have been below GPS for the past 3 years. Cobalt levels have decreased below the GPS in CECW-6D, CECW-6I, MW-5D, and PO-8D. Sulfide levels above GPS have been detected in several wells, while selenium was above the GPS only at CECW-3.

The CAP monitoring continues to indicate a geochemical environment conducive to an adsorption-based groundwater remedy. The anoxic groundwater beneath the landfill and the oxidizing environment near the surface water bodies provide evidence that conditions are suitable for MNA. Over the past 3 years, decreasing trends have been seen at multiple wells across the site. However, two deep wells (CECW-1D and CECW-3D) exhibit increasing arsenic concentrations over time. Both of these wells are located directly adjacent to the landfill and may be screened directly in waste ash material, which would not accurately represent downgradient groundwater conditions.

3.4.3 Surface Water Monitoring

As a component of the CAP performance monitoring, Dominion has been collecting surface water samples on a semi-annual basis. Four locations were chosen to represent the flowing bodies of water surrounding the Chesapeake Energy Center's landfill peninsula. The monitoring positions are located along the inactive cooling channel (SW-1), Deep Creek (SW-2), and the SBER (SW-3 and SW-4), as shown on Figure TM6-6. The surface water in these areas is brackish and does not serve as a public water supply. The surface water samples are analyzed for the CAP constituents arsenic, beryllium, cobalt, selenium, and sulfide.

In April 2016, nine locations upstream and downstream of the station were sampled independently of the routine CAP monitoring. Seven of the locations were on the SBER and two were on Deep Creek, as shown on Figure TM6-6. The samples were collected from the SBER between the center channel and the shallow zone along the western river bank. The channel depths at the sample collection locations ranged from 12 to 33 feet. The samples collected in Deep Creek were collected within the channel that is maintained at a depth of 15 feet. At each sample location, three discrete sample intervals were taken: 1 foot above the river bottom, mid-depth, and 1 foot below the water surface. The three intervals depict a vertical profile of the water column at each sample location. Samples were collected at each of the nine locations during both the advancing and receding tidal cycles, for a total of 54 samples. The water samples were analyzed for the following constituents: arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, sulfide, vanadium, and zinc.

3.4.4 Surface Water Quality

Since the MNA remedy was implemented in 2011, all results from the four surface water locations sampled twice per year in conjunction with the CAP monitoring have been below MCLs.

As summarized in Table TM6-9 located at the end of Section 3, the surface water samples from the April 2016 event were screened against the Virginia Water Quality Standards for aquatic life and human health, the Chesapeake Bay Program screening values, and the USEPA Biological Technical Assistance Group screening values. The results of all samples collected within a 1-mile radius of the station were below screening criteria.

3.5 Summary of Findings

The Chesapeake Energy Center, located in Chesapeake, VA, formerly operated four coal-burning units that were retired in 2014. Both the landfill and the Bottom Ash Pond are located on a peninsula south of the former power production area. Underneath the landfill and the Bottom Ash Pond is the footprint of a historic ash pond; neither the landfill nor the historic pond are subject to CCR regulations. The peninsula is bordered by the SBER, Deep Creek, and an inactive cooling water channel.

Locally, a silty sand depositional formation overlies shelly interbedded sand and silty clay. Together the saturated portions of these formations represent the uppermost aquifer beneath the landfill and the Bottom Ash Pond. The groundwater flow on the peninsula tends to be radial from the topographic high toward lower-lying areas.

Previous investigations indicate groundwater is not being used as a source of drinking water, and there is no evidence that the groundwater constituents are affecting surface water quality. Since the MNA remedy was implemented in 2011, the four surface water locations related to the CAP monitoring program have been sampled at least twice a year, and all of these sample results have been below MCLs. In addition, nine locations upstream and downstream of the Chesapeake Energy Center were sampled in April 2016. These additional surface water samples were screened based on several water quality standards. The results of all samples collected within a 1-mile radius of the landfill were below the screening criteria.

Tables

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Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	MW-5 (Performace)								
		4/6/2011	7/19/2011	11/1/2011	1/24/2012	6/19/2012	8/14/2012	11/27/2012	2/18/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	0.006 J	0.006 J	0.004 J	0.008 J	0.005 J	<0.010	0.005 J	0.006 J
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	0.0014 J	0.0012 J	0.0009 J	0.0006 J	0.0007 J	0.0018 J	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)[3]	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<1.0	<1.0

Parameter	GPS	MW-5 (Performace)								
		10/15/2013	4/1/2014	8/27/2014	3/3/2015	9/9/2015	3/21/2016	9/13/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	0.007 J	0.003 J	0.007 J	0.004 J	0.007 J	0.008	<0.0200	0.0074	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	0.0010 J	<0.0030	<0.0030	<0.0030	<0.0030	0.0004 J	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.0021 J	<0.0030	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Parameter	GPS	MW-5D (Performace)								
		4/6/2011	7/19/2011	11/2/2011	1/24/2012	6/19/2012	8/14/2012	11/28/2012	2/19/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	<0.010	0.003 J	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium	0.004	0.0011	0.0007 J	0.0005 J	0.0004 J	0.0004 J	0.0003 J	<0.0010	<0.0010	0.0002 J
Cobalt	0.006	**0.2346**	**0.1410**	**0.0802**	**0.1041**	**0.0589**	**0.0520**	**0.0434**	**0.0391**	**0.0330**
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<1.0	<1.0

Parameter	GPS	MW-5D (Performace)								
		10/16/2013	4/2/2014	8/27/2014	3/4/2015	9/10/2015	3/21/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	0.003 J	<0.010	<0.010	<0.010	0.002 J	<0.0120	<0.0050	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0001 J	<0.0040	<0.0040	
Cobalt	0.006	**0.0316**	**0.0338**	**0.0383**	**0.0406**	**0.0391**	**0.0352**	**0.0300**	**0.0226**	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0060	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

< - Not detected at the reported limit.
J - Result is less than the reporting limit, but greater or equal to the method detection limit
E - Estimated concentration outside calibration range
NT - Not tested
NS - Not sampled due to insufficient water
Bold detections are above the limit of quantitation for sulfide.
Bolded and Underlined detections are greater than the applicable GPS.

Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	CECW-1 (Performance)								
		4/6/2011	7/19/2011	11/2/2011	1/25/2012	6/19/2012	8/14/2012	11/28/2012	2/19/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.054**	**0.078**	**0.081**	**0.078**	**0.063**	**0.067**	**0.044**	**0.037**	**0.020**
Beryllium	0.004	0.0033	<0.0010	0.0006 J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	<0.0030	0.0009 J	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	**0.4**	<0.2	<0.2	<0.2	<0.2	**1.3**	**1.4**	<1.0

Parameter	GPS	CECW-1 (Performance)								
		10/15/2013	4/1/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.041**	**0.122**	**0.043**	**0.033**	**0.738**	**0.026**	**0.0307**	**0.0265**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0030	
Sulfide	(0)*	0.40 J	<1.0	<1.0	**9.19**	<1.0	<1.0	<1.0	<1.0	

Parameter	GPS	CECW-1D (Performance)								
		4/6/2011	7/19/2011	11/2/2011	1/25/2012	6/20/2012	8/14/2012	11/28/2012	2/19/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.024**	**0.026**	**0.027**	**0.032**	**0.027**	**0.029**	**0.027**	**0.028**	**0.026**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	<0.0030	<0.0030	0.0013 J	<0.0030	0.0007 J	<0.0030	<0.0030	0.0011 J
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<1.0	<1.0

Parameter	GPS	CECW-1D (Performance)								
		10/16/2013	4/2/2014	8/27/2014	3/4/2015	9/10/2015	3/22/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.031**	**0.035**	**0.027**	**0.024**	**0.036**	**0.028**	**0.0416**	**0.0362**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0060	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

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Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	CECW-2 (Performance)								
		4/6/2011	7/19/2011	11/2/2011	1/24/2012	6/19/2012	8/14/2012	11/27/2012	2/19/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	0.010	**0.020**	**0.025**	**0.038**	**0.036**	**0.016**	**0.019**
Beryllium	0.004	0.0004 J	**0.0070**	0.0017	0.0004 J	0.0003 J	<0.0010	<0.0010	0.0003 J	<0.0010
Cobalt	0.006	0.0031	**0.0153**	0.0059	0.0029 J	0.0047	**0.0074**	**0.0108**	**0.0145**	**0.0120**
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	**0.4**	<0.2	<0.2	**0.2**	<0.2	<0.2	<1.0	**2.2**	**2.2**

Parameter	GPS	CECW-2 (Performance)								
		10/15/2013	4/1/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.012**	**0.017**	**0.016**	**0.021**	0.007 J	0.002 J	**0.0131 J**	**0.0364**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	0.0003 J	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	0.0027 J	0.0033	0.0018 J	**0.0085**	0.0045	0.0049	0.0025 J	**0.0082**	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0030	
Sulfide	(0)*	**8.22**	**6.06**	**5.73**	<1.0	**8.31**	**13.7**	**4.66**	**14.4**	

Parameter	GPS	CECW-2D (Performance)								
		4/6/2011	7/19/2011	11/2/2011	1/24/2012	6/20/2012	8/14/2012	11/28/2012	2/19/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.048**	**0.055**	**0.069**	**0.119**	**0.115**	**0.096**	**0.086**	**0.098**	**0.108**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	**2**	**0.4**	<0.2	<0.2	<0.2	<0.2	<1.0	**1.1**	<1.0

Parameter	GPS	CECW-2D (Performance)								
		10/16/2013	4/1/2014	8/27/2014	3/4/2015	9/9/2015	3/22/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.141**	**0.218**	**0.101**	**0.099**	**0.078**	**0.077**	**0.214**	**0.133**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.0050	<0.0060	
Sulfide	(0)*	0.46 J	**1.48**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

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Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	CECW-3 (Performance)								
		4/7/2011	7/19/2011	11/2/2011	1/24/2012	6/19/2012	8/14/2012	11/27/2012	2/19/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.135**	**2.304**	**0.167**	**0.110**	**0.096**	**0.029**	**0.115**	**0.054**	**0.052**
Beryllium	0.004	<0.0010	0.003	0.0002 J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	0.0056	**0.2882**	**0.0609**	**0.0187**	**0.0340**	0.0047	**0.1023**	**0.0135**	**0.0267**
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<1.0	<1.0	<1.0

Parameter	GPS	CECW-3 (Performance)								
		10/15/2013	4/1/2014	8/27/2014	3/3/2015	9/10/2015	3/22/2016	9/13/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.065**	**0.068**	**0.035**	**1.287**	NS	**0.044**	**0.0802**	NS	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	0.0011	NS	<0.001	<0.0040	NS	
Cobalt	0.006	**0.0139**	**0.0297**	**0.0105**	**0.2144**	NS	**0.0101**	0.0024 J	NS	
Selenium	0.05	NT	NT	NT	NT	NS	NT	**0.230 E**	NS	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	NS	<1.0	<1.0	NS	

Parameter	GPS	CECW-3D (Performance)								
		4/7/2011	7/19/2011	11/2/2011	1/25/2012	6/20/2012	8/14/2012	11/28/2012	2/19/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.192**	**0.182**	**0.171**	**0.185**	**0.186**	**0.193**	**0.230**	**0.221**	**0.258**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	0.0012 J	<0.0030	0.0011 J	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	**8.8**	<0.2	<0.2	<0.2	<0.2	**1.2**	**1.3**	<1.0

Parameter	GPS	CECW-3D (Performance)								
		10/16/2013	4/2/2014	8/27/2014	3/4/2015	9/10/2015	3/22/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.242**	**0.244**	**0.216**	**0.022**	**0.342**	**0.153**	**0.301**	**0.273**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	**0.0074**	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0060	
Sulfide	(0)*	0.18 J	<1.0	<1.0	<1.0	<1.0	<1.0	**1.16**	**2.79**	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

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Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	CECW-6I (Performance)								
		4/6/2011	7/19/2011	11/1/2011	1/24/2012	6/19/2012	8/14/2012	11/27/2012	2/19/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.304**	**0.323**	**0.374**	**0.301**	**0.234**	**0.231**	**0.190**	**0.128**	**0.308**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	0.0026 J	0.0017 J	0.0019 J	0.0041	0.0008 J	0.0017 J	0.0014 J	0.0010 J	0.0020 J
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<1.0	<1.0

Parameter	GPS	CECW-6I (Performance)								
		10/15/2013	4/2/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.194**	**0.294**	**0.276**	**0.328**	**0.254**	**0.220**	**0.247**	**0.263**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	0.0007 J	<0.0030	<0.0030	<0.0030	0.0011 J	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0030	
Sulfide	(0)*	0.7 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Parameter	GPS	CECW-6D (Sentinel)								
		4/6/2011	7/19/2011	11/2/2011	1/24/2012	6/20/2012	8/14/2012	11/28/2012	2/19/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.029**	**0.032**	**0.029**	**0.040**	**0.030**	**0.031**	**0.026**	**0.030**	**0.022**
Beryllium	0.004	0.0008 J	0.0004 J	0.0003 J	0.0002 J	0.0006 J	0.0003 J	0.0003 J	0.0003 J	0.0006 J
Cobalt	0.006	**0.0080**	**0.0074**	**0.0070**	**0.0074**	0.0060	0.0057	0.0058	0.0053	**0.0070**
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**1.2**	<1.0	<1.0

Parameter	GPS	CECW-6D (Sentinel)								
		10/16/2013	4/2/2014	8/27/2014	3/4/2015	9/9/2015	3/22/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.028**	**0.037**	**0.026**	**0.019**	**0.024**	NS	**0.0786**	**0.0759**	
Beryllium	0.004	0.0003 J	0.0004 J	<0.0010	<0.0010	0.0004 J	NS	<0.0040	<0.0040	
Cobalt	0.006	**0.0066**	**0.0070**	0.0053	0.0051	0.0057	NS	0.0058	0.0057	
Selenium	0.05	NT	NT	NT	NT	NT	NS	0.0025 J	<0.0060	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	<1.0	NS	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

< - Not detected at the reporting limit.
J - Result is less than the reporting limit, but greater or equal to the method detection limit
E - Estimated concentration outside calibration range
NT - Not tested
NS - Not sampled due to insufficient water
Bold detections are above the limit of quantitation for sulfide.
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Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	CECW-8 (Sentinel)								
		4/7/2011	**7/20/2011**	**11/3/2011**	**1/25/2012**	**6/20/2012**	**8/13/2012**	**11/28/2012**	**2/18/2013**	**5/20/2013**
Corrective Action Plan Constituents										
Arsenic	0.01	NS	<0.010	NS	**<u>0.013</u>**	0.007 J	0.005 J	<0.010	0.003 J	<0.010
Beryllium	0.004	NS	<0.0010	NS	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0002 J
Cobalt	0.006	NS	<0.0030	NS	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	NS	**133**	NS	**160**	**156**	**184**	**6.3**	**55.8**	**27.1**

Parameter	GPS	CECW-8 (Sentinel)								
		10/16/2013	**4/2/2014**	**8/27/2014**	**3/4/2015**	**9/10/2015**	**3/22/2016**	**9/14/2016**	**2/22/2017**	
Corrective Action Plan Constituents										
Arsenic	0.01	0.002 J	0.003 J	0.005 J	0.004 J	<0.010	**<u>0.015</u>**	<0.0200	0.0042 J	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	0.0012 J	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.0021 J	<0.0030	
Sulfide	(0)*	**96.5**	**151**	**86.0**	<1.0	<1.0	**100**	**86.1**	**119**	

Parameter	GPS	CECW-8D (Sentinel)								
		4/7/2011	**7/20/2011**	**11/3/2011**	**1/25/2012**	**6/20/2012**	**8/15/2012**	**11/28/2012**	**2/20/2013**	**5/15/2013**
Corrective Action Plan Constituents										
Arsenic	0.01	**<u>0.043</u>**	**<u>0.016</u>**	**<u>0.017</u>**	**<u>0.019</u>**	**<u>0.038</u>**	**<u>0.016</u>**	**<u>0.011</u>**	**<u>0.012</u>**	**<u>0.023</u>**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	0.001 J	<0.0030	<0.0030	0.0006 J	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<1.0	<1.0

Parameter	GPS	CECW-8D (Sentinel)								
		10/16/2013	**4/2/2014**	**8/27/2014**	**3/4/2015**	**9/9/2015**	**3/22/2016**	**9/14/2016**	**2/22/2017**	
Corrective Action Plan Constituents										
Arsenic	0.01	**<u>0.038</u>**	0.009 J	**<u>0.015</u>**	0.004 J	**<u>0.022</u>**	**<u>0.011</u>**	<0.0200	**<u>0.0116</u>**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0004 J	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0060	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	**54.7**	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

< - Not detected at the reporting limit.
J - Result is less than the reporting limit, but greater or equal to the method detection limit
E - Estimated concentration outside calibration range
NT - Not tested
NS - Not sampled due to insufficient water
Bold detections are above the limit of quantitation for sulfide.
<u>Bolded and Underlined</u> detections are greater than the applicable GPS.

Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	CECW-10R (Sentinel)								
		4/7/2011	7/20/2011	11/2/2011	1/25/2012	6/20/2012	8/14/2012	11/28/2012	2/19/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.038**	**0.074**	**0.088**	**0.075**	**0.205**	**0.131**	**0.039**	**0.032**	**0.109**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**1.7**	**2.2**	**2.6**

Parameter	GPS	CECW-10R (Sentinel)								
		9/9/2015	3/22/2016	8/27/2014	3/4/2015	9/9/2015	3/22/2016	9/14/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.043**	**0.073**	**0.080**	**0.037**	**0.067**	**0.108**	**0.139**	**0.0589**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.0023 J	<0.0030	
Sulfide	(0)*	**2.4**	**3.7**	**3.32**	**3.26**	**2.25**	**6.38**	**7.28**	**5.16**	

Parameter	GPS	CECW-15 (Sentinel)								
		4/7/2011	7/20/2011	11/2/2011	1/25/2012	6/20/2012	8/14/2012	11/28/2012	2/19/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium	0.004	<0.0010	0.0002 J	0.0002 J	0.0003 J	0.0003 J	0.0003 J	<0.0010	<0.0010	0.0003 J
Cobalt	0.006	0.0010 J	0.0017 J	0.0015 J	0.0018 J	0.0008 J	0.0017 J	0.0010 J	<0.0030	0.0020 J
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**1.5**	**1.1**	**1.1**

Parameter	GPS	CECW-15 (Sentinel)								
		10/16/2013	4/2/2014	8/27/2014	3/4/2015	9/10/2015	3/22/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	0.004 J	<0.010	<0.010	<0.010	0.002 J	<0.0200	<0.0050	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0002 J	<0.0040	<0.0040	
Cobalt	0.006	0.0006 J	<0.0030	<0.0030	<0.0030	0.0008 J	0.0009 J	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0060	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

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Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	PO-8 (Performance)								
		4/7/2011	7/19/2011	11/1/2011	1/24/2012	6/19/2012	8/14/2012	11/27/2012	2/19/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**<u>0.020</u>**	**<u>0.019</u>**	**<u>0.013</u>**	**<u>0.024</u>**	**<u>0.015</u>**	**<u>0.020</u>**	**<u>0.011</u>**	**<u>0.014</u>**	**<u>0.018</u>**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	**0.4**	**0.4**	<0.2	**0.6**	<0.2	<0.2	**2.0**	**7.3**	**7.8**

Parameter	GPS	PO-8 (Performance)								
		10/15/2013	4/1/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**<u>0.018</u>**	**<u>0.029</u>**	**<u>0.019</u>**	**<u>0.013</u>**	**<u>0.022</u>**	**<u>0.020</u>**	**<u>0.0242</u>**	**<u>0.0255</u>**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0030	
Sulfide	(0)*	**7.22**	**5.77**	**7.09**	<1.0	**5.41**	**7.24**	**7.34**	**8.19**	

Parameter	GPS	PO-8D (Performance)								
		4/6/2011	7/19/2011	11/2/2011	1/24/2012	6/19/2012	8/14/2012	11/28/2012	2/20/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	0.006 J	0.003 J	0.003 J	0.005 J	0.005 J	0.003 J	0.004 J	0.004 J	0.002 J
Beryllium	0.004	<0.0010	<0.0010	0.0007 J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	**<u>0.0108</u>**	**<u>0.0108</u>**	**<u>0.0070</u>**	**<u>0.0078</u>**	**<u>0.0080</u>**	**<u>0.0072</u>**	**<u>0.0065</u>**	0.0036	0.0032
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	**0.4**	<0.2	<0.2	<0.2	<0.2	<1.0	<1.0	<1.0

Parameter	GPS	PO-8D (Performance)								
		10/16/2013	4/3/2014	8/27/2014	3/4/2015	9/9/2015	3/22/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	0.004 J	0.004 J	<0.01	0.002 J	<0.010	**<u>0.092</u>**	<0.0200	0.0033 J	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0001 J	<0.0040	<0.0040	
Cobalt	0.006	**<u>0.0092</u>**	**<u>0.0070</u>**	0.0012 J	0.0021 J	0.0053	0.0027 J	0.0055	0.0031 J	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0060	
Sulfide	(0)*	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

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E - Estimated concentration outside calibration range
NT - Not tested
NS - Not sampled due to insufficient water
Bold detections are above the limit of quantitation for sulfide.
<u>Bolded and Underlined</u> detections are greater than the applicable GPS.

Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	PO-10 (Performance)								
		4/7/2011	7/20/2011	11/2/2011	1/25/2012	6/19/2012	8/14/2012	11/28/2012	2/20/2013	5/14/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.157**	**0.167**	**0.146**	**0.128**	**0.206**	**0.164**	**0.108**	**0.135**	**0.153**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**1.5**	**2.9**	<1.0

Parameter	GPS	PO-10 (Performance)								
		10/15/2013	4/1/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/21/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.149**	**0.141**	**0.145**	**0.096**	**0.122**	**0.110**	**0.140**	**0.110**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0030	
Sulfide	(0)*	0.87 J	<1.0	**1.28**	<1.0	0.61 J	0.80 J	**1.99**	**1.53**	

Parameter	GPS	PO-10D (Performance)								
		4/7/2011	7/20/2011	11/2/2011	1/25/2012	6/20/2012	8/14/2012	11/28/2012	2/20/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	**0.132**	**0.135**	**0.128**	**0.271**	**0.168**	**0.287**	**0.102**	**0.103**	**0.168**
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	**0.4**	<0.2	<0.2	<0.2	<0.2	**2.9**	**2.2**	<1.0

Parameter	GPS	PO-10D (Performance)								
		10/16/2013	4/2/2014	8/27/2014	3/4/2015	9/9/2015	3/23/2016	9/14/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	**0.232**	**0.157**	**0.098**	**0.044**	**0.121**	**0.091**	**0.130**	**0.136**	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0040	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0040	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	<0.0030	<0.0060	
Sulfide	(0)*	**5.7**	<1.0	**1.63**	**2.52**	<1.0	<1.0	<1.0	0.88 J	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

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Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	SW-1 (Cooling Channel)								
		4/6/2011	7/20/2011	11/1/2011	1/24/2012	6/19/2012	8/13/2012	11/28/2012	2/18/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium	0.004	NT	<0.0010	NT	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	NT	0.0008 J	NT	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	NT	NT	NT	NT	NT

Parameter	GPS	SW-1 (Cooling Channel)								
		10/16/2013	4/1/2014	8/27/2014	3/3/2015	9/10/2015	3/22/2016	9/13/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	0.004 J	0.004 J	<0.010	0.002 J	0.001 J	0.0038	<0.010	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0001 J	<0.0020	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0100	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.00374	<0.010	
Sulfide	(0)*	NT	NT	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Parameter	GPS	SW-2 (Deep Creek)								
		4/6/2011	7/20/2011	11/1/2011	1/24/2012	6/19/2012	8/13/2012	11/28/2012	2/18/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium	0.004	NT	<0.0010	NT	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	NT	0.0008 J	NT	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	0.2	NT	NT	NT	NT	NT

Parameter	GPS	SW-2 (Deep Creek)								
		10/16/2013	4/1/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	0.004 J	<0.010	0.002 J	0.001 J	0.0035	<0.010	
Beryllium	0.004	<0.0010	<0.0010	NT	<0.0010	<0.0010	0.0001 J	<0.0020	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	NT	<0.0030	<0.0030	0.0005 J	<0.0100	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.0038	<0.010	
Sulfide	(0)*	NT	NT	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

< - Not detected at the reporting limit.
J - Result is less than the reporting limit, but greater or equal to the method detection limit
E - Estimated concentration outside calibration range
NT - Not tested
NS - Not sampled due to insufficient water
Bold detections are above the limit of quantitation for sulfide.
Bolded and Underlined detections are greater than the applicable GPS.

Table TM6-8
Industrial Landfill Corrective Action Program Data
Chesapeake Energy Center

Parameter	GPS	SW-3 (Southwest of Waste Management Unit)								
		4/6/2011	7/20/2011	11/1/2011	1/24/2012	6/19/2012	8/13/2012	11/28/2012	2/18/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	0.005 J	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.004 J	<0.010
Beryllium	0.004	NT	<0.0010	NT	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	NT	0.0008 J	NT	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	NT	NT	NT	NT	NT

Parameter	GPS	SW-3 (Southwest of Waste Management Unit)								
		10/16/2013	4/1/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	0.003 J	<0.010	<0.010	0.001 J	0.0033	<0.010	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0010	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.003	<0.0050	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.00392	<0.010	
Sulfide	(0)*	NT	NT	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Parameter	GPS	SW-4 (Northwest of Waste Management Unit)								
		4/6/2011	7/20/2011	11/1/2011	1/24/2012	6/19/2012	8/13/2012	11/28/2012	2/18/2013	5/15/2013
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium	0.004	NT	<0.0010	NT	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	0.006	NT	0.0008 J	NT	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium	0.05	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sulfide	(0)*	<0.2	<0.2	<0.2	<0.2	NT	NT	NT	NT	NT

Parameter	GPS	SW-4 (Northwest of Waste Management Unit)								
		10/16/2013	4/2/2014	8/27/2014	3/3/2015	9/9/2015	3/22/2016	9/13/2016	2/22/2017	
Corrective Action Plan Constituents										
Arsenic	0.01	<0.010	<0.010	0.002 J	<0.010	<0.010	0.001 J	0.003	<0.010	
Beryllium	0.004	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.001	<0.0020	<0.0040	
Cobalt	0.006	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0006 J	<0.0100	<0.0040	
Selenium	0.05	NT	NT	NT	NT	NT	NT	0.0043	<0.010	
Sulfide	(0)*	NT	NT	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the Virginia Solid Waste Management Regulations.
3. Data reported herein has been compared to applicable Groundwater Protection Standards (GPS).
* Sulfide does not have a numerical GPS value; the limit of quantitation is used as the alternative concentration limit for statistical comparison purposes.

< - Not detected at the reporting limit.
J - Result is less than the reporting limit, but greater or equal to the method detection limit
E - Estimated concentration outside calibration range
NT - Not tested
NS - Not sampled due to insufficient water
Bold detections are above the limit of quantitation for sulfide.
Bolded and Underlined detections are greater than the applicable GPS.

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Table TM6-9
Surface Water Sampling Results
Chesapeake Energy Center

Parameter	Screening Criteria[1]				Advancing Tide								
	Aquatic Life		Human Health		Point 1			Point 2			Point 3		
	Saltwater[2]		Public Water	All Other Surface									
	Acute (mg/l)	Chronic (mg/l)	Supply (mg/L)[3]	Waters (mg/L)	Surface	Mid	Deep	Surface	Mid	Deep	Surface	Mid	Deep
Dissolved Metals													
Arsenic	0.069	0.036	0.01	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	NS	NS	2	---	0.020	0.021	0.021	0.020	0.020	0.021	0.021	0.022	0.021
Beryllium	0.00066	---	---	---	0.00034 J	0.00036 J	0.00038 J	0.00033 J	0.00040 J	0.00046 J	0.00033 J	0.00038 J	0.00040 J
Cadmium	0.04	0.0088	0.005	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	1.1	0.05	---	---	ND	ND	ND	0.0039 J	ND	ND	ND	ND	ND
Cobalt	0.023	---	---	---	0.0015 J	ND	0.0015 J	0.0034 J	ND	ND	0.0011 J	ND	ND
Copper	0.0093	0.006	1.3	---	0.0031 J	0.0025 J	0.0029 J	0.0024 J	0.0020 J	0.0018 J	0.0027 J	0.0027 J	0.0018 J
Lead	0.23	0.0088	0.015	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.0018	0.000094	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.074	0.0082	0.61	4.6	0.0051 J	0.0051 J	0.0053 J	0.0072 J	0.0049 J	0.0048 J	0.0056 J	0.0048 J	0.0047 J
Selenium	0.29	0.071	0.17	4.2	0.011 J	ND	ND	0.011 J	ND	0.016 J	ND	ND	0.011 J
Vanadium	0.02	---	---	---	0.0031 J	0.0029 J	0.0032 J	0.0030 J	0.0033 J	0.0033 J	0.0031 J	0.0034 J	0.0030 J
Zinc	0.09	0.081	7.4	26	0.012 J	0.010 J	0.013 J	0.013 J	0.0091 J	ND	0.012 J	0.011 J	0.0087 J
Sulfide	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Metals													
Arsenic	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	---	---	---	---	0.019	0.020	0.020	0.020	0.020	0.020	0.020	0.021	0.020
Beryllium	---	---	---	---	0.00029 J	0.00032 J	0.00035 J	0.00030 J	0.00034 J	0.00039 J	0.00029 J	0.00033 J	0.00031 J
Cadmium	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	---	---	---	---	ND	ND	0.0028 J	ND	ND	ND	ND	ND	0.0020 J
Cobalt	---	---	---	---	0.0041 J	ND	0.0016 J	0.0026 J	0.0041 J	ND	ND	ND	0.0027 J
Copper	---	---	---	---	0.0034 J	0.0039 J	0.0035 J	0.0036 J	0.0036 J	0.0029 J	0.0040 J	0.0037 J	0.0035 J
Lead	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	---	---	---	---	0.0057 J	0.0053 J	0.0075 J	0.0048 J	0.0047 J	0.0047 J	0.0049 J	0.0050 J	0.0074 J
Selenium	---	---	---	---	ND	0.012 J	0.011 J	0.012 J	0.013 J	0.014 J	ND	0.017 J	ND
Vanadium	---	---	---	---	0.0034 J	0.0039 J	0.0040 J	0.0038 J	0.0041 J	0.0041 J	0.0038 J	0.0038 J	0.0039 J
Zinc	---	---	---	---	0.016 J	0.017 J	0.016 J	0.015 J	0.020	0.014 J	0.014 J	0.014 J	0.016 J
Sulfide	---	---	---	---	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Screening levels from 9VAC-260-140 unless otherwise noted here:
Beryllium, Cobalt, Vanadium - EPA Region 3 Freshwater

[2] According to the DEQ , this portion of the Elizabeth River is classified as Class II estaurine waters. As specified in 9VAC25-260-140, these waters are subject to Saltwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NA = Not available

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Bolded detectections are greater than the applicable screening criteria

Table TM6-9
Surface Water Sampling Results
Chesapeake Energy Center

Parameter	Screening Criteria[1]				Advancing Tide								
	Aquatic Life Saltwater[2]		Human Health		Point 4			Point 5			Point 6		
	Acute (mg/l)	Chronic (mg/l)	Public Water Supply (mg/L)[3]	All Other Surface Waters (mg/L)	Surface	Mid	Deep	Surface	Mid	Deep	Surface	Mid	Deep
Dissolved Metals													
Arsenic	0.069	0.036	0.01	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	NS	NS	2	---	0.022	0.022	0.022	0.022	0.022	0.021	0.021	0.020	0.021
Beryllium	0.00066	---	---	---	0.00031 J	0.00035 J	0.00046 J	0.00031 J	0.00032 J	0.00036 J	0.00030 J	0.00032 J	0.00033 J
Cadmium	0.04	0.0088	0.005	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	1.1	0.05	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	0.023	---	---	---	0.0029 J	ND	ND	ND	0.0017 J	ND	ND	ND	ND
Copper	0.0093	0.006	1.3	---	0.0025 J	0.0023 J	0.0024 J	0.0027 J	0.0029 J	0.0030 J	0.0025 J	0.0023 J	0.0025 J
Lead	0.23	0.0088	0.015	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.0018	0.000094	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.074	0.0082	0.61	4.6	0.0053 J	0.0051 J	0.0054 J	0.0053 J	0.0059 J	0.0049 J	0.0060 J	0.0060 J	0.0052 J
Selenium	0.29	0.071	0.17	4.2	ND	0.015 J	ND	ND	ND	0.011 J	0.011 J	ND	ND
Vanadium	0.02	---	---	---	0.0031 J	0.0030 J	0.0035 J	0.0033 J	0.0030 J	0.0029 J	0.0027 J	0.0030 J	0.0032 J
Zinc	0.09	0.081	7.4	26	0.014 J	0.010 J	0.0084 J	0.0092 J	0.013 J	0.010 J	0.011 J	0.012 J	0.011 J
Sulfide	---	---	---	---	ND	1.2	ND	ND	ND	ND	ND	ND	ND
Total Metals													
Arsenic	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	---	---	---	---	0.021	0.021	0.022	0.022	0.021	0.021	0.022	0.021	0.022
Beryllium	---	---	---	---	0.00029 J	0.00032 J	0.00044 J	0.00025 J	0.00026 J	0.00030 J	0.00027 J	0.00027 J	0.00031 J
Cadmium	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	0.0038 J
Cobalt	---	---	---	---	0.0012 J	0.0026 J	ND	ND	ND	0.0013 J	ND	ND	0.0016 J
Copper	---	---	---	---	0.0030 J	0.0037 J	0.0033 J	0.0033 J	0.0032 J	0.0030 J	0.0033 J	0.0030 J	0.0037 J
Lead	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	---	---	---	---	0.0048 J	0.0063 J	0.0061 J	0.0062 J	0.0052 J	0.0060 J	0.0062 J	0.0056 J	0.0068 J
Selenium	---	---	---	---	0.013 J	0.014 J	0.015 J	0.012 J	0.013 J	0.015 J	0.013 J	0.011 J	ND
Vanadium	---	---	---	---	0.0040 J	0.0039 J	0.0047 J	0.0037 J	0.0034 J	0.0037 J	0.0038 J	0.0037 J	0.0044 J
Zinc	---	---	---	---	0.014 J	0.016 J	0.011 J	0.013 J	0.014 J	0.016 J	0.013 J	0.014 J	0.016 J
Sulfide	---	---	---	---	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Screening levels from 9VAC-260-140 unless otherwise noted here:
Beryllium, Cobalt, Vanadium - EPA Region 3 Freshwater

[2] According to the DEQ , this portion of the Elizabeth River is classified as Class II estaurine waters. As specified in 9VAC25-260-140, these waters are subject to Saltwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NA = Not available

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Bolded detectections are greater than the applicable screening criteria

Table TM6-9
Surface Water Sampling Results
Chesapeake Energy Center

Parameter	Screening Criteria[1]				Advancing Tide								
	Aquatic Life		Human Health		Point 7			Point 8			Point 9		
	Saltwater[2]		Public Water	All Other Surface									
	Acute (mg/l)	Chronic (mg/l)	Supply (mg/L)[3]	Waters (mg/L)	Surface	Mid	Deep	Surface	Mid	Deep	Surface	Mid	Deep
Dissolved Metals													
Arsenic	0.069	0.036	0.01	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	NS	NS	2	---	0.023	0.021	0.020	0.022	0.023	0.022	0.021	0.022	0.021
Beryllium	0.00066	---	---	---	0.00018 J	0.00037 J	0.00040 J	0.00015 J	0.00017 J	0.00029 J	0.00028 J	0.00032 J	0.00032 J
Cadmium	0.04	0.0088	0.005	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	1.1	0.05	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	0.023	---	---	---	0.0011 J	ND	ND	0.0012 J	0.0012 J	ND	ND	ND	ND
Copper	0.0093	0.006	1.3	---	0.0023 J	0.0060 J	0.0024 J	ND	0.0019 J	0.0024 J	0.0032 J	0.0026 J	0.0025 J
Lead	0.23	0.0088	0.015	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.0018	0.000094	---	---	ND	ND	0.000091 J	ND	ND	ND	ND	ND	ND
Nickel	0.074	0.0082	0.61	4.6	0.0050 J	0.0054 J	0.0042 J	0.0035 J	0.0048 J	0.0059 J	0.0061 J	0.0057 J	0.0050 J
Selenium	0.29	0.071	0.17	4.2	ND	0.014 J	0.012 J	ND	ND	ND	0.011 J	0.013 J	ND
Vanadium	0.02	---	---	---	0.0027 J	0.0030 J	0.0032 J	0.0023 J	0.0025 J	0.0030 J	0.0027 J	0.0026 J	0.0030 J
Zinc	0.09	0.081	7.4	26	0.0088 J	0.0085 J	0.0094 J	0.0097 J	0.0097 J	0.010 J	0.0094 J	0.0090 J	0.0090 J
Sulfide	---	---	---	---	ND	ND	ND	ND	1.4	ND	ND	ND	ND
Total Metals													
Arsenic	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	0.0076 J
Barium	---	---	---	---	0.024	0.022	0.022	0.023	0.025	0.023	0.023	0.022	0.063
Beryllium	---	---	---	---	0.00013 J	0.00029 J	0.00033 J	0.00012 J	0.00013 J	0.00021 J	0.00024 J	0.00029 J	0.0010 J
Cadmium	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	---	---	---	---	0.0034 J	ND	0.0045 J	0.0068 J	0.0035 J	0.0049 J	ND	ND	0.025
Cobalt	---	---	---	---	ND	ND	ND	ND	0.0012 J	0.0028 J	ND	ND	0.0049 J
Copper	---	---	---	---	0.0024 J	0.0030 J	0.0028 J	0.0020 J	0.0020 J	0.0036 J	0.0031 J	0.0041 J	0.039
Lead	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	0.032
Mercury	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	0.000098 J
Nickel	---	---	---	---	0.0061 J	0.0056 J	0.0085 J	0.0062 J	0.006 J	0.0084 J	0.0062 J	0.0048 J	0.016 J
Selenium	---	---	---	---	ND	ND	ND	ND	ND	0.010 J	0.010 J	0.016 J	0.016 J
Vanadium	---	---	---	---	0.0034 J	0.0037 J	0.0039 J	0.0033 J	0.0033 J	0.0041 J	0.0036 J	0.0038 J	0.036
Zinc	---	---	---	---	0.011 J	0.016 J	0.014 J	0.011 J	0.012 J	0.020	0.014 J	0.016 J	0.14
Sulfide	---	---	---	---	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Screening levels from 9VAC-260-140 unless otherwise noted here:
Beryllium, Cobalt, Vanadium - EPA Region 3 Freshwater

[2] According to the DEQ , this portion of the Elizabeth River is classified as Class II estaurine waters. As specified in 9VAC25-260-140, these waters are subject to Saltwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NA = Not available

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Bolded detectections are greater than the applicable screening criteria

Table TM6-9
Surface Water Sampling Results
Chesapeake Energy Center

Parameter	Screening Criteria[1]				Receding Tide								
	Aquatic Life		Human Health		Point 1			Point 2			Point 3		
	Saltwater[2]		Public Water	All Other Surface									
	Acute (mg/l)	Chronic (mg/l)	Supply (mg/L)[3]	Waters (mg/L)	Surface	Mid	Deep	Surface	Mid	Deep	Surface	Mid	Deep
Dissolved Metals													
Arsenic	0.069	0.036	0.01	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	NS	NS	2	---	0.022	0.024	0.023	0.020	0.021	0.021	0.021	0.021	0.022
Beryllium	0.00066	---	---	---	0.00036 J	0.00048 J	0.00041 J	0.00035 J	0.00041 J	0.00046 J	0.00031 J	0.00040 J	0.00046 J
Cadmium	0.04	0.0088	0.005	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	1.1	0.05	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	0.023	---	---	---	0.0054 J	ND	ND	0.0039 J	0.0033 J	0.0031 J	ND	0.0011 J	ND
Copper	0.0093	0.006	1.3	---	0.0050 J	**0.011 J**	0.0032 J	0.0032 J	0.0022 J	0.0018 J	0.0035 J	0.0028 J	ND
Lead	0.23	0.0088	0.015	---	ND	0.0075 J	ND	ND	ND	ND	ND	ND	ND
Mercury	0.0018	0.000094	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.074	0.0082	0.61	4.6	0.0068 J	0.0056 J	0.007 J	0.0059 J	0.0050 J	0.0048 J	0.0050 J	0.0056 J	0.0052 J
Selenium	0.29	0.071	0.17	4.2	0.013 J	0.010 J	0.014 J	0.013 J	ND	ND	ND	0.013 J	ND
Vanadium	0.02	---	---	---	0.0030 J	0.0063 J	0.0032 J	0.0031 J	0.0032 J	0.0036 J	0.0027 J	0.0030 J	0.0035 J
Zinc	0.09	0.081	7.4	26	0.019 J	0.037	0.017 J	0.013 J	0.012 J	0.013 J	0.012 J	0.010 J	0.0099 J
Sulfide	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Metals													
Arsenic	---	---	---	---	ND	ND	0.093	ND	ND	ND	ND	ND	ND
Barium	---	---	---	---	0.020	0.044	0.30	0.020	0.021	0.021	0.020	0.020	0.019
Beryllium	---	---	---	---	0.00031 J	0.00063 J	0.0065	0.00032 J	0.00038 J	0.00039 J	0.00026 J	0.00034 J	0.00038 J
Cadmium	---	---	---	---	ND	ND	0.0034 J	ND	ND	ND	ND	ND	ND
Chromium VI	---	---	---	---	ND	0.018	0.21	ND	ND	0.0041 J	ND	ND	ND
Cobalt	---	---	---	---	0.0027 J	0.0027 J	0.049	0.0028 J	0.0048 J	0.0022 J	0.0019 J	0.0016 J	ND
Copper	---	---	---	---	0.0039 J	0.023	0.34	0.0039 J	0.0035 J	0.0034 J	0.0036 J	0.0030 J	0.0027 J
Lead	---	---	---	---	ND	0.015	0.26	ND	ND	ND	ND	ND	ND
Mercury	---	---	---	---	ND	ND	0.00063	ND	ND	ND	ND	ND	ND
Nickel	---	---	---	---	0.0050 J	0.013 J	0.10	0.0058 J	0.0058 J	0.0077 J	0.0057 J	0.0057 J	0.0046 J
Selenium	---	---	---	---	0.010 J	0.015 J	0.019 J	0.014 J	0.012 J	0.016 J	0.010 J	0.018 J	0.015 J
Vanadium	---	---	---	---	0.0036 J	0.018	0.25	0.0036 J	0.0040 J	0.0039 J	0.0034 J	0.0038 J	0.0040 J
Zinc	---	---	---	---	0.017 J	0.070	1.1	0.016 J	0.014 J	0.015 J	0.016 J	0.012 J	0.011 J
Sulfide	---	---	---	---	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Screening levels from 9VAC-260-140 unless otherwise noted here:
Beryllium, Cobalt, Vanadium - EPA Region 3 Freshwater

[2] According to the DEQ , this portion of the Elizabeth River is classified as Class II estaurine waters. As specified in 9VAC25-260-140, these waters are subject to Saltwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NA = Not available

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Bolded detectections are greater than the applicable screening criteria

Table TM6-9
Surface Water Sampling Results
Chesapeake Energy Center

Parameter	Screening Criteria[1]				Receding Tide								
	Aquatic Life		Human Health		Point 4			Point 5			Point 6		
	Saltwater[2]		Public Water	All Other Surface									
	Acute (mg/l)	Chronic (mg/l)	Supply (mg/L)[3]	Waters (mg/L)	Surface	Mid	Deep	Surface	Mid	Deep	Surface	Mid	Deep
Dissolved Metals													
Arsenic	0.069	0.036	0.01	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	NS	NS	2	---	0.022	0.021	0.021	0.022	0.022	0.021	0.024	0.022	0.023
Beryllium	0.00066	---	---	---	0.00033 J	0.00036 J	0.00045 J	0.00027 J	0.00033 J	0.00037 J	0.00029 J	0.00032 J	0.00035 J
Cadmium	0.04	0.0088	0.005	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	1.1	0.05	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	0.023	---	---	---	ND	0.0011 J	0.0010 J	ND	ND	ND	ND	ND	ND
Copper	0.0093	0.006	1.3	---	0.0027 J	0.0025 J	0.0028 J	0.0024 J	0.0029 J	0.0026 J	0.0026 J	0.0026 J	0.0045 J
Lead	0.23	0.0088	0.015	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.0018	0.000094	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.074	0.0082	0.61	4.6	0.0045 J	0.0054 J	0.0048 J	0.0061 J	0.0052 J	0.0047 J	0.0058 J	0.0062 J	0.0056 J
Selenium	0.29	0.071	0.17	4.2	0.011 J	0.014 J	0.014 J	ND	ND	0.010 J	0.012 J	ND	0.010 J
Vanadium	0.02	---	---	---	0.0032 J	0.0029 J	0.0035 J	0.0030 J	0.0035 J	0.0034 J	0.0032 J	0.0032 J	0.0047 J
Zinc	0.09	0.081	7.4	26	0.0087 J	0.012 J	0.0091 J	0.012 J	0.011 J	0.013 J	0.014 J	0.013 J	0.018 J
Sulfide	---	---	---	---	ND	ND	ND	ND	1.7	ND	ND	ND	ND
Total Metals													
Arsenic	---	---	---	---	ND	ND	0.25	ND	ND	ND	ND	ND	ND
Barium	---	---	---	---	0.021	0.021	0.78	0.024	0.020	0.037	0.022	0.023	0.037
Beryllium	---	---	---	---	0.00028 J	0.00030 J	0.015	0.00025 J	0.00032 J	0.00049 J	0.00023 J	0.00031 J	0.00050 J
Cadmium	---	---	---	---	ND	ND	0.0096	ND	ND	ND	ND	ND	ND
Chromium VI	---	---	---	---	ND	ND	0.51	ND	ND	0.0072 J	ND	ND	0.0054 J
Cobalt	---	---	---	---	ND	ND	0.10	ND	ND	0.0032 J	ND	0.0012 J	0.0015 J
Copper	---	---	---	---	0.0039 J	0.0042 J	1.1	0.0038 J	0.0035 J	0.015 J	0.0030 J	0.0036 J	0.012 J
Lead	---	---	---	---	ND	ND	0.78	ND	ND	0.0061 J	ND	ND	0.0065 J
Mercury	---	---	---	---	ND	ND	0.00067	ND	ND	ND	ND	ND	ND
Nickel	---	---	---	---	0.0048 J	0.0060 J	0.30	0.0051 J	0.0061 J	0.0096 J	0.0048 J	0.0055 J	0.0076 J
Selenium	---	---	---	---	0.011 J	0.012 J	0.033	0.011 J	0.014 J	0.015 J	0.011 J	0.015 J	0.012 J
Vanadium	---	---	---	---	0.0038 J	0.0037 J	0.96	0.0041 J	0.0039 J	0.013	0.0040 J	0.0048 J	0.013
Zinc	---	---	---	---	0.013 J	0.013 J	3.2	0.016 J	0.014 J	0.057	0.016 J	0.016 J	0.043
Sulfide	---	---	---	---	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Screening levels from 9VAC-260-140 unless otherwise noted here:
Beryllium, Cobalt, Vanadium - EPA Region 3 Freshwater

[2] According to the DEQ , this portion of the Elizabeth River is classified as Class II estaurine waters. As specified in 9VAC25-260-140, these waters are subject to Saltwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NA = Not available

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J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Bolded detectections are greater than the applicable screening criteria

Table TM6-9
Surface Water Sampling Results
Chesapeake Energy Center

Parameter	Screening Criteria[1]				Receding Tide								
	Aquatic Life		Human Health		Point 7			Point 8			Point 9		
	Saltwater[2]		Public Water Supply (mg/L)[3]	All Other Surface Waters (mg/L)	Surface	Mid	Deep	Surface	Mid	Deep	Surface	Mid	Deep
	Acute (mg/l)	Chronic (mg/l)											
Dissolved Metals													
Arsenic	0.069	0.036	0.01	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	NS	NS	2	---	0.023	0.021	0.021	0.023	0.023	0.024	0.022	0.021	0.022
Beryllium	0.00066	---	---	---	0.00023 J	0.00036 J	0.00038 J	0.00017 J	0.00030 J	0.00031 J	0.00031 J	0.00034 J	0.00037 J
Cadmium	0.04	0.0088	0.005	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	1.1	0.05	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	0.023	---	---	---	0.0012 J	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.0093	0.006	1.3	---	0.0027 J	0.0021 J	0.0030 J	0.0018 J	0.0027 J	0.0041 J	0.0031 J	0.0030 J	0.0030 J
Lead	0.23	0.0088	0.015	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.0018	0.000094	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.074	0.0082	0.61	4.6	0.0053 J	0.0056 J	0.0051 J	0.0055 J	0.0062 J	0.0050 J	0.0051 J	0.0054 J	0.0044 J
Selenium	0.29	0.071	0.17	4.2	ND	0.013 J	ND	ND	0.015 J	0.011 J	ND	0.010 J	ND
Vanadium	0.02	---	---	---	0.0028 J	0.0030 J	0.0032 J	0.0024 J	0.0033 J	0.0040 J	0.0029 J	0.0032 J	0.0037 J
Zinc	0.09	0.081	7.4	26	0.010 J	0.010 J	0.0098 J	0.011 J	0.0098 J	0.014 J	0.0097 J	0.010 J	0.0098 J
Sulfide	---	---	---	---	1.3	ND	ND	2.1	ND	ND	ND	ND	1.2
Total Metals													
Arsenic	---	---	---	---	ND	ND	ND	ND	ND	0.012 J	ND	ND	ND
Barium	---	---	---	---	0.023	0.020	0.020	0.023	0.023	0.064	0.022	0.021	0.051
Beryllium	---	---	---	---	0.00017 J	0.00035 J	0.00035 J	0.00014 J	0.00028 J	0.00096 J	0.00028 J	0.00032 J	0.00081 J
Cadmium	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI	---	---	---	---	ND	ND	ND	0.0025 J	ND	0.024	ND	ND	0.018
Cobalt	---	---	---	---	0.0010 J	0.0026 J	ND	ND	ND	0.0045 J	ND	ND	0.0030 J
Copper	---	---	---	---	0.0028 J	0.0042 J	0.0032 J	0.0027 J	0.0035 J	0.029	0.0038 J	0.0039 J	0.034
Lead	---	---	---	---	ND	ND	ND	ND	ND	0.022	ND	ND	0.020
Mercury	---	---	---	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	---	---	---	---	0.0056 J	0.0052 J	0.0049 J	0.0057 J	0.0059 J	0.017 J	0.0059 J	0.0050 J	0.013 J
Selenium	---	---	---	---	ND	0.017 J	0.017 J	ND	ND	ND	0.011 J	0.012 J	0.010 J
Vanadium	---	---	---	---	0.0036 J	0.0041 J	0.0041 J	0.0036 J	0.0041 J	0.036	0.0040 J	0.0037 J	0.026
Zinc	---	---	---	---	0.013 J	0.016 J	0.013 J	0.012 J	0.014 J	0.12	0.013 J	0.015 J	0.11
Sulfide	---	---	---	---	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Screening levels from 9VAC-260-140 unless otherwise noted here:
Beryllium, Cobalt, Vanadium - EPA Region 3 Freshwater

[2] According to the DEQ , this portion of the Elizabeth River is classified as Class II estaurine waters. As specified in 9VAC25-260-140, these waters are subject to Saltwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NA = Not available

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J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Bolded detectections are greater than the applicable screening criteria

Figures

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LEGEND

Approximate Property Boundary

Limit of Waste

Approximate Pond Boundary

Topographic Contours, 5 ft intervals

Topography Source: U.S. Geological Survey, 2016, Topo TNM Style Template: USGS - National Geospatial Technical Operations Center (NGTOC), Rolla, MO and Denver, CO

N

0 350 700 1,400
Feet

AECOM

Figure TM6-4
Site Topography

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CAG	DFM	REV. 0

Chesapeake Energy Center

DATE:	DEPT:
11/8/2017	Environment

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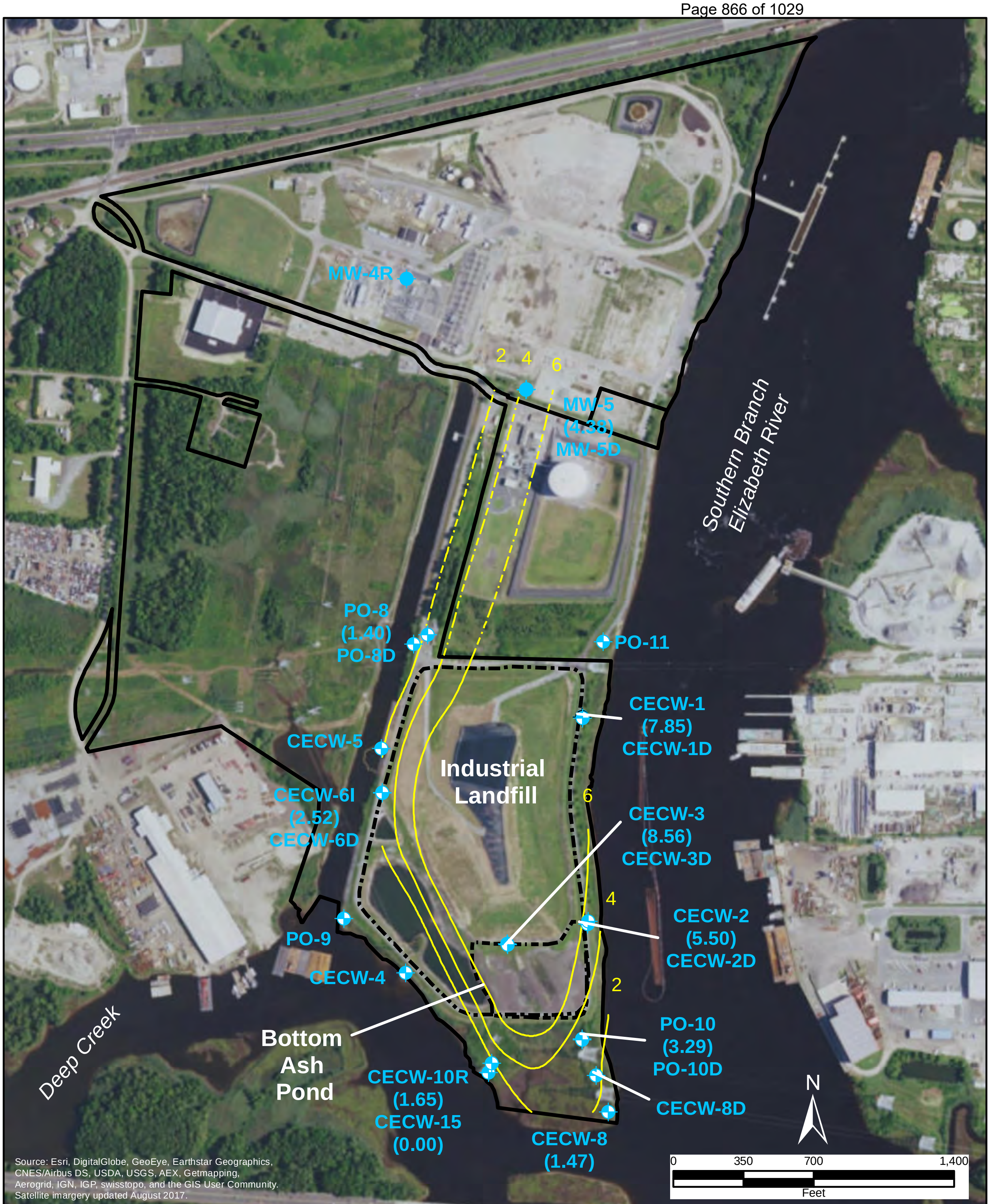

LEGEND

- Approximate Property Boundary
- Limit of Waste
- Approximate Pond Boundary
- Potentiometric Contours
- Inferred Potentiometric Contours

Compliance Program

- VSWMR Network Well
- VSWMR Network Background Well

AECOM

Figure TM6-5
Potentiometric Surface
March 2016

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CAG	DFM	REV. 0

Chesapeake Energy Center

DATE:	DEPT:
10/26/2017	Environment

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AECOM

Figure TM6-6
Surface Water Sampling Locations

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CAG	DFM	REV. 0

Chesapeake Energy Center

DATE:	DEPT:
10/26/2017	Environment

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4. Chesterfield Power Station

4.1 Location and Background

4.1.1 Facility Location

The Chesterfield Power Station is located at 500 Coxendale Road, Chester, Chesterfield County, VA. The station is situated on approximately 844 acres along the southern bank of the James River. The Chesterfield Power Station, the largest fossil-fueled power station in Virginia, has been in operation since at least 1952 and has converted to dry ash handling. There are two ash ponds located at the station: the Lower Ash Pond and the Upper Ash Pond. Figure TM6-7 shows the property boundary along with the locations of Lower and Upper Ash Ponds.

4.1.2 Coal Combustion Residuals Background

The Lower Ash Pond was constructed in 1964, and the Upper Ash Pond was constructed in 1983. Both ponds served as CCR settling ponds for the facility's wastewater treatment system. Available site records indicate that these settling ponds consist of unlined storage units that have received only CCR and associated coal combustion process waste for disposal. Settled CCR in the Lower Ash Pond has been excavated, dewatered, and transferred to the Upper Ash Pond for permanent storage. An earthen dike with a minimum crest width of 20 feet borders the ponds. The Lower Ash Pond encompasses approximately 101 acres, and the Upper Ash Pond encompasses approximately 112 acres.

4.2 Physical Setting

The Chesterfield Power Station is in the Chesapeake Bay watershed along the southern shore of the James River. The Lower and Upper Ash Ponds are bounded by Coxendale Road to the north, Henricus Park Road and Aiken Swamp to the east, the Old Channel of the James River and the Dutch Gap Conservation Area to the south, and the power station to the west. To the north of the station is approximately 650 acres of undeveloped land. The neighboring properties to the south are located past the Dutch Gap Conservation Area along the south bank of the Old Channel of the James River. The City of Richmond Proctors Creek Wastewater Treatment Plant and commercial warehouses are located to the west of the station. Much of the surrounding land is designated as a heavy industrial district, which is designed to accommodate intense manufacturing uses that process raw materials.

Adjacent to the Chesterfield Power Station, the Old Channel of the James River flows through the Dutch Gap Conservation Area, south of the ash ponds. From there, the Old Channel continues flowing eastward and connects with the main channel of the James River. Virginia tidal charts indicate that the James River is tidal and fluctuates an average of 3 feet between regular high and low tides. From the Dutch Gap Conservation Area, the James River flows approximately 60 miles east to its mouth, which opens into the Chesapeake Bay. The James River Federal Navigation Project periodically performs dredging activities to a depth of 25 feet and a width of 200 feet from Hopewell, VA to the Richmond Deepwater Terminal. DEQ classifies portions of the James River adjacent to Chesterfield Power Station as Class II Tidal Freshwater, and lists this portion of the James River as a Category 5 impaired water for aquatic life use due to an inadequate benthic community, fish consumption due to PCBs in fish tissue and the water column, and public water supply due to PCBs in the water column (DEQ, 2017). Sources for these impairments include contaminated sediments and other unknown sources. DEQ classifies the Old Channel of the James River and the tidal pools immediately south of the Lower Ash Pond as Class II Tidal Freshwaters, and these waters are listed as Category 4 impaired waters for aquatic life and shallow-water submerged aquatic vegetation due to aquatic plants (macrophytes). Sources for Category 4 impairments are not listed in the DEQ's 2016 draft report.

There are no surveyed drinking water wells downgradient from the Chesterfield Power Station (i.e., between the power generation plant, the Lower Ash Pond, the Upper Ash Pond, the thermal channel, or the James River; URS, 2012), and no drinking water supply wells are located on the Chesterfield Power Station property.

4.3 Geology and Hydrogeology

Golder's Groundwater Monitoring Plan (Golder, 2017b) included a discussion of regional and site geology and hydrogeology, which was based on review of several historic water quality and hydrogeologic reports submitted for the station. A brief summary of Golder's discussion of regional and local geology and hydrogeology is provided in the following sections.

4.3.1 Geology

The station is located approximately 2.5 miles east of the Fall Line (the line between the Piedmont and Coastal Plain provinces) in the western part of the Virginia Coastal Plain Physiographic Province. The Coastal Plain is an eastward-thickening wedge of marine and fluvial sedimentary deposits overlying crystalline basement rock. The area immediately surrounding the station is characterized by relatively flat upland areas dissected by the James River and its tributaries, resulting in up to 200 feet of local topographic relief. The James River has carved out a relatively flat-bottomed and steep-sided valley in which the river meanders widely. At the station location, the river carved significant meanders that have been cut off by shipping channels and left behind abandoned oxbow lakes and wetlands. One such oxbow area is occupied by the Upper and Lower Ash Ponds.

Because of the erosional history of the site, the geology of the Upper and Lower Ash Ponds consists of semi-consolidated Coastal Plain sediments of the Tertiary and Cretaceous periods that are overlain by more recent sandy alluvial deposits of the present day river valley, and underlain at relatively shallow depth by some thickness of Triassic sedimentary bedrock followed by crystalline (igneous and/or metamorphic) bedrock (referred to as the basement rock). Each of these geologic units represents a significant element of the overall character of the site geology.

4.3.2 Hydrogeology

The uppermost aquifer at the site is found in the permeable layers of the youngest of the coastal plain sediments (Quaternary and Tertiary), which are generally referred to as part of the Columbia Aquifer system. However, locally, the Columbia appears to be somewhat hydraulically connected to permeable layers of the underlying Cretaceous Potomac Formation and even to the underlying basement bedrock groundwater zones. Accordingly, three groundwater zones are monitored at the site as discussed below.

The uppermost aquifer (Columbia) consists of 35 to 45 feet of sandy material underlain by a sandy clay that acts as a partially confining unit. Some of the aquifer thickness was likely removed by sand and gravel mining operations prior to use of the area as an ash pond. Consequently, observed thicknesses on site range on the order of 20 to 25 feet. Depth to water in the uppermost aquifer wells is generally elevated above the adjacent wetlands, suggesting either a confined condition or radial flow away from the pond areas. Figure TM6-8 provides the potentiometric surface map for the Chesterfield Power Station.

The next aquifer unit is identified as the sand and sandy gravel beds of the underlying Potomac Formation. The thickness of the Potomac is widely variable (from 10 to 160 feet) because the underlying crystalline bedrock surface is offset by faulting that has raised and lowered adjacent blocks of the bedrock. This variability, combined with some heterogeneity in the permeability of the sediments, makes for locally variable conditions of hydraulic confinement and particularly of interconnection to the overlying Columbia.

The bedrock aquifer is similarly heterogeneous in its potential connection to overlying Potomac and Columbia aquifer units. In places, the bedrock has low permeability or is too deeply buried to effectively communicate. In these places, the shallow aquifers appear to have the potential to contribute recharge to the bedrock. However, in others places, there is a distinct upward gradient into the overlying aquifers. This upward gradient reflects the fact that the bedrock is hydraulically connected to the nearby high lands of the Piedmont Province where the bedrock receives direct recharge at the surface. That recharge can be hydraulically transmitted for great distances under the Coastal Plain. As a result of the upward recharge potential, the character of bedrock groundwater may have a background influence on the Potomac and/or Columbia Aquifer wells.

4.4 Groundwater and Surface Water Quality

4.4.1 Groundwater Monitoring Programs

Groundwater at the Chesterfield Power Station is currently being monitored under the VPDES permit program and the CCR Rule.

Groundwater monitoring at the Lower and Upper Ash Ponds has been conducted since the issuance of the site's VPDES permit. The current reporting requirements include quarterly reporting for both ponds, and annual reporting is required for the Upper Ash Pond. As part of the VPDES compliance monitoring program, the Lower Ash Pond monitoring wells are sampled on a quarterly and annual basis for the constituents listed in Table TM6-10.

Table TM6-10: Chesterfield Lower Ash Pond VPDES Monitoring Constituents

Sampling Frequency	Dissolved Metals		Water Quality Parameters		Field Measurements
Quarterly	• Copper • Iron	• Molybdenum • Zinc	• Ammonia • Chloride • Nitrate • Sulfate	• Total Dissolved Solids • Total Hardness	• Groundwater elevation • pH • Conductivity
Additional Annual Parameters	• Arsenic • Barium • Cadmium • Chromium • Hexavalent chromium	• Lead • Manganese • Mercury • Selenium • Silver • Vanadium	No additional parameters		No additional parameters

As part of the VPDES compliance monitoring program, the Upper Ash Pond monitoring wells are sampled on a quarterly basis for the constituents listed in Table TM6-11.

Table TM6-11: Chesterfield Upper Ash Pond VPDES Monitoring Constituents

Dissolved Metals			Water Quality Parameters		Field Measurements
• Arsenic	• Copper	• Molybdenum	• Ammonia	• Total Dissolved Solids	• Groundwater elevation
• Barium	• Iron	• Selenium	• Chloride	• Total Hardness	• pH
• Cadmium	• Lead	• Silver	• Nitrate		• Conductivity
• Chromium	• Manganese	• Vanadium	• Sulfate		
• Hexavalent chromium	• Mercury	• Zinc			

CCR Rule compliance background monitoring was performed at the Chesterfield Power Station between October 2016 and August 2017. Modifications were made to the standard CCR Rule sampling protocol to comply with anticipated VSWMR and DEQ requirements. CCR compliance sampling will be conducted semi-annually with annual reports submitted, and anticipated VSWMR reports will be submitted semi-annually. At this time, there are 41 wells in the CCR monitoring network. The Columbia Aquifer is the only water-bearing unit potentially impacted by the Lower Ash Pond; the CCR monitoring network wells for the Lower Ash Pond are shown in Table TM6-12. The monitoring network for the Upper Ash Pond monitors four potentially impacted aquifers, the Columbia, the Potomac and Triassic (which are combined for purposes of CCR monitoring), and the bedrock aquifer; Upper Ash Pond CCR wells are shown in Table TM6-13. All well locations are shown on Figure TM6-8.

**Table TM6-12: Chesterfield Power Station
Lower Ash Pond CCR Monitoring Well Network**

Background Lower Ash Pond CCR Monitoring Wells – Columbia Aquifer	Downgradient Lower Ash Pond CCR Monitoring Wells – Columbia Aquifer		
MW-29U	MW-20	MW-25	MW-33
MW-35S	MW-21	MW-26	MW-34
	MW-22	MW-27	MW-B40A
	MW-23	MW-28	MW-B50
	MW-24	MW-32	

Table TM6-13: Chesterfield Power Station Upper Ash Pond CCR Monitoring Well Networks

Background Upper Ash Pond CCR Monitoring Wells – Columbia Aquifer	Downgradient Upper Ash Pond CCR Monitoring Wells – Columbia Aquifer			Background Upper Ash Pond CCR Monitoring Wells – Potomac/Triassic Aquifers	Downgradient Upper Ash Pond CCR Monitoring Wells – Potomac/ Triassic Aquifers		Background Upper Ash Pond CCR Monitoring Wells – Bedrock Aquifer	Downgradient Upper Ash Pond CCR Monitoring Wells – Bedrock Aquifer
MW-29U	MW-1	MW-9R	MW-16	MW-30U (Potomac)	MW-1D	MW-14	MW-31U	MW-1DD
MW-35S	MW-2	MW-11	MW-17S	MW-35D (Potomac)	MW-4	MW-16D	MW-35B	MW-6DD
	MW-3	MW-12	MW-B31	MW-29U (Columbia)	MW-6	MW-3D		MW-16DD
	MW-5	MW-13	MW-B32	MW-35S (Columbia)	MW-7	MW-6D		
	MW-8R	MW-15			MW-10			

In addition to the background and downgradient wells for the compliance network, Dominion maintains several observation wells that are used for periodic water level gauging and water quality assessments. These wells have not been included in this assessment.

As part of the CCR/VSWMR compliance monitoring program, the wells are sampled for the CCR analytes listed in Table TM6-2 on page 1-3. Additional VSWMR and Virginia Water Control Board constituents include the following:

- VSWMR assessment constituents: copper, cyanide, nickel, silver, sulfide, tin, thallium, vanadium, and zinc
- Virginia Water Control Board Constituents: ammonia and manganese

All of the metals constituents for the CCR/VSWMR compliance monitoring are being analyzed as total metals, as opposed to the VPDES program, which monitors dissolved metals.

4.4.2 Groundwater Quality

According to the 2016 annual report for the Upper Ash Pond VPDES monitoring, one dissolved metal (manganese) and several water quality parameters (ammonia, sulfate, total dissolved solids [TDS], total hardness, conductivity, and pH) were greater than background levels (or lower in the case of pH; Dominion, 2016). However, a review of historic reports indicates selenium was the only constituent detected above site-specific action levels in VPDES program samples collected between 2002 and 2017. This action level is below the USEPA MCL for selenium.

According to the VPDES permit, statistical analysis (comparison of data to background) is not employed for data from the Lower Ash Pond monitoring network. Additionally, action levels have not been established for monitoring wells associated with the Lower Ash Pond.

Groundwater analytical results for CCR wells are summarized on Tables TM6-14 through TM6-18. The CCR baseline data set includes eight monitoring events dating back to October 2016. For the purposes of this discussion, a preliminary background value was calculated from background well data for each CCR/VSWMR constituent listed in Section 4.4.1.

The quantitative evaluations in the subsections below summarize groundwater quality using CCR compliance data (as opposed to the VPDES dataset) for the following reasons:

- CCR groundwater data are analyzed for total metals, which is a more conservative measure of constituent concentrations than the dissolved metals analysis used for VPDES data.
- The CCR groundwater data set is more representative of current conditions.
- Many of the VPDES network wells were installed during early investigations of site conditions and not for the explicit function of monitoring ash pond impacts to groundwater. The monitoring well network used for the CCR compliance sampling was designed and constructed to meet the requirements of the CCR Rule.

4.4.2.1 Lower Ash Pond

The Lower Ash Pond CCR compliance dataset is provided in Table TM6-14 located at the end of Section 4. These data show that each detection monitoring constituent was detected in downgradient wells at levels above preliminary background. If these detections are validated during future sampling events, the CCR Rule will direct the Lower Ash Pond into assessment monitoring.

Several CCR assessment monitoring constituents have been detected above preliminary background levels, and arsenic and combined radium were detected above MCLs. If these detections are validated during future sampling events, the CCR Rule will direct the Lower Ash Pond into corrective measures.

Several VSWMR assessment constituents were detected in downgradient wells at concentrations above background levels. Additionally, Virginia Water Control Board constituents ammonia and manganese have been detected at concentrations above background levels.

4.4.2.2 Upper Ash Pond – Columbia Aquifer

The Upper Ash Pond Columbia Aquifer CCR baseline dataset is provided in Table TM6-15 located at the end of Section 4. These data show that detection monitoring constituents boron, calcium, chloride, fluoride, pH, sulfate, and TDS have been detected in downgradient wells at levels above preliminary background. If these detections are validated during future sampling events, the CCR Rule will direct the Upper Ash Pond into assessment monitoring.

Several CCR assessment monitoring constituents have been detected above background levels, and arsenic, beryllium, and radium have been detected above MCLs. If these detections are validated during future sampling events, the CCR Rule will direct the Upper Ash Pond into corrective measures. However, beryllium has been detected above the MCL only once during the eight rounds of background monitoring, and these results may not be indicative of current groundwater conditions.

VSWMR assessment constituents nickel, tin, and vanadium have been detected above background levels; however, tin and vanadium were detected at levels above background only one to two times each during the monitoring, and these results may not be indicative of current groundwater conditions. The Virginia Water Control Board constituent manganese has also been detected above background levels.

4.4.2.3 Upper Ash Pond – Potomac and Triassic Aquifers

The Upper Ash Pond Potomac and Triassic Aquifers CCR baseline dataset is provided in Table TM6-16 located at the end of Section 4. These data show that detection monitoring constituents boron, calcium, chloride, fluoride, pH, sulfate, and TDS have been detected in downgradient wells at levels above preliminary background. If these detections are validated during future sampling events, the CCR Rule will direct the Upper Ash Pond into assessment monitoring.

Several CCR assessment monitoring constituents have been detected above background levels. In addition, arsenic, beryllium, chromium, and radium have been detected above MCLs. If these detections are validated during future sampling events, the CCR Rule will direct the Upper Ash Pond into corrective measures. However, chromium has been detected above the MCL only once during CCR background monitoring (in October 2016), and these results may not be indicative of current groundwater conditions.

Several VSWMR assessment constituents have been detected above background levels. However, cyanide, sulfide, and tin have been detected at levels above background only once to twice each over the course of groundwater monitoring, and these results may not be indicative of current groundwater conditions. No Virginia Water Control Board constituents have been detected above background.

4.4.2.4 Upper Ash Pond – Bedrock Aquifer

The Upper Ash Pond Bedrock Aquifer compliance dataset is provided in Table TM6-17 located at the end of Section 4. These data show that detection monitoring constituents boron, calcium, chloride, fluoride, pH, and TDS have been detected in downgradient wells at levels above preliminary background. If these detections are validated during future sampling events, the CCR Rule will direct the Upper Ash Pond Bedrock Aquifer to conduct assessment monitoring.

CCR assessment monitoring constituents cobalt, lead, and lithium have been detected above background levels. Beryllium was detected above the MCL in one well only during the first round of background sampling, and therefore may not be representative of current groundwater conditions. If these detections are validated during future sampling events, the CCR Rule will direct the Upper Ash Pond Bedrock Aquifer into corrective measures.

VSWMR constituents nickel, silver, vanadium, and zinc have been detected in downgradient wells at concentrations above background levels. One Virginia Water Control Board constituent (manganese) has been detected at concentrations above background levels.

4.4.3 Surface Water Monitoring

Two surface water sampling events were conducted along the James River for CCR-related metals constituents. The first event (June 2016) included eight sampling locations, and the second event (April 2017) included five sampling locations. Sampling locations are indicated on Figure TM6-9.

4.4.4 Surface Water Quality

As summarized in Table TM6-18 located at the end of Section 4, laboratory-analyzed constituents were below Virginia Surface Water Quality Standards for freshwater aquatic life and human health during both surface water sampling events.

4.5 Summary of Findings

The Chesterfield Power Station is located in Chester, VA, between the historic channel of the James River to the south and the new channel of the James River to the north. The station has been in operation since at least 1952 and has recently converted to dry ash handling. There are two coal ash ponds located at the station: the Lower and Upper Ash Ponds, constructed in 1964 and 1983, respectively. Settled CCR in the Lower Ash Pond has been excavated, dewatered, and transferred to the Upper Ash Pond for permanent storage.

The uppermost sediments at the station are alluvial materials associated with the present day James River. Ground surface topography in the area of the station is typically level, with some slightly sloping grades adjacent to the banks of the James River, and groundwater in the uppermost aquifer generally flows radially from beneath the Lower and Upper Ash Ponds.

Recent VPDES monitoring at the Upper Ash Pond indicates VPDES parameters at concentrations greater than background. A review of historic reports indicates selenium was the only constituent detected above site-specific action levels in VPDES program samples collected between 2002 and 2017; however, selenium concentrations are below the MCL.

Groundwater sampling has demonstrated that there are detections above background levels of several CCR constituents in the uppermost aquifers downgradient of the Lower and Upper Ash Ponds. Bedrock groundwater quality has also been evaluated downgradient of the Upper Ash Pond, where several constituents have been detected at levels above background. Arsenic and combined radium (isotopes 226 and 228) have been detected above MCLs at the Lower Ash Pond, and arsenic, beryllium, chromium, and combined radium have been detected above MCLs at the Upper Ash Pond. Chromium detections above the MCL were limited to the first round of background sampling, and therefore may not be representative of current groundwater conditions (there have been no detections above the MCL since fall 2016). Additionally, arsenic was detected above MCL in a background well, indicating that there may be a naturally occurring source of arsenic at the station.

The surface water samples collected from the James River in June 2016 and April 2017 indicated analytical results below Virginia Surface Water Quality Standards for freshwater aquatic life and human health.

Tables

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Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-29U (Background)							
			10/7/2016	11/16/2016	1/9/2017	2/20/2017	4/3/2017	5/15/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.1	0.040B	0.018B	<0.10	0.0096B	0.0092J	0.013J	<0.0500	<0.0500
Calcium	---	63.9	54	52	38	51	42	48	58.0	63.9
Chloride	---	46	17	16	20	26	46	33	26.3	21.4
Fluoride	NA	0.37	0.079J	0.16J	0.12	0.13	0.23J+	0.19	0.22	0.14
pH (std unit)	---	4.56 - 6.80	6.07	6.05	5.22	6.34	6.04	6.04	5.72	6.29
Sulfate	---	10.86	3.5	1.6	7.7	3.1	5.1	1.4	<1.0	<1.0
TDS	---	450	350	330	310	360	450J+	350	365	346
CCR Assessment Constituents										
Antimony	0.006	---	0.00047J	<0.0020	<0.0020	<0.0020	0.00051J+	<0.0020	0.00013J	<0.0050
Arsenic	0.010	---	0.0021J	0.0093	0.0037J	0.0072	0.0091	<u>**0.013**</u>	<u>**0.0178**</u>	<u>**0.0146**</u>
Barium	2	---	0.20	0.27	0.18	0.24	0.21	0.28	0.318	0.275
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	0.00043J	<0.0010	<0.0010	0.00033J	0.00090	<0.00080
Chromium	0.1	---	0.0020B	0.0016J	0.00057B	0.00075J	0.00084J+	<0.0020	0.0014	0.0018J+
Cobalt	---	0.0086	0.0034	0.0039	0.0027	0.0041	0.0069J+	0.0044	0.0038	0.0036
Fluoride	4.0	---	0.079J	0.16J	0.12	0.13	0.23J+	0.19	0.22	0.14
Lead	---	0.001	0.00051B	0.00079J	<0.0010	0.00019B	0.00028J+	0.00047J	<0.00010	<0.0010
Lithium	---	0.05	<0.050	<0.050	0.00048B	0.00051J	0.0010J+	<0.0080	0.00041J	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0010J	0.0011J	0.00074J	0.0012B	0.0011J	0.0019J	0.0064	0.0050J
Radium 226/228 (pCi/L)	5	---	0.909	1.00	0.709	1.24	0.476	0.693	<1.72	1.53
Selenium	0.05	---	0.00052J	0.00050J	<0.0050	<0.0050	0.00081J+	0.00089J	0.0012J+	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0034B	0.0016B	0.00050J	0.00043B	0.00086J+	<0.0020	0.0012J+	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0039B	0.0040	0.0025B	0.0021B	0.0015J	0.0015J	0.0020	<0.0050
Silver	---	0.005	<0.0010	<0.0010	0.00083J	<0.0010	0.00013J	<0.0010	<0.00050	<0.0050
Sulfide	---	3	<3.0	<3.0	2.4J	<3.0	1.2J	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0028J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.0014J	0.0022J	0.00082J	0.0014J	0.0017J	0.0023J	0.0040J	0.0030J
Zinc	---	0.054	0.054	0.020	0.018J	0.0068J	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	15	15	12	15	9.2	12	14.1	15.0
Manganese	---	6.8	4.7	4.4	3.3	4.4	6.80J+	5.1	4.74	4.20

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>**Bolded and Underlined**</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-35S (Background)							
			1/12/2017	2/23/2017	3/16/2017	4/7/2017	5/3/2017	6/6/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	0.011J+	<0.0500	<0.0500
Calcium	---	63.9	6.0	5.5	5.6	5.5	4.2	5.8	5.47	5.59
Chloride	---	46	8.2	8.5	8.5	9.3	9.2	9.4	9.1	10.3
Fluoride	NA	0.37	0.024B	0.029B	0.042B	0.027J	<0.050	0.028J	<0.10	<0.10
pH (std unit)	---	4.56 - 6.80	5.25	5.16	5.58	5.21	5.37	5.59	5.52	5.37
Sulfate	---	10.86	5.0	5.6	5.3	5.5	5.2	5.8	4.4	5.5
TDS	---	450	99B	99	93	86	89	78	82	66
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.0011J	0.0017B	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	<0.0050	0.00041J	0.00051J	<0.0050	<0.0050	<0.0010	<0.0010
Barium	2	---	0.048	0.042	0.042	0.041	0.028	0.040	0.0430	0.0384
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00034J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.0013B	0.00034B	<0.0020	0.00038J	<0.0020	<0.0020	0.0012J	<0.0050
Cobalt	---	0.0086	0.0054	0.0038	0.0036	0.0030	0.0017	0.0019	0.00094J	0.00082J
Fluoride	4.0	---	0.024B	0.029B	0.042B	0.027J	<0.050	0.028J	<0.10	<0.10
Lead	---	0.001	0.00046B	0.00018B	0.00031B	0.00037J	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0015J	0.0017B	0.0016J	0.0019J	0.0021J	0.0024J	0.0015J	0.0024J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	0.00058J	0.00068J	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	0.841	0.615	0.658	0.358	0.554	<0.324	<1.24	<1.12
Selenium	0.05	---	0.00062J	0.00055J	0.00089J	0.0011J	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0020B	0.00070J	0.00066B	0.00069B	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	0.0034J	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0053	0.0031	0.0032B	0.0033B	0.0022	0.0027	<0.0050	<0.0050
Silver	---	0.005	<0.0010	0.000077J	0.00014J	0.000036J	0.00039J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	2.7J+	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	0.0070B	0.0077J	0.0070J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00055J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.013B	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.560J+	<0.10	<0.10
Manganese	---	6.8	0.40	0.29	0.27	0.23	0.16	0.18	0.140	0.101

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-20 (Downgradient CCR Well)							
			10/7/2016	11/15/2016	1/12/2017	2/22/2017	4/5/2017	5/17/2017	6/22/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**0.71**	**0.64**	**0.68**	**0.71**	**0.62**	**0.74**	**0.740**	**0.753**
Calcium	---	63.9	53	**65**	**80**	**66**	54	**69**	16.0	**69.5**
Chloride	---	46	**64**	**82**	**100**	**99**	**100**	**86**	**82.6**	**66.6**
Fluoride	NA	0.37	0.059B	0.10J	0.10	0.13	0.12	0.13	0.14	0.052J
pH (std unit)	---	4.56 - 6.80	**4.54**	4.83	4.72	4.69	4.56	4.72	5.00	4.77
Sulfate	---	10.86	**260**	**350**	**380**	**290**	**250**	**320**	**350**	**294**
TDS	---	450	**530**	**620**	**720**	**630**	**520**	**600**	**641**	**633**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	0.0017J+	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00040J	0.00061J	0.0010J	0.00070J	0.00084J	0.00083J	<0.0010	<0.0010
Barium	2	---	0.028	0.032	0.035	0.032	0.034	0.032	0.0307	0.0270
Beryllium	0.004	---	0.00088J	0.0013	0.0013	0.0013	0.0012	0.0015	0.0010	0.00071J
Cadmium	0.005	---	0.0011	0.0017	0.0021	0.0021	0.0022	0.0024	0.0019	0.0015
Chromium	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.16**	**0.24**	**0.26**	**0.20**	**0.17**	**0.24**	**0.219**	**0.170**
Fluoride	4.0	---	0.059B	0.10J	0.10	0.13	0.12	0.13	0.14	0.052J
Lead	---	0.001	0.00031B	0.00036J	0.00077B	0.00062B	0.00067J+	0.00079J	<0.0010	<0.0010
Lithium	---	0.05	0.0078J	0.0089J	0.0094	0.0099	0.011	0.011	<0.0250	0.0067J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	<0.010	0.00067J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	0.751	1.22	1.44	0.817	0.436	1.15	1.68	<1.51
Selenium	0.05	---	0.00091J	0.0012J	0.0033J	0.00096J	0.0020J	0.0015J	<0.0050	<0.0050
Thallium	0.002	---	0.00038J	0.00053J	0.00057J	0.00054J	0.00055J	0.00061J	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00070B	0.0014J	0.0026B	0.0030B	0.0033J+	0.0030	<0.0050	0.0013J
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0051J	<0.0080
Nickel	---	0.0076	**0.053**	**0.054**	**0.060**	**0.054**	**0.049**	**0.063**	**0.0680**	**0.0588**
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0069J	0.0033J	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0028J
Zinc	---	0.054	**0.073**	**0.11**	**0.12B**	**0.11**	**0.096**	**0.12**	**0.112**	**0.0820**
VPDES Parameters										
Ammonia	---	15	<2.0	1.0	<2.0	1.4J	1.1J	1.4J	1.2	1.0
Manganese	---	6.8	**8.3**	**13**	**16**	**13B**	**12**	**15**	**15.0**	**9.16**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-21 (Downgradient CCR Well)							
			10/4/2016	11/15/2016	1/12/2017	2/22/2017	4/5/2017	5/17/2017	6/22/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**0.47**	**0.48**	**0.47**	**0.38**	**0.38**	**0.38**	**0.495**	**0.634**
Calcium	---	63.9	61	57	56	46	46	45	58.8	**85.8**
Chloride	---	46	**99**	**87**	**87**	**84**	**86**	**80**	**81**	1.9
Fluoride	NA	0.37	**0.72**	0.079J	0.058B	0.058	0.064	0.069	0.082J	0.13
pH (std unit)	---	4.56 - 6.80	5.80	6.01	5.91	6.00	5.58	5.78	5.99	5.94
Sulfate	---	10.86	**200**	**160**	**150**	**140**	**150**	**140**	**148**	1.7
TDS	---	450	**490**	450	**460**	430	420	**470**	440	**524**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	0.0022J	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	0.0018J	0.0010J	0.0020J	0.0014J	0.0010J	0.00089J	0.00068J
Barium	2	---	0.083	0.081	0.074	0.068	0.063	0.061	0.0652	0.0732
Beryllium	0.004	---	<0.0010	0.00058J	<0.0010	<0.0010	<0.0010	<0.0010	0.00059J	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	0.00032J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.016**	**0.024**	**0.022**	**0.025**	**0.023**	**0.022**	**0.0170**	**0.0145**
Fluoride	4.0	---	0.72	0.079J	0.058B	0.058	0.064	0.069	0.082J	0.13
Lead	---	0.001	<0.0010	<0.0010	0.00027B	0.00019B	0.00054J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	<0.050	0.0027J	0.0010B	0.0020J	0.0023J	0.0019J	0.0025J	0.0015J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0011J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<0.353	1.08	0.906	0.527	<0.344	0.553	<1.31	<1.23
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	0.0013J	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	<0.0020	<0.0020	0.00040J+	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	**0.037**	<0.010	0.0040J	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	**0.019**	**0.012**	**0.016**	**0.017**	**0.016**	**0.016**	**0.0152**	**0.0136**
Silver	---	0.005	<0.0010	<0.0010	<0.0010	0.000085J	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0095J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0064J	0.011J	0.011B	0.012J	0.013J	<0.020	0.0092J	0.0065J
VPDES Parameters										
Ammonia	---	15	<2.0	0.34	<2.0	<2.0	<2.0	0.56J	0.28	0.44
Manganese	---	6.8	6.5	6.0	4.4	3.6	3.1	3.2	4.14	5.85

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-22 (Downgradient CCR Well)							
			10/4/2016	11/15/2016	1/12/2017	2/22/2017	4/5/2017	5/17/2017	6/22/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**0.53**	**0.51**	**0.54**	**0.53**	**0.51**	**0.52**	**0.562**	**0.520**
Calcium	---	63.9	29	28	30	29	28	30	28.1	29.4
Chloride	---	46	27	28	28	26	27	26	27.6	26.9
Fluoride	NA	0.37	0.12J	0.070J	0.062	0.084	0.082	0.080	0.084J	<0.10
pH (std unit)	---	4.56 - 6.80	5.84	5.73	5.46	5.00	5.59	5.74	5.82	5.60
Sulfate	---	10.86	**15**	**17**	**17**	**16**	**18**	**17**	**18.7**	**17.7**
TDS	---	450	200	220	240	200	200	180	197	202
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	0.00076J+	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00042J	0.00050J	0.00080J	0.0010J	0.00063J	0.00085J	<0.0010	<0.0010
Barium	2	---	0.12	0.12	0.13	0.14	0.13	0.14	0.136	0.116
Beryllium	0.004	---	<0.0010	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00035J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0041	0.0044	0.0065	**0.0091**	0.0083	0.0079	0.0038	0.0032
Fluoride	4.0	---	0.12J	0.070J	0.062	0.084	0.082	0.080	0.084J	<0.10
Lead	---	0.001	0.00024B	0.00018J	0.00023B	<0.0010	0.00029J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	<0.050	0.0028J	0.0020	0.0027B	0.0027J	0.0030J	0.0042J+	0.0030J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0044J	<0.0050
Radium 226/228 (pCi/L)	5	---	0.741	0.733	1.33	0.674	0.430	1.18	1.30	1.49
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00055B	0.00055J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0074	0.0070	**0.0082**	**0.0081**	0.0075	**0.0084**	0.0072	0.0072
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00013J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	0.0046J
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0091J	0.0090J	0.0080B	0.0075J	0.0065J	<0.020	0.0100	0.0061J
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.84J	<0.10	<0.10
Manganese	---	6.8	0.45	0.48	0.74	1.1	0.92	0.81	0.524	0.423

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-23 (Downgradient CCR Well)							
			10/3/2016	11/16/2016	1/12/2017	2/23/2017	4/6/2017	5/17/2017	6/22/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	0.014J	0.019B	0.012B	0.011J	0.016J+	0.013J	<0.0500	<0.0500
Calcium	---	63.9	60	55	49	55	61	60	**73.2**	**67.5**
Chloride	---	46	2.3	2.3	2.4	2.3	2.7	2.5	2.6	2.3
Fluoride	NA	0.37	0.28	0.31	0.32	0.29	**0.39J+**	**0.39**	0.33	0.27
pH (std unit)	---	4.56 - 6.80	6.52	6.43	6.23	6.02	6.20	6.32	6.42	6.48
Sulfate	---	10.86	2.3	2.5	2.0	3.1	4.4	4.5	3.1	2.2
TDS	---	450	290	280	280	280	310	280	315	326
CCR Assessment Constituents										
Antimony	0.006	---	0.00027J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<u>**0.014**</u>	<u>**0.016**</u>	<u>**0.015**</u>	<u>**0.013**</u>	<u>**0.014**</u>	<u>**0.014**</u>	<u>**0.0190**</u>	<u>**0.0152**</u>
Barium	2	---	0.21	0.18	0.15	0.16	0.17	0.17	0.180	0.159
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.0023	0.0011J	0.0011B	0.00045J	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0031	0.0025	0.0021	0.0023	0.0021	0.0021	0.0023	0.0021
Fluoride	4.0	---	0.28	0.31	0.32	0.29	0.39J+	0.39	0.33	0.27
Lead	---	0.001	0.0010	0.00050J	0.00059B	0.00023B	0.00016J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0099J	<0.050	0.0014J	0.0016B	0.0015J	0.0017J	0.0035J	0.0041J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0035J	0.0034J	0.0030J	0.0028J	0.0032J	0.0032J	0.0031J	<0.0050
Radium 226/228 (pCi/L)	5	---	1.41	<0.479	0.515	<0.435	0.176	<0.412	<0.969	<1.01
Selenium	0.05	---	0.00058J	<0.0050	0.00054J	0.00048J	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00060J+	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0029B	0.0042	0.0015B	0.00057J	<0.0020	<0.0020	0.0040J	<0.0050
Cyanide	---	0.01	<0.010	0.0029J	<0.010	0.0026J	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0033	0.0023B	0.0016B	0.0013J	0.0010J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	<0.0010	0.0013	0.000053J	0.00037J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.0039J	0.0017J	0.0021J	0.00065J	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.022B	0.023B	<0.020	<0.020	<0.020	<0.020	0.0108	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	0.50	<2.0	<2.0	<2.0	1.7J	0.45	0.41
Manganese	---	6.8	6.8B	**7.4**	5.9	6.7	**7.6J+**	**7.5**	**7.56**	**7.04**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>**Bolded and Underlined**</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-24 (Downgradient CCR Well)							
			10/7/2016	11/15/2016	1/11/2017	2/22/2017	4/6/2017	5/16/2017	6/21/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	**0.76**	**0.70**	**0.66**	**0.72**	**0.69**	**0.69**	**0.698**	**0.677**
Calcium	---	63.9	35	33	30	36	36	37	39.2	36.5
Chloride	---	46	34	37	39	40	44	44	44.2	41.7
Fluoride	NA	0.37	0.060B	0.11J	0.10	0.13	0.11	0.11	0.13	0.079J
pH (std unit)	---	4.56 - 6.80	6.68	6.27	**6.84**	6.64	6.76	6.72	6.74	6.79
Sulfate	---	10.86	0.55J	0.92J	<1.0	<1.0	<1.0	<1.0	0.54J	<1.0
TDS	---	450	230	230	260	230	230	230	218	231
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0075	0.0082	0.0080	0.0081	0.0088	0.0078	0.0091	0.0096
Barium	2	---	0.31	0.30	0.27	0.32	0.32	0.34	0.321	0.312
Beryllium	0.004	---	<0.0010	0.0022	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.0013J	0.00071J	0.00061B	0.00029J	0.00030J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0017	0.0016	0.0017	0.0017	0.0017	0.0018	0.0016	0.0016
Fluoride	4.0	---	0.060B	0.11J	0.10	0.13	0.11	0.11	0.13	0.079J
Lead	---	0.001	0.00098B	0.00039J	0.00041B	0.00016B	0.00026J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	<0.050	<0.050	0.00050B	<0.0080	<0.0080	<0.0080	0.0011J+	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0026J	0.0027J	0.0024J	0.0024J	0.0025J	0.0025J	0.0031J	0.0026J
Radium 226/228 (pCi/L)	5	---	<0.649	0.744	0.437	0.640	0.602	<0.490	<1.49	1.70J+
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0035J	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0062B	0.00038J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0031B	0.0012J	0.0014B	0.0013J	0.0013J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	<0.0010	0.00045J	0.00048J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.0023J	0.0012J	0.0010J	<0.0050	0.00078J	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0063J	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	**27**	**25**	**28**	**26**	**27**	**27**	**25.4**	**25.3**
Manganese	---	6.8	0.13	0.12	0.11	0.12	0.12	0.13	0.116	0.116

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-25 (Downgradient CCR Well)							
			10/12/2016	11/16/2016	1/10/2017	2/23/2017	4/5/2017	5/17/2017	6/22/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	0.037	0.0025J	0.013J	0.012J	0.015J	0.019J	<0.0500	<0.0500
Calcium	---	63.9	28	29	31	29	30	30	34.1	44.5
Chloride	---	46	**66**	16	9.9	12	13	11	14	6.1
Fluoride	NA	0.37	0.20	0.30	0.31	0.28	0.36J+	**0.42**	0.36	**0.38**
pH (std unit)	---	4.56 - 6.80	6.42	6.38	6.42	6.21	**6.95**	6.26	6.30	6.42
Sulfate	---	10.86	**100**	**15**	5.6	9.0	**11**	8.3	**11.1**	2.4
TDS	---	450	400	220	230	210	210	210	221	271
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	0.00030J	<0.0020	0.00062J	<0.0050	<0.0050
Arsenic	0.010	---	0.0035J	0.0082	0.0083	0.0051	0.0068	0.0067	0.0091	**<u>0.0198</u>**
Barium	2	---	0.12	0.13	0.11	0.082	0.11	0.084	0.112	0.132
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00043J	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.0011J	0.0016J	0.00085B	0.00045J	0.00053J	<0.0020	0.0012J	<0.0050
Cobalt	---	0.0086	0.00052J	0.0011	0.00085J	0.00063J	0.00071J	0.00099J	0.0010	0.0011
Fluoride	4.0	---	0.20	0.30	0.31	0.28	0.36J+	0.42	0.36	0.38
Lead	---	0.001	0.00069B	**0.0013**	**0.0011B**	0.00046B	0.00060J	0.00064J	**0.0015**	<0.0010
Lithium	---	0.05	0.0076J	0.0035J	0.0026J	0.0024J	0.0030J	0.0025J	0.0048J	0.0022J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	0.0029J	0.0024J	0.0021J	0.0024J	0.0028J	<0.0050	0.0046J
Radium 226/228 (pCi/L)	5	---	0.719	1.74	1.41	<0.430	0.371	<0.406	<1.31	<1.12
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	0.00051J	0.0010J	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0014B	0.0017B	0.0016B	<0.0020	0.00085J+	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	**0.011**	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0011B	0.0023B	0.0018B	0.00054J	0.0014J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.0022	0.00043J	<0.0010	0.000065J	<0.0010	0.000064J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.0037J	<0.0050	<0.0050
Vanadium	---	0.005	0.0014J	0.0025J	0.0012J	0.00066J	0.00076J	<0.0050	<0.0050	0.0028J
Zinc	---	0.054	<0.020	0.011B	0.015J	<0.020	<0.020	<0.020	0.0056J	<0.0100
VPDES Parameters										
Ammonia	---	15	11	3.0	2.2	2.0	1.7J	2.8	2.2	1.5
Manganese	---	6.8	1.9	3.2	3.4	3.1	3.1	3.5	3.54	4.87J+

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-26 (Downgradient CCR Well)							
			10/4/2016	11/15/2016	1/10/2017	2/23/2017	4/5/2017	5/16/2017	6/22/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	0.012J	0.017B	0.013J	0.013J	0.014J+	0.0015J	<0.0500	<0.0500
Calcium	---	63.9	6.0	5.8	5.7	6.5	7.7J+	7.2	7.93	7.76
Chloride	---	46	7.4	7.9	7.8	7.6	8.2	8.0	7.9	6.9
Fluoride	NA	0.37	0.15J	0.066J	0.069	0.061	0.095J+	0.087	0.10	0.068J
pH (std unit)	---	4.56 - 6.80	5.46	5.32	5.74	5.46	5.88	5.80	5.77	5.84
Sulfate	---	10.86	3.8	3.4	3.8	4.9	9.5	9.6	9.1	6.2
TDS	---	450	98	89	110B	100	100	96	103	116
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	0.00051J	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00089J	0.00079J	0.00055J	0.00061J	0.00078J	<0.0050	0.0014	0.0017
Barium	2	---	0.033	0.027	0.026	0.030	0.036J+	0.034	0.0342	0.0314
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00050J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0046	0.0032	0.0022	0.0039	0.0049	0.0039	0.0038	0.0041
Fluoride	4.0	---	0.15J	0.066J	0.069	0.061	0.095J+	0.087	0.10	0.068J
Lead	---	0.001	0.00037B	<0.0010	0.00026B	0.00024B	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0034J	0.0034J	0.0030J	0.0028J	0.0031J	0.0031J	0.0039J+	0.0036J+
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	0.453	<0.567	0.808	<0.435	<0.327	<0.604	<1.31	<1.53
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00071B	<0.0020	0.00051B	0.00062J	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0024	0.0018J	0.0019B	0.0020	0.0022	0.0019J	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	0.000051J	0.000079J	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	0.0040J	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00082J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0083J	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	0.094J	<2.0	<2.0	<2.0	<2.0	0.56J	0.25	0.22
Manganese	---	6.8	0.38	0.27	0.22	0.38	0.54J+	0.46	0.470	0.465

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-27 (Downgradient CCR Well)							
			10/4/2016	11/15/2016	1/9/2017	2/22/2017	4/5/2017	5/16/2017	6/22/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	**0.39**	**0.39**	**0.40**	**0.41**	**0.42**	**0.39**	**0.414**	**0.383**
Calcium	---	63.9	19	19	20	19	19	19	21.6	20.5
Chloride	---	46	25	26	26	25	27	26	27.2	24.7
Fluoride	NA	0.37	0.037B	0.045J	0.037B	0.054B	0.055	0.049J	<0.10	<0.10
pH (std unit)	---	4.56 - 6.80	5.86	5.38	5.79	5.73	5.29	5.73	5.45	5.83
Sulfate	---	10.86	**37**	**35**	**35**	**32**	**34**	**32**	**32.5**	**27.0**
TDS	---	450	210	190	200	210	200	180	175	183
CCR Assessment Constituents										
Antimony	0.006	---	0.00087J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00077J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0010	<0.0010
Barium	2	---	0.064	0.068	0.067	0.073	0.072	0.075	0.0763	0.0683
Beryllium	0.004	---	0.0030	0.00073J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00055J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00071J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.012**	**0.013**	**0.012**	**0.012**	**0.012**	**0.012**	**0.0113**	**0.0124**
Fluoride	4.0	---	0.037B	0.045J	0.037B	0.054B	0.055	0.049J	<0.10	<0.10
Lead	---	0.001	0.00067B	<0.0010	<0.0010	<0.0010	0.00020J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0035J	<0.050	0.0018J	0.0019J	0.0021J	0.0021J	0.0033J	0.0024J
Mercury	0.002	---	<0.00020	<0.00020	0.00011J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.00082J	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<u>**5.55**</u>	<u>**6.52**</u>	<u>**5.18**</u>	4.47	4.08	3.96	4.88	<u>**5.12J+**</u>
Selenium	0.05	---	0.0012J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	0.00035J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00080B	0.00036J	0.00048J	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	0.0042J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	**0.0099**	**0.0099**	**0.011**	**0.011**	**0.011**	**0.011**	**0.0125**	**0.0124**
Silver	---	0.005	0.000046J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	2.0J	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	0.00043J	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00060J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	0.062J	<2.0	<2.0	<2.0	0.84J	<0.10	<0.10
Manganese	---	6.8	0.22	0.21	0.21	0.20	0.21	0.21	0.210	0.210

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>**Bolded and Underlined**</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-28 (Downgradient CCR Well)							
			10/12/2016	11/15/2016	1/12/2017	2/22/2017	4/5/2017	5/17/2017	6/22/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**0.16**	**0.13**	**0.13**	**0.13**	**0.12**	**0.12**	**0.116**	**0.116**
Calcium	---	63.9	29	25	26	28	28	28	32.6	36.1
Chloride	---	46	16	16	19	19	19	18	19.5	18.2
Fluoride	NA	0.37	**0.55**	**0.62**	**0.60**	**0.62**	**0.65J+**	**0.62**	**0.57**	**0.40**
pH (std unit)	---	4.56 - 6.80	**7.23**	**7.16**	**7.11**	**6.84**	**7.15**	**7.23**	**7.17**	**6.96**
Sulfate	---	10.86	**26**	**22**	**23**	**23**	**26**	**25**	**26.7**	**29.7**
TDS	---	450	180	160	170	190	160	150	167	168
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.00052J	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	**0.12**	**0.14**	**0.15**	**0.15**	**0.14**	**0.13**	**0.165**	**0.177**
Barium	2	---	0.044	0.038	0.039	0.041	0.041	0.040	0.0433	0.0440
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0211	<0.0050
Cobalt	---	0.0086	0.0041	0.00030J	0.00022J	0.00024J	0.00019J	0.00024J	0.00076J	0.00011J
Fluoride	4.0	---	0.55	0.62	0.60	0.62	0.65J+	0.62	0.57	0.40
Lead	---	0.001	0.00025B	<0.0010	0.00046B	0.00022	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.010J	0.011J	0.012	0.012	0.015	0.013	0.0134J	0.0157J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	**0.020**	**0.022**	**0.022**	**0.020**	**0.019**	**0.018**	**0.0170**	**0.0154**
Radium 226/228 (pCi/L)	5	---	0.830	<0.427	0.124	<0.385	0.436	<0.401	<1.05	<1.41
Selenium	0.05	---	<0.0050	<0.0050	0.00052J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00080B	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	0.0021J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0035	<0.0020	0.00058B	0.00059J	0.00051J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.000069J	<0.0050	<0.0050
Sulfide	---	3	1.1B	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	0.0036J	0.0040J	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	**0.017**	**0.021**	**0.019**	**0.019**	**0.018**	**0.018**	**0.0178**	**0.0193**
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	0.34	<2.0	<2.0	1.4J	0.56J	0.36	0.33
Manganese	---	6.8	0.46	0.30	0.26	0.27	0.27	0.28	0.279	0.286

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-32 (Downgradient CCR Well)							
			10/3/2016	11/16/2016	1/12/2017	2/23/2017	4/6/2017	5/17/2017	6/22/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	0.016J	0.025B	0.020B	0.017J	0.017J	0.083J	<0.0500	<0.0500
Calcium	---	63.9	21	25	27	28	24	27	31.2	29.5
Chloride	---	46	3.6	3.6	3.3	3.4	3.5	3.4	3.1	2.4
Fluoride	NA	0.37	0.26	0.29	0.32	0.33	**0.39J+**	**0.46**	**0.44**	0.28
pH (std unit)	---	4.56 - 6.80	6.10	6.25	6.14	6.09	6.11	6.36	6.47	6.26
Sulfate	---	10.86	4.3	6.0	6.4	6.2	5.0	5.6	4.5	2.9
TDS	---	450	170	170	220	190	170	130	181	206
CCR Assessment Constituents										
Antimony	0.006	---	0.00033J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0053	0.0041J	0.0069	0.0072	0.0062	0.010	**<u>0.0159</u>**	**<u>0.0161</u>**
Barium	2	---	0.093	0.11	0.12	0.11	0.094	0.11	0.123	0.108
Beryllium	0.004	---	0.00043J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00037J	<0.0020	<0.0020	0.00033J	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0030	0.0037	0.0036	0.0031	0.0026	0.0029	0.0033	0.0031
Fluoride	4.0	---	0.26	0.29	0.32	0.33	0.39J+	0.46	0.44	0.28
Lead	---	0.001	0.00065B	<0.0010	0.00026B	0.00019B	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0040J	<0.050	0.00078B	0.0012	0.0020J	0.0018J	0.0025J	0.0019J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0011J	0.00098J	0.0013J	0.0014J	0.0013J	0.0017J	0.0081	<0.0050
Radium 226/228 (pCi/L)	5	---	<0.349	0.550	0.512	<0.349	0.240	<0.436	<1.000	<1.52
Selenium	0.05	---	0.00060J	<0.0050	0.00050J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00060B	<0.0020	<0.0020	0.00055J	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.00094B	0.0010B	0.00091B	0.00091J	0.00043J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.000030J	<0.0010	0.000031J	0.00012J	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	1.1J	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0062J	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	0.60	1.1J	<2.0	<2.0	1.4J	1.2	1.2
Manganese	---	6.8	1.9B	2.5	2.4	2.5	2.3	2.3	2.44	2.18

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-33 (Downgradient CCR Well)							
			10/3/2016	11/15/2016	1/12/2017	2/22/2017	4/6/2017	5/17/2017	6/22/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	0.081	**0.11**	**0.14**	**0.13**	0.083J	0.071J	0.0638	0.0508
Calcium	---	63.9	28	29	28	29	28	27	28.8	27.4
Chloride	---	46	24	25	25	23	24	24	26.0	22.8
Fluoride	NA	0.37	0.092J	0.10J	0.091	0.12	0.12	0.12	0.13	0.085J
pH (std unit)	---	4.56 - 6.80	6.76	6.76	**6.83**	**7.05**	**7.10**	6.78	**6.91**	**6.83**
Sulfate	---	10.86	0.50J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
TDS	---	450	210	210	240	220	200	160	189	184
CCR Assessment Constituents										
Antimony	0.006	---	0.00028J	0.00069J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0090	0.0091	0.0091	0.0091	0.0090	0.0080	0.0094	0.0088
Barium	2	---	0.18	0.19	0.18	0.19	0.18	0.17	0.182	0.160
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00062J	0.00079J	0.00051B	0.00049J	0.00035J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0024	0.0029	0.0022	0.0024	0.0023	0.0018	0.0017	0.0020
Fluoride	4.0	---	0.092J	0.10J	0.091	0.12	0.12	0.12	0.13	0.085J
Lead	---	0.001	0.00049B	0.00041J	0.00026B	0.00016B	0.00017J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	<0.050	<0.050	<0.0080	<0.0080	<0.0080	<0.0080	0.0011J+	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0025J	0.0029J	0.0023J	0.0024J	0.0024J	0.0023J	0.0039J	0.0025J
Radium 226/228 (pCi/L)	5	---	0.581	<0.568	0.454	<0.439	0.338	0.511	<1.11	1.19J+
Selenium	0.05	---	0.00066J	0.00076J	0.00061J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00037B	0.00041J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0010B	0.00067J	0.00083B	0.00081J	0.00079J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	0.0039J	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00094J	0.0012J	0.00083J	0.00078J	0.00080J	0.00086J	<0.0050	0.0037J
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	**42**	**42**	**43**	**42**	**46**	**38**	**39.0**	**39.7**
Manganese	---	6.8	0.10B	0.12	0.10	0.11	0.11	0.10	0.0993	0.108

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-34 (Downgradient CCR Well)							
			10/12/2016	11/16/2016	1/10/2017	2/23/2017	4/5/2017	5/16/2017	6/22/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	**1.2**	**1.2**	**1.3**	**1.3**	**1.3**	**1.2**	**1.26**	**1.22**
Calcium	---	63.9	47	46	46	48	47	45	49.8	**85.1**
Chloride	---	46	**94**	**100**	**98**	**96**	**94**	**92**	**94.7**	**86.4**
Fluoride	NA	0.37	0.069B	0.067J	0.070	0.068	0.094J+	0.085	0.086J	0.059J
pH (std unit)	---	4.56 - 6.80	6.77	6.71	6.79	6.59	**7.24**	6.60	6.65	6.35
Sulfate	---	10.86	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
TDS	---	450	320	270	330	290	280	370	298	305
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	0.0010J	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0096	0.0094	0.0088	0.0096	0.0087	0.0078	0.0098	<u>**0.0171**</u>
Barium	2	---	0.22	0.22	0.22	0.23	0.22	0.22	0.234	0.215
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00049J	0.00037J	0.00037B	0.00068J	<0.0020	<0.0020	<0.0050	0.0032J+
Cobalt	---	0.0086	0.0023	0.0023	0.0024	0.0025	0.0023	0.0022	0.0021	0.0039
Fluoride	4.0	---	0.069B	0.067J	0.070	0.068	0.094J+	0.085	0.086J	0.059J
Lead	---	0.001	0.00027B	<0.0010	0.00029B	0.00035B	0.00023J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	<0.050	<0.050	0.00031J	<0.0080	<0.0080	<0.0080	0.0014J+	0.00075J+
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0015J	0.0016J	0.0015J	0.0021J	0.0016J	0.0016J	<0.0050	0.0029J
Radium 226/228 (pCi/L)	5	---	<0.444	<0.659	0.683	<0.388	0.667	<0.548	<1.28	1.09
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	0.00095J	<0.0050	<0.0050	<0.0050	0.0082
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00047B	<0.0020	0.00046B	0.00038J	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	0.0030J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.00090J	0.00077B	0.00084B	0.00097J	0.00073J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.00081J	0.000071J	<0.0010	0.00039J	0.000032J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	1.1B	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	0.0058J	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	0.00062J	0.00077J	0.00074J	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	**20**	**22**	**18**	**19**	**21**	**20**	**19.4**	**18.5**
Manganese	---	6.8	0.22	0.21	0.21	0.21	0.21	0.21	0.208	0.207

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>**Bolded and Underlined**</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-B40A (Downgradient CCR Well)							
			10/5/2016	11/17/2016	1/12/2017	2/22/2017	4/6/2017	5/16/2017	6/21/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	**1.7**	**1.6**	**1.3**	**1.4**	**1.3**	**1.4**	**1.73**	**1.81**
Calcium	---	63.9	49	52	41	48	48	46	51.7	47.9
Chloride	---	46	**200**	**170**	**140**	**140**	**140**	**140**	**144**	**133**
Fluoride	NA	0.37	0.36	0.097J	0.065	0.094	0.13	<0.25	0.11	0.070J
pH (std unit)	---	4.56 - 6.80	6.21	6.25	6.11	6.38	6.75	6.39	6.40	6.53
Sulfate	---	10.86	1.0	3.1	7.3	3.6	2.2	2.7J	7.9	0.66J
TDS	---	450	**520**	**490**	430	**480**	440	440	**468**	419
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.00034J	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0036J	0.0032J	0.0040J	0.0038J	0.0037J	0.0032J	0.0027	0.0072
Barium	2	---	0.32	0.34	0.27	0.31	0.29	0.28	0.290	0.302
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00036J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00051J	0.00066J	<0.0020	<0.0020	<0.0020	<0.0020	0.0016J	<0.0050
Cobalt	---	0.0086	0.00020J	0.00023J	0.00062J	0.00056J	0.00036J	0.00064J	0.00039J	0.00016J
Fluoride	4.0	---	0.36	0.097J	0.065	0.094	0.13	<0.25	0.11	0.070J
Lead	---	0.001	0.00030B	0.00018J	0.00038B	0.00018B	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0030J	<0.050	<0.0080	<0.0080	<0.0080	<0.0080	0.0016J	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	0.00071J	0.00099J	<0.010	0.00052J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.01	1.36	0.852	0.675	0.477	0.624	<1.42	1.24
Selenium	0.05	---	<0.0050	<0.0050	0.00051J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0013B	0.00040B	0.0015B	0.00080B	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.00097B	0.0011J	0.0011B	0.00081J	0.00078J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00056J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.017B	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	3.1	2.2	2.8	3.4	3.6	2.2	2.4	3.0
Manganese	---	6.8	4.3	5.2	4.1	5.6	5.4	5.1	4.65	3.85

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-14
CCR Compliance Data
Lower Ash Pond - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-B50 (Downgradient CCR Well)							
			10/12/2016	11/16/2016	1/10/2017	2/22/2017	4/5/2017	5/17/2017	6/22/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**0.37**	**0.35**	**0.36**	**0.39**	**0.38**	**0.37**	**0.377**	**0.333**
Calcium	---	63.9	**78**	**73**	**72**	**74**	**72**	**71**	**72.3**	**79.0**
Chloride	---	46	**54**	**49**	**50**	**48**	**48**	42	**48.5**	**46.3**
Fluoride	NA	0.37	0.19J	0.22	0.19	0.22	0.22	0.25	0.20	0.14
pH (std unit)	---	4.56 - 6.80	6.68	6.49	6.69	6.26	6.52	6.65	6.63	6.24
Sulfate	---	10.86	**75**	**83**	**79**	**72**	**74**	**71**	**69.8**	**64.4**
TDS	---	450	410	390	380	390	380	370	365	377
CCR Assessment Constituents										
Antimony	0.006	---	0.00053B	<0.0020	<0.0020	0.0011J	0.00057J+	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0079	0.0070	0.0059	0.0066	0.0053	0.0057	0.0058	0.0046
Barium	2	---	0.23	0.22	0.21	0.20	0.20	0.21	0.217	0.170
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	0.00071J	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00039J	<0.0010	<0.0010	0.00037J	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00043J	<0.0020	<0.0020	0.00052J	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0028	0.0025	0.0023	0.0024	0.0022	0.0024	0.0018	0.0019
Fluoride	4.0	---	0.19J	0.22	0.19	0.22	0.22	0.25	0.20	0.14
Lead	---	0.001	0.00051B	<0.0010	0.00060B	0.00054B	0.00036J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0035J	<0.050	0.00041J	0.00023J	0.00017J	<0.0080	0.0016J	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0022J	0.0018J	0.0014J	0.0021J	0.0016J	0.0017J	0.0038J	0.0034J
Radium 226/228 (pCi/L)	5	---	0.797	<0.552	1.23	0.498	0.576	0.379	1.17	1.44
Selenium	0.05	---	0.00097J	<0.0050	<0.0050	0.00080J	0.00069J	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	0.00030J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00050B	<0.0020	0.00043B	0.00062B	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	0.0046J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.00075J	0.00054B	0.00066B	0.00096J	0.00061B	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.000036J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	0.0027J	<0.010	<0.010	0.0062J	0.0024J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	3.6	3.7	3.9	3.9	3.9	3.9	3.7	3.8
Manganese	---	6.8	3.9	4.1	3.5	3.5	3.3	3.7	3.62	3.19

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-29U (Background)							
			10/7/2016	11/16/2016	1/9/2017	2/20/2017	4/3/2017	5/15/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.1	0.040B	0.018B	<0.10	0.0096B	0.0092J	0.013J	<0.0500	<0.0500
Calcium	---	63.9	54	52	38	51	42	48	58.0	63.9
Chloride	---	46	17	16	20	26	46	33	26.3	21.4
Fluoride	NA	0.37	0.079J	0.16J	0.12	0.13	0.23J+	0.19	0.22	0.14
pH (std units)	---	4.56-6.80	6.07	6.05	5.22	6.34	6.04	6.04	5.72	6.29
Sulfate	---	10.86	3.5	1.6	7.7	3.1	5.1	1.4	<1.0	<1.0
TDS	---	450	350	330	310	360	450J+	350	365	346
CCR Assessment Constituents										
Antimony	0.006	---	0.00047J	<0.0020	<0.0020	<0.0020	0.00051J+	<0.0020	0.00013J	<0.0050
Arsenic	0.010	---	0.0021J	0.0093	0.0037J	0.0072	0.0091	**<u>0.013</u>**	**<u>0.0178</u>**	**<u>0.0146</u>**
Barium	2	---	0.20	0.27	0.18	0.24	0.21	0.28	0.318	0.275
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	0.00043J	<0.0010	<0.0010	0.00033J	0.00090	<0.00080
Chromium, Total	0.1	---	0.0020B	0.0016J	0.00057B	0.00075J	0.00084J+	<0.0020	0.0014	0.0018J+
Cobalt	---	0.0086	0.0034	0.0039	0.0027	0.0041	0.0069J+	0.0044	0.0038	0.0036
Fluoride	4.0	---	0.079J	0.16J	0.12	0.13	0.23J+	0.19	0.22	0.14
Lead	---	0.001	0.00051B	0.00079J	<0.0010	0.00019B	0.00028J+	0.00047J	<0.00010	<0.0010
Lithium	---	0.05	<0.050	<0.050	0.00048B	0.00051J	0.0010J+	<0.0080	0.00041J	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0010J	0.0011J	0.00074J	0.0012B	0.0011J	0.0019J	0.0064	0.0050J
Radium 226/228 (pCi/L)	5	--	0.909	1.00	0.709	1.24	0.476	0.693	<1.72	1.53
Selenium	0.05	---	0.00052J	0.00050J	<0.0050	<0.0050	0.00081J+	0.00089J	0.0012J+	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0034B	0.0016B	0.00050J	0.00043B	0.00086J+	<0.0020	0.0012J+	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0039B	0.0040	0.0025B	0.0021B	0.0015J	0.0015J	0.0020	<0.0050
Silver	---	0.005	<0.0010	<0.0010	0.00083J	<0.0010	0.00013J	<0.0010	<0.00050	<0.0050
Sulfide	---	3	<3.0	<3.0	2.4J	<3.0	1.2J	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0028J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.0014J	0.0022J	0.00082J	0.0014J	0.0017J	0.0023J	0.0040J	0.0030J
Zinc	---	0.054	0.054	0.020	0.018J	0.0068J	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	15	15	12	15	9.2	12	14.1	15.0
Manganese	---	6.8	4.7	4.4	3.3	4.4	6.80J+	5.1	4.74	4.20

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-35S (Background)							
			1/12/2017	2/23/2017	3/16/2017	4/7/2017	5/3/2017	6/6/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	0.011J+	<0.0500	<0.0500
Calcium	---	63.9	6.0	5.5	5.6	5.5	4.2	5.8	5.47	5.59
Chloride	---	46	8.2	8.5	8.5	9.3	9.2	9.4	9.1	10.3
Fluoride	NA	0.37	0.024B	0.029B	0.042B	0.027J	<0.050	0.028J	<0.10	<0.10
pH (std units)	---	4.56-6.80	5.25	5.16	5.58	5.21	5.37	5.59	5.52	5.37
Sulfate	---	10.86	5.0	5.6	5.3	5.5	5.2	5.8	4.4	5.5
TDS	---	450	99B	99	93	86	89	78	82	66
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.0011J	0.0017B	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	<0.0050	0.00041J	0.00051J	<0.0050	<0.0050	<0.0010	<0.0010
Barium	2	---	0.048	0.042	0.042	0.041	0.028	0.040	0.0430	0.0384
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00034J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.0013B	0.00034B	<0.0020	0.00038J	<0.0020	<0.0020	0.0012J	<0.0050
Cobalt	---	0.0086	0.0054	0.0038	0.0036	0.0030	0.0017	0.0019	0.00094J	0.00082J
Fluoride	4.0	---	0.024B	0.029B	0.042B	0.027J	<0.050	0.028J	<0.10	<0.10
Lead	---	0.001	0.00046B	0.00018B	0.00031B	0.00037J	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0015J	0.0017B	0.0016J	0.0019J	0.0021J	0.0024J	0.0015J	0.0024J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	0.00058J	0.00068J	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	0.841	0.615	0.658	0.358	0.554	<0.324	<1.24	<1.12
Selenium	0.05	---	0.00062J	0.00055J	0.00089J	0.0011J	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0020B	0.00070J	0.00066B	0.00069B	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	0.0034J	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0053	0.0031	0.0032B	0.0033B	0.0022	0.0027	<0.0050	<0.0050
Silver	---	0.005	<0.0010	0.000077J	0.00014J	0.000036J	0.00039J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	2.7J+	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	0.0070B	0.0077J	0.0070J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00055J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.013B	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.560J+	<0.10	<0.10
Manganese	---	6.8	0.40	0.29	0.27	0.23	0.16	0.18	0.140	0.101

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-1 (Downgradient CCR Well)							
			10/6/2016	11/14/2016	1/10/2017	2/20/2017	4/4/2017	5/16/2017	6/21/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.1	**1.9J**	**2.8**	**2.9**	**2.9**	**2.8**	**2.6**	**2.71**	**2.76**
Calcium	---	63.9	**82**	**88**	**90**	**86**	**83**	**84**	**86.5**	**83.2**
Chloride	---	46	20	21	21	21	20	20	21.3	19.5
Fluoride	NA	0.37	<0.20	<0.20	0.11	0.094	0.11	<0.25	0.10	<0.10
pH (std units)	---	4.56-6.80	6.10	6.26	6.30	6.47	5.90	6.17	6.37	5.74
Sulfate	---	10.86	**87**	**77**	**74**	**77**	**77**	**77**	**74.6**	**72.3**
TDS	---	450	**500**	**490**	**520**	**490**	**470**	**480**	**460**	**464**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	0.0015J	0.0016J	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00052J	0.00080J	0.00087J	0.0022J	0.00084J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.18	0.19	0.19	0.18	0.18	0.18	0.177	0.176
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	**0.0081**	<0.0010	0.00040J	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	0.0017	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.00056B	<0.0020	<0.0020	0.0021	0.00026J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0029	0.0025	0.0025	0.0037	0.0020	0.0017	0.0014	0.0012
Fluoride	4.0	---	0.11J	0.12J	0.11	0.094	0.11	<0.25	0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	0.00042B	**0.0015**	0.00030J	0.00053J	<0.0010	<0.0010
Lithium	---	0.05	0.0037B	<0.050	0.00069B	0.00092J	0.00081J	<0.0080	0.0020J+	<0.0250
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	0.0017J	0.0012J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	**7.30**	**6.66**	**9.31**	**6.79**	**7.69**	**6.19**	**7.41**	**8.27**
Selenium	0.05	---	0.00062J	<0.0050	<0.0050	0.0018J	0.0014J	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	0.00070J	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	0.00046B	0.0018	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0051B	0.0041	0.0041B	0.0056	0.0051	0.0045	0.0046J	0.0049J
Silver	---	0.005	0.0027	0.0025	<0.0010	0.000098J	0.000098J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	0.0099J	0.0071J	0.0047J	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	0.0019J	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0059J	<0.0100
VPDES Parameters										
Ammonia	---	15	1.4J	<2.0	<2.0	<2.0	<2.0	0.84J	0.24	0.20
Manganese	---	6.8	0.62	0.68	0.65	0.60	0.52	0.54	0.540	0.476

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-2 (Downgradient CCR Well)							
			10/6/2016	11/17/2016	1/10/2017	2/21/2017	4/4/2017	5/16/2017	6/21/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**0.68**	**0.66**	**0.58**	**0.67**	**0.75**	**0.74**	**0.754**	**0.837**
Calcium	---	63.9	17	15	14	16	16	18	18.6	20.8
Chloride	---	46	16	17	17	16	17	17	17.6	16.6
Fluoride	NA	0.37	0.12JF1	0.11J	0.091	0.14	0.15J+	0.15J+	0.12	0.075J
pH (std units)	---	4.56-6.80	5.11	5.13	5.10	5.18	4.93	5.30	5.41	5.52
Sulfate	---	10.86	**33**	**36**	**39**	**39**	**42**	**43**	**44.7**	**41.3**
TDS	---	450	190	170	180	170	180	190	162	166
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00042J	0.00062J	0.00060J	0.00068J	0.00064J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.055	0.053	0.057	0.061	0.063	0.066	0.0665	0.0660
Beryllium	0.004	---	<0.0010	0.00046J	<0.0010	0.00051J	0.00054J	0.00061J	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	<0.0020	0.00031J	0.00040B	0.00058J	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.013**	**0.011**	**0.011**	**0.010**	**0.011**	**0.011**	**0.0110**	**0.0122**
Fluoride	4.0	---	0.12JF1	0.11J	0.091	0.14	0.15J+	0.15J+	0.12	0.075J
Lead	---	0.001	0.00025B	0.00025J	0.00079B	0.00035J	0.00031J	0.00070J	**0.0011**	<0.0010
Lithium	---	0.05	0.0053B	<0.0080	0.0050J	0.0054J	0.0044J	0.0047J	0.0062J+	0.0050J
Mercury	0.002	---	<0.00020H	<0.00020	0.000092B	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	0.00051J	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	4.65	4.01	**6.25**	**5.22**	4.68	4.44	**5.30**	**5.23J+**
Selenium	0.05	---	0.0010J	0.00080J	0.00062J	0.00077J	0.0016J+	0.0011J	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00062B	0.00053B	0.0015B	0.00062	0.00070J+	0.0035J+	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	0.0051J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	**0.013**	**0.012**	**0.013**	**0.012**	**0.013**	**0.013**	**0.0140**	**0.0144**
Silver	---	0.005	<0.0010	<0.0010	0.00036J	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0068J	0.0078J	0.018J	0.0072J	0.010J	<0.020	0.0101	0.0105
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	1.1J	<0.10	<0.10
Manganese	---	6.8	0.74	0.61	0.53	0.58	0.61	0.69	0.650	0.727

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-3 (Downgradient CCR Well)							
			10/6/2016	11/14/2016	1/11/2017	2/21/2017	4/4/2017	5/16/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**1.7**	**2.2**	**2.1**	**2.1**	**2.1**	**2.1**	**2.0**	**1.88**
Calcium	---	63.9	**180**	**230**	**180**	**200**	**200**	**210**	**195**	**195**
Chloride	---	46	6.9	6.5	7.9	8.0	8.1	8.2	8.0	7.8
Fluoride	NA	0.37	**1.1**	**0.98J**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**0.95**
pH (std units)	---	4.56-6.80	6.50	6.70	6.72	6.62	6.73	6.62	6.73	**6.88**
Sulfate	---	10.86	**410**	**590**	**430**	**390**	**400**	**410**	**364**	**269**
TDS	---	450	**940**	**1200**	**960**	**950**	**960**	**950**	**858**	**784**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00036J	0.00049J	0.0012J	0.00058J	0.00043J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.13	0.15	0.13	0.14	0.15	0.17	0.164	0.182
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00032J	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.015**	**0.019**	**0.015**	**0.014**	**0.015**	**0.015**	**0.0139**	**0.0125**
Fluoride	4.0	---	1.1	0.98J	1.1	1.1	1.1	1.1	1.1	0.95
Lead	---	0.001	<0.0010	<0.0010	0.00016B	<0.0010	0.00021J+	0.00067J	<0.0010	<0.0010
Lithium	---	0.05	0.028	0.028J	0.024	0.023	0.026	0.025	0.0248J	0.0235J
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	**0.079**	**0.076**	**0.078**	**0.085**	**0.085**	**0.085**	**0.0788**	**0.0891**
Radium 226/228 (pCi/L)	5	--	1.35	1.77	1.65	1.09	0.881	1.08	1.69	<1.58
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	0.00076J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	0.00028J	<0.0010	<0.0010	<0.0010	0.00031J	0.00022J	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0027B	0.0030B	0.0026B	0.0026	0.0024	0.0023	<0.0050	<0.0050
Silver	---	0.005	<0.0010	0.000054J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0068J	<0.020	<0.020	<0.020	<0.020	<0.020	0.0057J	<0.0100
VPDES Parameters										
Ammonia	---	15	1.1J	1.4J	1.7J	1.1J	1.4J	1.4J	0.96	0.87
Manganese	---	6.8	6.3	**7.9**	6.2	6.1	6.1	6.7	5.64	4.98

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-5 (Downgradient CCR Well)							
			10/6/2016	**11/14/2016**	**1/11/2017**	**2/21/2017**	**4/4/2017**	**5/15/2017**	**6/20/2017**	**7/25/2017**
CCR Detection Constituents										
Boron	---	0.1	**0.96J**	**1.3**	**1.3**	**1.4**	**1.4**	**1.3**	**1.38**	**1.38**
Calcium	---	63.9	**110**	**110**	**110**	**110**	**110**	**95**	**115**	**136**
Chloride	---	46	7.9	8.2	8.2	7.9	7.7	7.9	7.5	7.4
Fluoride	NA	0.37	0.090J	0.043B	0.034B	0.042J	0.040J	<0.25	<0.10	<0.10
pH (std units)	---	4.56-6.80	5.17	5.27	5.39	5.02	4.82	5.03	5.11	5.19
Sulfate	---	10.86	**840**	**760**	**790**	**730**	**730**	**690**	**669**	**647**
TDS	---	450	**1100**	**1100**	**1100**	**1100**	**1000**	**1100**	**1000**	**1020**
CCR Assessment Constituents										
Antimony	0.006	---	0.00035J	<0.0020	<0.0020	0.0017J	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0037J	0.0041J	0.0044J	0.0040J	0.0034J	0.0028J	0.0028	0.0033
Barium	2	---	0.019	0.017	0.015	0.016	0.016	0.013	0.0122	0.0130
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	0.00040J	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.00038B	0.00044B	0.00032B	0.00053J	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.044**	**0.044**	**0.043**	**0.039**	**0.038**	**0.031**	**0.0322**	**0.0379J+**
Fluoride	4.0	---	0.090J	0.043B	0.034B	0.042J	0.040J	<0.25	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	0.00022B	0.00052J	0.00021J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.038J	0.035J	0.035	0.034	0.033	0.016	0.0340	0.0430J+
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	0.00057B	0.00079J	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	1.74	1.81	3.03	2.55	2.75	2.53	2.53	3.00J+
Selenium	0.05	---	0.0016J	0.0015J	0.00058J	0.0022J	0.0021J	0.00096J	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	**0.039**	**0.041**	**0.048**	**0.052**	**0.051**	**0.044**	**0.0523**	**0.0609**
Silver	---	0.005	0.000059J	<0.0010	0.0011	0.00032J	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	1.7J	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.010J	0.013J	0.015B	0.016J	0.017J	<0.020	0.0227J+	0.0172
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.10	<0.10
Manganese	---	6.8	0.94	0.80	0.61	0.45	0.40	0.31	0.318	0.306

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-8R (Downgradient CCR Well)							
			1/13/2017	2/21/2017	3/16/2017	4/7/2017	5/3/2017	6/6/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	0.1	**2.3**	**1.8**	**1.7**	**1.6**	**1.6**	**1.7**	**1.49**	**1.36**
Calcium	---	63.9	**170**	**130**	**120**	**120**	**130**	**120**	**126**	**117**
Chloride	---	46	10	11	12	11	12	11	10.6	12.2
Fluoride	NA	0.37	0.15	0.16	0.16	0.21	0.25	0.22	0.16	0.21
pH (std units)	---	4.56-6.80	6.28	6.38	6.50	6.41	6.44	6.50	6.46	6.40
Sulfate	---	10.86	**330**	**240**	**210**	**190**	**220**	**230**	**209**	**195**
TDS	---	450	**910**	**750**	**710**	**710**	**720**	**760**	**734**	**697**
CCR Assessment Constituents										
Antimony	0.006	---	0.00037B	<0.0020	<0.0020	0.00035B	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0079	0.0092	0.0096	**0.011**	**0.014**	**0.013**	**0.0162**	**0.0183**
Barium	2	---	0.22	0.25	0.24	0.24	0.24	0.23	0.216	0.206
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00087J
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.00060J	0.00026J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.011**	**0.0097**	0.0080	**0.0088**	0.0082	0.0074	0.0073	0.0085
Fluoride	4.0	---	0.15	0.16	0.16	0.21	0.25	0.22	0.16	0.21
Lead	---	0.001	0.00067B	0.00023J	0.00036J	0.00019J	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.00078J	0.00047J	<0.0080	<0.0080	<0.0080	<0.0080	<0.0250	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0064J	0.0047B	0.0044J	0.0045J	0.0046J	0.0054J	0.0070	0.0049J
Radium 226/228 (pCi/L)	5	--	1.58	0.953	0.799	1.19	0.747	0.942	<1.47	1.75
Selenium	0.05	---	0.00063J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00063B	<0.0020	0.00041B	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.0024J+	<0.0080	<0.0080
Nickel	---	0.0076	0.0024B	0.0021B	0.0017J	0.0016J	0.0017J	0.0015J	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	0.00027J	0.00011J	<0.0010	0.000059J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	0.0075B	<0.010	<0.010	0.0056J	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00092J	<0.0050	0.00064J	<0.0050	<0.0050	<0.0050	**0.0097**	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0118J+	<0.0100
VPDES Parameters										
Ammonia	---	15	1.1J	2.2	2.0	2.2	2.2	2.8J+	2.0	2.3
Manganese	---	6.8	**8.4**	**8.5**	**7.8**	**8.6**	**8.7**	**8.2**	**7.12**	**7.48**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-9R (Downgradient CCR Well)							
			1/24/2017	2/21/2017	3/16/2017	4/7/2017	5/3/2017	6/6/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	0.1	**0.45**	**0.17**	**0.15**	**0.32**	**0.14**	**0.21**	**0.154**	**0.184**
Calcium	---	63.9	57	40	38	44	38	36	34.8	34.9
Chloride	---	46	8.7	11	11	9.1	9.7	9.2	8.3	9.5
Fluoride	NA	0.37	0.090	0.13	0.096	0.13	0.16	0.16	0.12	0.16
pH (std units)	---	4.56-6.80	5.94	6.01	5.91	5.92	5.93	6.09	5.88	6.02
Sulfate	---	10.86	**97**	**36**	**30**	**61**	**27**	**41**	**26.2**	**36.2**
TDS	---	450	320	250	220B	270	230	260	214	223
CCR Assessment Constituents										
Antimony	0.006	---	0.0016J	<0.0020	<0.0020	0.00029B	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00098J	0.0013J	0.0018J	0.0046J	0.0023J	0.0027J	0.0021	0.0025
Barium	2	---	0.087	0.090	0.10	0.099	0.11	0.10	0.112	0.118
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00061J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.00086J	<0.0020	0.0011J	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.020**	**0.019**	**0.016**	**0.017**	**0.013**	**0.011**	**0.0097**	**0.0090**
Fluoride	4.0	---	0.090	0.13	0.096	0.13	0.16	0.16	0.12	0.16
Lead	---	0.001	0.00053J	<0.0010	0.00051J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0019J	0.0012J	0.0013J	0.00045J	<0.0080	<0.0080	<0.0250	0.0015J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0011J	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	0.745	<0.391	0.448	0.207	0.480	<0.508	1.78	<1.49
Selenium	0.05	---	0.00092J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00080J	<0.0020	0.00083B	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.0027J+	<0.0080	<0.0080
Nickel	---	0.0076	**0.0083**	0.0041	0.0042	0.0038	0.0029	0.0029	<0.0050	<0.0050
Silver	---	0.005	0.000037J	<0.0010	0.00035J	0.000041J	<0.0010	0.00019J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	0.0057J	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.0018J	0.00060J	0.0020J	<0.0050	<0.0050	<0.0050	0.0045J	<0.0050
Zinc	---	0.054	<0.020	<0.020	0.0066J	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	0.84J	0.84J	0.79	0.78
Manganese	---	6.8	2.1	1.5	1.5	1.8	2.7	2.6	3.12	3.12

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-11 (Downgradient CCR Well)							
			10/5/2016	11/15/2016	1/12/2017	2/21/2017	4/4/2017	5/16/2017	6/21/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.1	**1.1**	**1.3**	**1.4**	**1.5**	**1.5**	**1.4**	**1.47**	**1.44**
Calcium	---	63.9	**120**	**110**	**120**	**130**	**120**	**120**	4.65	13.0
Chloride	---	46	**100**	20	19	17	18	17	16.6	15.5
Fluoride	NA	0.37	0.21	0.092J	0.087	0.12	0.12	0.12J	0.11	0.060J
pH (std units)	---	4.56-6.80	6.68	5.74	6.25	6.40	6.25	6.36	6.35	**8.75R**
Sulfate	---	10.86	**220**	**150**	**150**	**140**	**140**	**150**	**147**	**139**
TDS	---	450	**760**	**610**	**610**	**610**	**620**	**590**	**601**	**609**
CCR Assessment Constituents										
Antimony	0.006	---	0.00033J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0067	0.0083	0.0092	0.0092	0.0096	0.0082	<0.0010	0.00097
Barium	2	---	0.14	0.20	0.19	0.22	0.21	0.21	0.218	0.205
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.000080
Chromium, Total	0.1	---	0.0060	0.0031	0.00082B	0.00035J	0.00033J	<0.0020	<0.0050	0.00021J
Cobalt	---	0.0086	0.0064	0.0083	0.0073	0.0077	0.0079	0.0076	0.00011J	0.00079
Fluoride	4.0	---	0.21	0.092J	0.087	0.12	0.12	0.12J	0.11	0.060J
Lead	---	0.001	<0.0010	<0.0010	0.00034B	<0.0010	0.00017J+	<0.0010	<0.0010	<0.00010
Lithium	---	0.05	0.0090J	<0.050	0.0010B	0.00073J	0.00056J	<0.0080	0.0079J	<0.0025
Mercury	0.002	---	<0.00020	<0.00020	0.00012B	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	**0.026**	0.0040J	0.0043J	0.0032J	0.0032J	0.0026J	0.0029J	<0.0050
Radium 226/228 (pCi/L)	5	--	0.687	0.583	0.724	0.638	1.05	0.367	1.86	1.64
Selenium	0.05	---	0.0013J	<0.0050	<0.0050	<0.0050	0.00069J+	<0.0050	<0.0050	<0.00050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0063B	0.0011J	0.00038B	<0.0020	<0.0020	<0.0020	<0.0050	<0.00050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0045B	0.0019J	0.0024B	0.0023	0.0025	0.0024	<0.0050	<0.00050
Silver	---	0.005	<0.0010	<0.0010	0.000055J	<0.0010	0.000090J	0.00084J	0.0016J	<0.00050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	**0.0060**	0.0022J	0.0012J	0.00064J	0.00091J	<0.0050	<0.0050	0.0025J
Zinc	---	0.054	0.0074B	0.0082J	0.0069B	0.0064J	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	6.2	2.2	1.4J	2.0	2.8	2.2	1.7	1.7
Manganese	---	6.8	6.0	**8.4**	**8.2**	**8.8**	**8.5**	**9.1**	**8.56**	**8.38**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-12 (Downgradient CCR Well)							
			10/5/2016	11/15/2016	1/11/2017	2/22/2017	4/4/2017	5/16/2017	6/21/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**1.6**	**1.5**	**1.7**	**1.8**	**1.8**	**1.7**	**1.75**	**1.62**
Calcium	---	63.9	**180**	**170**	**160**	**180**	**170**	**170**	**163**	**176**
Chloride	---	46	21	24	22	21	21	22	21.6	20.1
Fluoride	NA	0.37	0.19J	0.11J	0.083	0.11	0.11	0.12J+	0.11	<0.10
pH (std units)	---	4.56-6.80	6.02	5.80	6.32	6.19	6.15	6.31	6.27	6.37
Sulfate	---	10.86	**490**	**480**	**510**	**440**	**460**	**430**	**419**	**370**
TDS	---	450	**1000**	**1000**	**1000**	**1000**	**1000**	**940**	**1000**	**934**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	0.0019J	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0085	0.010	0.010	**0.011B**	**0.012**	0.010	**0.0108**	**0.0110**
Barium	2	---	0.077	0.069	0.068	0.071	0.072	0.071	0.0711	0.0059
Beryllium	0.004	---	<0.0010	0.0017	<0.0010	<0.0010	<0.0010	0.0040	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00039J	<0.00080	<0.00080
Chromium, Total	0.1	---	0.0012B	0.0011J	0.00050B	<0.0020	0.00069J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.022**	**0.019**	**0.019**	**0.018**	**0.018**	**0.018**	**0.0156**	**0.0173**
Fluoride	4.0	---	0.19J	0.11J	0.083	0.11	0.11	0.12J+	0.11	<0.10
Lead	---	0.001	0.00061B	0.00057J	0.00038B	0.00016B	0.00067J+	0.00082J	<0.0010	<0.0010
Lithium	---	0.05	0.0060J	<0.050	0.0011B	0.00068J	0.00081J	<0.0080	0.0024J	0.0013J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0027J	0.0045J	0.0014J	0.0020B	0.0028J	0.0026J	0.0055	<0.0050
Radium 226/228 (pCi/L)	5	--	0.650	1.29	0.613	0.634	0.477	<0.300	1.83	2.12J+
Selenium	0.05	---	<0.0050	0.00053J	<0.0050	<0.0050	0.0018J+	0.00099J	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00033J	0.00023J	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0016B	0.00086J	0.0036B	<0.0020	0.00057J+	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0046B	0.0038	0.0039B	0.0028B	0.0035	0.0035	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	0.000033J	0.000048J	0.00014J	0.000064J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0088J	0.0036J	<0.0050	<0.0050
Vanadium	---	0.005	0.0025J	0.0039J	0.0012J	0.00092J	0.0018J	0.0016J	<0.0050	<0.0050
Zinc	---	0.054	0.013B	0.0063J	<0.020	<0.020	<0.020	<0.020	0.0306J+	<0.0100
VPDES Parameters										
Ammonia	---	15	2.0	2.0	2.0	<2.0	2.2	2.2	1.8	1.7
Manganese	---	6.8	**20**	**17**	**17**	**17**	**16**	**18**	**17.2**	1.39

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-13 (Downgradient CCR Well)							
			10/7/2016	11/16/2016	1/10/2017	2/20/2017	4/3/2017	5/15/2017	6/19/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**1.5**	**1.7**	**1.6**	**2.1**	**1.9**	**1.8**	**1.90**	**1.72**
Calcium	---	63.9	**200**	**220**	**190**	**230**	**200**	**220**	**361**	**238**
Chloride	---	46	23	23	23	28	25	26	28.4	28.6
Fluoride	NA	0.37	**0.39**	0.18J	0.14	0.27	0.20	0.18J	0.21	0.26
pH (std units)	---	4.56-6.80	5.80	5.96	5.89	6.04	5.97	5.59	5.89	6.39
Sulfate	---	10.86	**760**	**670**	**600**	**820**	**670**	**700**	**685**	**760**
TDS	---	450	**1200**	**1100**	**1100**	**1300**	**1200**	**1200**	**1220**	**1300**
CCR Assessment Constituents										
Antimony	0.006	---	0.00027J	0.0029	0.00076J	<0.0020	0.00030J	<0.0020	<0.00050	<0.0050
Arsenic	0.010	---	**0.092**	**0.065**	**0.055**	**0.11**	**0.072**	**0.064**	**0.0864**	**0.0940**
Barium	2	---	0.033	0.038	0.032	0.028	0.034	0.033	0.0311	0.0265
Beryllium	0.004	---	<0.0010	0.00060J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	0.00051J	0.00034J	<0.0010	0.00036J	0.00028J	0.00043	<0.00080
Chromium, Total	0.1	---	0.00089B	0.00033J	<0.0020	<0.0020	<0.0020	<0.0020	0.00030J	<0.0050
Cobalt	---	0.0086	**0.038**	**0.040**	**0.038**	**0.044**	**0.047J+**	**0.050**	**0.0473**	**0.0518J+**
Fluoride	4.0	---	0.39	0.18J	0.14	0.27	0.20	0.18J	0.21	0.26
Lead	---	0.001	0.00046B	0.00041J	0.0010B	0.00037B	0.00070J+	<0.0010	<0.00010	<0.0010
Lithium	---	0.05	**0.097**	**0.072**	**0.056**	**0.11**	**0.078**	**0.059**	**0.0813**	**0.0855**
Mercury	0.002	---	<0.00020F1	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	**0.011**	**0.011**	0.0065J	**0.014**	0.0071J	0.0063J	0.0068	0.0097
Radium 226/228 (pCi/L)	5	--	1.06	<0.434	1.24	<0.432	0.461	0.524	2.55	<1.34
Selenium	0.05	---	0.00092J	0.00055J	0.00082J	<0.0050	0.00073J	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	0.00030J	0.00031J	<0.0010	<0.0010	0.00031J	<0.0010	0.00017	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00062B	0.00062B	0.00037B	<0.0020	<0.0020	<0.0020	<0.00050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0095	<0.0080
Nickel	---	0.0076	**0.049**	**0.036**	**0.033**	**0.063**	**0.045**	**0.041**	**0.0482**	**0.0546**
Silver	---	0.005	0.000050J	0.000047J	0.00029J	<0.0010	<0.0010	<0.0010	<0.00050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	2.0J+	2.1J	<0.10	<0.10
Tin	---	0.01	<0.010	**0.046**	0.0048J	<0.010	0.0034J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00078J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.011J	0.0089J	0.0087J	0.011J	0.0094J	<0.020	0.014	0.0088J
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	1.7B	2.0	1.7J	1.2	1.1
Manganese	---	6.8	**10**	**13**	**14**	**12**	**14**	**16**	**16.8**	**12.6**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-15 (Downgradient CCR Well)							
			10/7/2016	11/16/2016	1/10/2017	2/20/2017	4/3/2017	5/15/2017	6/21/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**0.35**	**0.40**	**0.41**	**0.44**	**0.43**	**0.40**	**0.410**	**0.373**
Calcium	---	63.9	51	57	58	59	61	60	51.9	**64.5**
Chloride	---	46	19	24	27	30	29	31	32.5	33.0
Fluoride	NA	0.37	<1.0	0.065B	0.060B	0.060	0.056	0.061J+	0.062J	<0.10
pH (std units)	---	4.56-6.80	5.34	5.48	5.22	5.54	5.50	5.60	5.60	5.63
Sulfate	---	10.86	**190**	**210**	**230**	**220**	**290**	**220**	**217**	**160**
TDS	---	450	400	400	450	440	**490J+**	440	427	446
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.00040J	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	0.00037J	0.00052J	0.00048B	0.00051J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.064	0.065	0.064	0.062	0.064	0.060	0.0615	0.0528
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	0.00040J+	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.033**	**0.037**	**0.038**	**0.036**	**0.038**	**0.036**	**0.0288**	**0.0368**
Fluoride	4.0	---	<1.0	0.065B	0.060B	0.060	0.056	0.061J+	0.062J	<0.10
Lead	---	0.001	<0.0010	<0.0010	0.00075B	0.00022B	0.00039J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.016J	0.019J	0.017	0.019	0.021	0.013	0.0146J	0.0207J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	0.00051J	0.00051J	<0.010	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	2.33	2.33	3.37	1.99	1.36	2.42	2.82	3.01
Selenium	0.05	---	<0.0050	<0.0050	0.00053J	<0.0050	0.00053J	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	0.00030J	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	0.00038B	<0.0020	0.00079J+	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	0.0073J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	**0.033**	**0.040**	**0.040**	**0.040**	**0.043**	**0.040**	**0.0315**	**0.0407**
Silver	---	0.005	<0.0010	<0.0010	0.00011J	<0.0010	0.00015J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0F1	<3.0	<3.0	1.6J+	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	0.0047J	<0.010	0.0051J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0089J	0.0076J	<0.020	<0.020	0.0064J+	<0.020	0.0076J	0.0056J
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	1.1J	0.57	0.49
Manganese	---	6.8	0.83	0.97	1.0	1.1	1.1	1.1	1.08	0.983

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-16 (Downgradient CCR Well)							
			10/6/2016	11/14/2016	1/10/2017	2/20/2017	4/3/2017	5/15/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**1.9J**	**2.6**	**2.9**	**3.0**	**2.9**	**2.8**	**3.02**	**2.77**
Calcium	---	63.9	**270**	**300**	**330**	**340**	**330**	**330**	**265**	**397**
Chloride	---	46	**140**	**160**	**170**	**180**	**180**	**200**	**203**	**219**
Fluoride	NA	0.37	**0.41J**	**0.43J**	**0.42**	**0.44**	**0.48**	**0.44J**	**0.43**	**0.42**
pH (std units)	---	4.56-6.80	6.53	6.54	6.42	6.48	6.42	6.54	6.47	**7.08**
Sulfate	---	10.86	**590**	**600**	**620**	**610**	**570**	**620**	**599**	**605**
TDS	---	450	**1300**	**1400**	**1500**	**1400**	**1400**	**1600**	**1520**	**1560**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00036J	0.00048J	0.00089J	0.00066J	0.00052J	0.00077J	<0.0010	<0.0010
Barium	2	---	0.035	0.031	0.034	0.032	0.034	0.031	0.0331	0.0297
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	0.00038J	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	<0.0020	0.00029J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	**0.020**	**0.019**	**0.020**	**0.019**	**0.020**	**0.019**	**0.0156**	**0.0221J+**
Fluoride	4.0	---	0.41J	0.43J	0.42	0.44	0.48	0.44J	0.43	0.42
Lead	---	0.001	<0.0010	<0.0010	**0.0012B**	0.00025B	0.00042J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	**0.078**	**0.084**	**0.090**	**0.094**	**0.093**	**0.069**	**0.0652**	**0.0992J+**
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	**0.013**	**0.013**	**0.015**	**0.014**	**0.014**	**0.013**	**0.0122**	**0.0130**
Radium 226/228 (pCi/L)	5	--	2.49	2.75	3.48	2.00	2.02	3.07	3.47	3.09
Selenium	0.05	---	0.00053J	<0.0050	0.00059J	<0.0050	0.00070J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	0.00032J	<0.0010	0.00042J	0.00026J	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	0.00051B	<0.0020	0.00050J+	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0042B	0.0050	0.0048B	0.0044B	0.0048	0.0045	<0.0050	0.0047J
Silver	---	0.005	<0.0010	0.0020	<0.0010	<0.0010	0.00049J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	1.2J+	1.7J	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	0.00061J	<0.0050	<0.0050	<0.0050	<0.0050	0.00029J
Zinc	---	0.054	<0.020	<0.020	0.0090J	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	1.1J	<2.0	<2.0	<2.0	1.7J	1.7J	0.96	0.92
Manganese	---	6.8	**8.8**	**9.1**	**9.5**	**9.4**	**9.0**	**9.5**	**9.68**	**9.02**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-17S (Downgradient CCR Well)							
			10/6/2016	11/16/2016	1/11/2017	2/21/2017	4/3/2017	5/16/2017	6/21/2017	7/26/2017
CCR Detection Constituents										
Boron	---	0.1	**1.6J**	**2.2**	**2.2**	**2.2**	**2.1**	**2.1**	**2.22**	**2.03**
Calcium	---	63.9	**180**	**190**	**190**	**200**	**200**	**190**	**135**	**401**
Chloride	---	46	18	17	19	18	18	19	18.6	17.7
Fluoride	NA	0.37	0.34	0.22J	0.20	0.24	0.23	0.22J	0.24	0.15
pH (std units)	---	4.56-6.80	6.43	6.46	6.38	6.59	6.44	6.62	6.57	6.75
Sulfate	---	10.86	**270**	**290**	**310**	**300**	**290**	**260**	**226**	**201**
TDS	---	450	**870**	**890**	**920**	**890**	**900**	**820**	**888**	**787**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	**0.013**	**0.013**	**0.013**	**0.013**	**0.019**	**0.011**	**0.0102**	**0.0312**
Barium	2	---	0.14	0.13	0.12	0.12	0.12	0.12	0.124	0.104
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	0.0037J+
Cobalt	---	0.0086	**0.014**	**0.015**	**0.014**	**0.014**	**0.015**	**0.014**	**0.0083**	**0.0278J+**
Fluoride	4.0	---	0.34	0.22J	0.20	0.24	0.23	0.22J	0.24	0.15
Lead	---	0.001	<0.0010	<0.0010	0.00017B	0.00022J	0.00021J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0039B	<0.050	<0.0080	0.00019J	0.00033J	<0.0080	<0.0250	<0.0250
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0082J	0.0098J	0.0086J	0.0085J	0.0084J	0.0089J	0.010	0.0078
Radium 226/228 (pCi/L)	5	--	3.68	4.34	4.33	4.10	3.41	3.49	**5.02**	4.77J+
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0104
Thallium	0.002	---	0.00046J	0.00050J	0.00048J	0.00044J	0.00047J	0.00039J	<0.0010	0.00064J
VSWMR Assessment Constituents										
Copper	1.3	---	0.011B	<0.0020	<0.0020	<0.0020	0.00039J+	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	0.0032B	0.0032B	0.0032B	0.0030	0.0031	0.0028	<0.0050	0.0072
Silver	---	0.005	<0.0010	<0.0010	0.000066J	<0.0010	0.000033J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	1.6J+	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0039J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0031J
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	0.0053J
VPDES Parameters										
Ammonia	---	15	4.8	4.5	4.5	4.5	4.5	5.0	4.3	4.1
Manganese	---	6.8	**9.9**	**10**	**10**	**10**	**10**	**10**	**9.68**	**8.38**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-B31 (Downgradient CCR Well)							
			10/6/2016	11/16/2016	1/11/2017	2/21/2017	4/4/2017	5/16/2017	6/21/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	0.0027B	0.045J	<0.10	0.010B	0.015J	0.011J	<0.0500	<0.050
Calcium	---	63.9	2.4	2.9	4.4	3.2	2.9	2.7	2.96	3.17
Chloride	---	46	2.7	2.9	2.8	2.9	2.8	2.9	2.8	2.6
Fluoride	NA	0.37	0.021J	0.025B	0.024B	0.038J	0.035	0.031J	<0.10	<0.10
pH (std units)	---	4.56-6.80	5.12	5.50	5.54	5.58	5.08	5.43	5.48	5.51
Sulfate	---	10.86	5.7	5.9	5.7	6.0	6.1	6.1	6.6	5.6
TDS	---	450	68B	78	77	64	35	44	39	36
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	0.00052J	<0.0050	0.00055J	<0.0050	<0.0050	<0.0010	<0.0010
Barium	2	---	0.016	0.018	0.015	0.020	0.017	0.014	0.0135	0.0127
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.00084B	0.0013J	0.00064B	0.0014J	0.00066J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0015	0.0046	0.0021	0.0012	0.0012	0.00077J	0.00067J	0.00072J
Fluoride	4.0	---	0.021J	0.025B	0.024B	0.038J	0.035	0.031J	<0.10	<0.10
Lead	---	0.001	0.00046B	0.00070J	0.00036B	0.00066J	0.00041J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	<0.050	<0.050	0.0024J	0.0019J	0.0015J	<0.0080	0.0024J	0.0017J
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	<0.412	0.560	0.740	<0.384	0.436	<0.449	1.30	0.994
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	0.00064J+	<0.0050	0.0038J+	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00086B	0.0019B	0.0018B	0.0017	0.00094J	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.0020J	<0.0080	<0.0080
Nickel	---	0.0076	0.0031B	0.0049	0.0053	0.0033	0.0033	0.0026	0.0062	<0.0050
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.0015J	0.0024J	0.0014J	0.0020J	0.0013J	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	0.011J	0.016B	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	1.7J	<2.0	<2.0	<2.0	<2.0	<0.10	<0.10
Manganese	---	6.8	0.066	0.12	0.095	0.053	0.059	0.047	0.0501	0.0425

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
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J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-15
CCR Compliance Data
Upper Ash Pond, Columbia Aquifer - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-B32 (Downgradient CCR Well)							
			10/6/2016	11/16/2016	1/10/2017	2/21/2017	4/3/2017	5/16/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.1	**1.5J**	**2.2**	**2.2**	**2.4**	**2.3**	**2.3**	**2.33**	**2.11**
Calcium	---	63.9	**160**	**190**	**180**	**180**	**180**	**180**	**165**	**192**
Chloride	---	46	26	27	30	30	31	33	35.0	34.1
Fluoride	NA	0.37	0.23	0.15J	0.14	0.17	0.17	0.16J	0.15	0.16
pH (std units)	---	4.56-6.80	6.05	6.14	5.89	6.16	6.01	6.18	6.04	6.14
Sulfate	---	10.86	**450**	**540**	**550**	**520**	**560**	**520**	**498**	**498**
TDS	---	450	**1000**	**1000**	**1100**	220	**1000**	**1000**	**994**	**1050**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	0.00052J	0.00053J	0.00061J	0.00066J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.041	0.039	0.038	0.037	0.038	0.038	0.0368	0.0341
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0086	0.0029	0.0032	0.0031	0.0034	0.0034	0.0030	0.0030	0.0034
Fluoride	4.0	---	0.23	0.15J	0.14	0.17	0.17	0.16J	0.15	0.16
Lead	---	0.001	<0.0010	<0.0010	0.00043B	0.00030J	0.00048J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.011B	0.0090J	0.0061J	0.0064J	0.0069J	0.0065J	0.0058J	0.0086J
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0011J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	--	3.98	3.85	3.67	3.39	3.18	3.32	4.12	3.20
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	0.0014J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	0.00041J	0.00023J	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0076	**0.0081**	**0.0094**	**0.0089**	**0.0083**	**0.0091**	**0.0086**	**0.0077**	**0.0095**
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0089J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	0.0063J	<0.020	<0.020	0.049	<0.020	0.0133	0.0057J
VPDES Parameters										
Ammonia	---	15	1.7J	2.0	1.7J	1.7J	2.0	2.2	1.6	1.5
Manganese	---	6.8	4.3	5.0	4.5	4.6	4.6	5.3	4.77	4.37

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
F1 - MS and/or MSD Recovery is outside acceptable limits
H - Sample was prepped or analyzed beyond the specified holding time
R - RPD value was outside of control limits
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-29U (Background)							
			10/7/2016	11/16/2016	1/9/2017	2/20/2017	4/3/2017	5/15/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.15	0.040B	0.018B	<0.10	0.0096B	0.0092J	0.013J	<0.0500	<0.0500
Calcium	---	63.9	54	52	38	51	42	48	58.0	63.9
Chloride	---	46	17	16	20	26	46	33	26.3	21.4
Fluoride	NA	0.26	0.079J	0.16J	0.12	0.13	0.23J+	0.19	0.22	0.14
pH (std units)	---	4.04 -7.16	6.07	6.05	5.22	6.34	6.04	6.04	5.72	6.29
Sulfate	---	7.7	3.5	1.6	7.7	3.1	5.1	1.4	<1.0	<1.0
TDS	---	450	350	330	310	360	450J+	350	365	346
CCR Assessment Constituents										
Antimony	0.006	---	0.00047J	<0.0020	<0.0020	<0.0020	0.00051J+	<0.0020	0.00013J	<0.0050
Arsenic	0.010	---	0.0021J	0.0093	0.0037J	0.0072	0.0091	**<u>0.013</u>**	**<u>0.0178</u>**	**<u>0.0146</u>**
Barium	2	---	0.20	0.27	0.18	0.24	0.21	0.28	0.318	0.275
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	0.00043J	<0.0010	<0.0010	0.00033J	0.00090	<0.00080
Chromium	0.1	---	0.0020B	0.0016J	0.00057B	0.00075J	0.00084J+	<0.0020	0.0014	0.0018J+
Cobalt	---	0.0069	0.0034	0.0039	0.0027	0.0041	0.0069J+	0.0044	0.0038	0.0036
Fluoride	4.0	--	0.079J	0.16J	0.12	0.13	0.23J+	0.19	0.22	0.14
Lead	---	0.001	0.00051B	0.00079J	<0.0010	0.00019B	0.00028J+	0.00047J	<0.00010	<0.0010
Lithium	---	0.05	<0.050	<0.050	0.00048B	0.00051J	0.0010J+	<0.0080	0.00041J	<0.0250
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0010J	0.0011J	0.00074J	0.0012B	0.0011J	0.0019J	0.0064	0.0050J
Radium 226/228 (pCi/L)	5	---	0.909	1.00	0.709	1.24	0.476	0.693	<1.72	1.53
Selenium	0.05	---	0.00052J	0.00050J	<0.0050	<0.0050	0.00081J+	0.00089J	0.0012J+	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0034B	0.0016B	0.00050J	0.00043B	0.00086J+	<0.0020	0.0012J+	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	0.0039B	0.0040	0.0025B	0.0021B	0.0015J	0.0015J	0.0020	<0.0050
Silver	---	0.005	<0.0010	<0.0010	0.00083J	<0.0010	0.00013J	<0.0010	<0.00050	<0.0050
Sulfide	---	3	<3.0	<3.0	2.4J	<3.0	1.2J	<3.0	<0.10	<0.10
Tin	---	0.012	<0.010	<0.010	<0.010	<0.010	0.0028J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.0014J	0.0022J	0.00082J	0.0014J	0.0017J	0.0023J	0.0040J	0.0030J
Zinc	---	0.054	0.054	0.020	0.018J	0.0068J	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	15	15	12	15	9.2	12	14.1	15.0
Manganese	---	6.8	4.7	4.4	3.3	4.4	6.80J+	5.1	4.74	4.20

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the miethod detection limit
H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-30U (Background)							
			10/7/2016	11/16/2016	1/9/2017	2/20/2017	4/3/2017	5/15/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.15	0.15	0.13	0.13	0.13	0.13	0.13	0.126	0.127
Calcium	---	63.9	9.1	9.2	8.8	8.4	8.4	8.5	8.48	7.97
Chloride	---	46	8.3	13	7.9	7.9	8.8	8.4	8.1	7.9
Fluoride	NA	0.26	0.028B	0.11J	0.13	0.14	0.13	0.12	0.10	0.058J
pH (std units)	---	4.04 -7.16	6.14	6.32	6.28	6.43	6.41	6.35	6.20	6.58
Sulfate	---	7.7	0.43J	2.3	<1.0	<1.0	1.4	0.4J	<1.0	<1.0
TDS	---	450	180	180	190	170	170	160	144	146
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	0.0019J+	<0.0020	<0.00050	<0.0050
Arsenic	0.010	---	0.00062J	0.00067J	<0.0050	0.00077B	0.00084J	<0.0050	0.00022	<0.0010
Barium	2	---	0.073	0.074	0.068	0.080	0.077	0.080	0.0682	0.0648
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000080	<0.00080
Chromium	0.1	---	0.00029B	<0.0020	<0.0020	0.00032J	0.00042J+	<0.0020	0.00024J	<0.0050
Cobalt	---	0.0069	0.00024J	0.00020J	<0.0010	0.00013B	0.00033J+	<0.0010	0.000040J	<0.0010
Fluoride	4.0	--	0.028B	0.11J	0.13	0.14	0.13	0.12	0.10	0.058J
Lead	---	0.001	0.00024B	<0.0010	<0.0010	0.00024B	0.00058J+	<0.0010	0.000093J	<0.0010
Lithium	---	0.05	0.0097J	0.011J	0.010	0.011	0.011	0.0099	0.0107	0.0088J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.00060J	0.00061J	<0.010	<0.010	0.00061J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	0.627	0.924	0.582	<0.488	0.688	1.31	<1.82	<1.21
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	0.00080J+	<0.0050	<0.00050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0011B	0.00040B	<0.0020	0.00076B	0.00088J+	<0.0020	0.00058J+	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	<0.0020	<0.0020	<0.0020	<0.0020	0.00041J+	<0.0020	<0.00050	<0.0050
Silver	---	0.005	<0.0010	0.00011J	<0.0010	0.00054J	0.00014J	0.00010J	<0.00050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	1.7J	<0.10	<0.10
Tin	---	0.012	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0111	0.0225
VPDES Parameters										
Ammonia	---	15	1.4J	1.4J	1.4J	2.0B	1.7J	1.4J	1.1	1.1
Manganese	---	6.8	0.29	0.30	0.27	0.28	0.27	0.27	0.264	0.261

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the miethod detection limit
H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-35S (Background)							
			1/12/2017	2/23/2017	3/16/2017	4/7/2017	5/3/2017	6/6/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	0.011J+	<0.0500	<0.0500
Calcium	---	63.9	6.0	5.5	5.6	5.5	4.2	5.8	5.47	5.59
Chloride	---	46	8.2	8.5	8.5	9.3	9.2	9.4	9.1	10.3
Fluoride	NA	0.26	0.024B	0.029B	0.042B	0.027J	<0.050	0.028J	<0.10	<0.10
pH (std units)	---	4.04 -7.16	5.25	5.16	5.58	5.21	5.37	5.59	5.52	5.37
Sulfate	---	7.7	5.0	5.6	5.3	5.5	5.2	5.8	4.4	5.5
TDS	---	450	99B	99	93	86	89	78	82	66
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.0011J	0.0017B	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	<0.0050	0.00041J	0.00051J	<0.0050	<0.0050	<0.0010	<0.0010
Barium	2	---	0.048	0.042	0.042	0.041	0.028	0.040	0.0430	0.0384
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	0.00034J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.0013B	0.00034B	<0.0020	0.00038J	<0.0020	<0.0020	0.0012J	<0.0050
Cobalt	---	0.0069	0.0054	0.0038	0.0036	0.0030	0.0017	0.0019	0.00094J	0.00082J
Fluoride	4.0	--	0.024B	0.029B	0.042B	0.027J	<0.050	0.028J	<0.10	<0.10
Lead	---	0.001	0.00046B	0.00018B	0.00031B	0.00037J	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0015J	0.0017B	0.0016J	0.0019J	0.0021J	0.0024J	0.0015J	0.0024J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	0.00058J	0.00068J	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	0.841	0.615	0.658	0.358	0.554	<0.324	<1.24	<1.12
Selenium	0.05	---	0.00062J	0.00055J	0.00089J	0.0011J	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0020B	0.00070J	0.00066J	0.00069B	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	0.0034J	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	0.0053	0.0031	0.0032B	0.0033B	0.0022	0.0027	<0.0050	<0.0050
Silver	---	0.005	<0.0010	0.000077J	0.00014J	0.000036J	0.00039J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	2.7J+	<3.0	<0.10	<0.10
Tin	---	0.012	<0.010	<0.010	0.0070B	0.0077J	0.0070J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00055J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.013B	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.560J+	<0.10	<0.10
Manganese	---	6.8	0.40	0.29	0.27	0.23	0.16	0.18	0.140	0.101

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the miethod detection limit
H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-35D (Background)							
			1/13/2017	2/23/2017	3/16/2017	4/7/2017	5/3/2017	6/6/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	0.15	0.10	0.10	0.10	0.11	0.10	0.11	0.105	0.101
Calcium	---	63.9	10	9.2	9.0	8.9	9.1	9.5	9.05	9.48
Chloride	---	46	11	10	11	11	10	10	9.6	10.7
Fluoride	NA	0.26	0.22	0.25	0.20	0.26	0.26	0.24	0.13	0.16
pH (std units)	---	4.04 -7.16	6.64	6.22	6.92	6.56	6.71	6.39	6.23	6.22
Sulfate	---	7.7	4.2	6.4	4.2	4.7	4.6	4.6	3.3	4.3
TDS	---	450	160	140	140	140	140	150	128	155
CCR Assessment Constituents										
Antimony	0.006	---	0.0017J	<0.0020	0.0017J	0.00067B	0.00061J	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00063J	0.00037J	0.00058J	<0.0050	<0.0050	<0.0050	<0.0010	<0.0010
Barium	2	---	0.046	0.044	0.043	0.043	0.041	0.044	0.0428	0.0412
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.0014B	0.00047B	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0069	0.00036J	0.00014J	0.00041B	0.00014J	0.00037J+	0.00064J	0.00010J	<0.0010
Fluoride	4.0	--	0.22	0.25	0.20	0.26	0.26	0.24	0.13	0.16
Lead	---	0.001	0.00079B	0.00020B	0.00051B	0.00021J	0.00048J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.013	0.012	0.012	0.012	0.012	0.013	0.0124J	0.0123J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0022B	0.0014J	0.0013J	0.00066J	0.0012J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	0.911	<0.491	0.367	0.709	0.638	0.505	1.51	<1.91
Selenium	0.05	---	0.00096J	<0.0050	0.00076J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0011B	0.00079J	<0.0020	0.00045B	<0.0020	0.0033J+	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	0.00097B	0.00055J	0.00037B	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.00012J	0.00065J	0.00022J	<0.0010	0.000078J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	2.3J+	<3.0	0.22	0.19
Tin	---	0.012	0.0065B	<0.010	0.0084B	<0.010	0.0091J	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00062J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.56J+	<0.10	0.057J
Manganese	---	6.8	0.075	0.067	0.063	0.061	0.061	0.062	0.0576	0.0622

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-1D (Downgradient CCR Well)							
			10/6/2016	11/17/2016	1/10/2017	2/20/2017	4/4/2017	5/16/2017	6/21/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.15	0.010B	0.013B	0.017J	0.023B	0.024J+	0.018J	0.0261J	<0.0500
Calcium	---	63.9	4.7	4.1	5.4	5.3	5.3	5.3	6.68	4.67
Chloride	---	46	13	15	15	15	15	15	15.1	14.4
Fluoride	NA	0.26	0.063J	0.045B	0.074B	0.065	0.12J+	0.11J+	0.11	<0.10
pH (std units)	---	4.04 -7.16	4.35	4.04	4.04	**4.03**	**3.53**	4.08	4.36	4.28
Sulfate	---	7.7	**31**	**36**	**51**	**49**	**50**	**54**	**56.9**	**54.2**
TDS	---	450	130	140	170	160	140	170	141	146
CCR Assessment Constituents										
Antimony	0.006	---	0.00029J	0.0010J	<0.0020	0.0017J	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00051J	0.00069J	0.00042J	0.0023J	0.00066J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.026	0.021	0.024	0.025	0.025	0.025	0.0240	0.0234
Beryllium	0.004	---	0.00061J	0.0011	0.00098J	**0.010**	0.0011	0.0012	0.0010	0.00096J
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	0.0020	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00095B	0.00051J	0.00033B	0.0027	0.00048J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0069	**0.0079**	**0.0090**	**0.014**	**0.016**	**0.014**	**0.014**	**0.0136**	**0.0129**
Fluoride	4.0	--	0.063J	0.045B	0.074B	0.065	0.12J+	0.11J+	0.11	<0.10
Lead	---	0.001	0.00076B	0.00062J	0.0010B	**0.0030**	0.0010	**0.0011**	<0.0010	<0.0010
Lithium	---	0.05	0.0092B	0.0068J	0.0086	0.0092	0.0096	0.0088	0.0119J+	0.0063J
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	0.00061J	<0.010	0.0014J	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	4.02	4.78	**10.7**	**9.00**	**7.67**	**8.47**	**7.61**	**7.12**
Selenium	0.05	---	<0.0050	0.00070J	<0.0050	0.0025J	0.0011J	<0.0050	0.0039J+	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	0.00023J	0.00034J	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0013B	<0.0020	<0.0020	0.00043B	0.00088J+	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	0.0021J	0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	**0.010**	**0.011**	**0.017**	**0.018**	**0.017**	**0.016**	**0.0170**	**0.0151**
Silver	---	0.005	<0.0010	<0.0010	<0.0010	0.00013J	0.000092J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.012	<0.010	0.0039J	<0.010	0.011	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	0.00075J	<0.0050	0.00054J	0.0026J	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.017J	0.014J	0.023	0.021	0.021	0.019J	0.0215	0.0198
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.10	<0.10
Manganese	---	6.8	0.27	0.25	0.24	0.25	0.24	0.26	0.243	0.248

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
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pCi/L - picocuries per liter
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MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-4 (Downgradient CCR Well)							
			10/6/2016	11/14/2016	1/11/2017	2/21/2017	4/4/2017	5/15/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.15	**1.2**	**1.5**	**1.5**	**1.5**	**1.5**	**1.4**	**1.47**	**1.29**
Calcium	---	63.9	58	60	**76**	59	55	56	61.3	**138**
Chloride	---	46	7.6	7.5	7.3	7.0	6.9	7.1	6.8	6.9
Fluoride	NA	0.26	0.030J	0.025B	0.029B	0.032J	0.029J	<0.25	<0.10	<0.10
pH (std units)	---	4.04 -7.16	4.65	5.00	4.95	4.59	4.79	4.72	4.83	5.53
Sulfate	---	7.7	**450**	**460**	**460**	**420**	**420**	**410**	**407**	**397**
TDS	---	450	**660**	**670**	**670**	**660**	**630**	**630**	**622**	**633**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00041J	0.00059J	0.00046J	0.00054J	0.00063J	<0.0050	<0.0010	0.00065J
Barium	2	---	0.024	0.019	0.019	0.017	0.017	0.016	0.0145	0.0134
Beryllium	0.004	---	0.00058J	0.00050J	0.00048J	0.00056J	0.00058J	0.00040J	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00024J	<0.00080	<0.00080
Chromium	0.1	---	<0.0020	<0.0020	<0.0020	0.00026J	<0.0020	<0.0020	<0.0050	0.0054J+
Cobalt	---	0.0069	**0.071**	**0.070**	**0.082**	**0.061**	**0.059**	**0.059**	**0.0601**	**0.135J+**
Fluoride	4.0	--	0.030J	0.025B	0.029B	0.032J	0.029J	<0.25	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	0.00022B	0.00031J	0.00031J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	**0.063**	**0.061**	**0.066**	**0.061**	**0.058**	0.044	**0.0571**	**0.0604**
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	0.00053J	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	3.13	3.42	3.38	3.04	3.43	3.85	2.20	3.59J+
Selenium	0.05	---	0.00067J	<0.0050	<0.0050	<0.0050	0.00068J+	<0.0050	<0.0050	0.0131
Thallium	0.002	---	<0.0010	<0.0010	0.00028J	<0.0010	<0.0010	0.00026J	0.00020J	0.00031
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	0.00070B	<0.0020	0.00038J+	<0.0020	<0.0050	0.0025J+
Cyanide	---	0.01	<0.010	0.0020J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	**0.047**	**0.048**	**0.059**	**0.045**	**0.044**	**0.044**	**0.0444**	**0.108**
Silver	---	0.005	<0.0010	<0.0010	0.0012	0.00023J	0.00022J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	**0.056**	**0.063**	**0.080**	**0.055**	0.051	0.050	**0.0587**	0.0498
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.56J	0.15	0.11
Manganese	---	6.8	0.53	0.52	0.65	0.50	0.49	0.49	0.523	0.465

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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H - Analyzed outside method hold time
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NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-6 (Downgradient CCR Well)							
			10/4/2016	11/14/2016	1/12/2017	2/20/2017	4/4/2017	5/15/2017	6/20/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.15	**0.44**	**0.52**	**0.72**	**0.94**	**1.0**	**0.95**	**1.10**	**1.16**
Calcium	---	63.9	12	18	23	28	30	28	31.0	35.8
Chloride	---	46	5.0	8.8	7.4	6.5	6.3	5.7	5.4	4.9
Fluoride	NA	0.26	**0.32**	0.12J	0.10	0.13	0.11J	<0.25	0.095J	<0.10
pH (std units)	---	4.04 -7.16	6.71	6.55	6.46	6.21	6.10	6.21	6.02	6.80H
Sulfate	---	7.7	**310**	**390**	**510**	**540**	**540**	**530**	**536**	**503**
TDS	---	450	**610**	**780**	**930**	**960**	**990**	**960**	**964**	**1010**
CCR Assessment Constituents										
Antimony	0.006	---	0.00078J	0.0015J	0.0017J	0.00080B	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00053J	0.00097J	0.00090J	0.00072J	0.00046J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.055	0.082	0.086	0.076	0.057	0.042	0.0328	0.0282
Beryllium	0.004	---	<0.0010	0.00045J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00035B	0.00030J	0.00041B	0.00028J	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0069	0.00013J	0.00028J	0.00029J	0.00025J	<0.0010	<0.0010	<0.0010	<0.0010
Fluoride	4.0	--	0.32	0.12J	0.10	0.13	0.11J	<0.25	0.095J	<0.10
Lead	---	0.001	0.00027B	0.00024J	0.00042B	0.00053J	0.00017J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.046J	0.048J	**0.064**	**0.077**	**0.085**	**0.071**	**0.0863J**	**0.115**
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.011J	0.032J	0.0015J	0.00088J	0.00060J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.24	1.20	1.56	1.05	1.06	<0.491	1.62	1.78
Selenium	0.05	---	<0.0050	0.00069J	<0.0050	0.00063J	0.00067J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0027B	0.00071B	0.0012B	0.00039	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	0.00068B	0.00046B	0.00058B	0.00051	0.00048J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.0042	0.000066J	0.000058J	0.00019J	0.00011J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.012	<0.010	0.011	0.0054J	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.0065J	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.56J	0.28	0.24
Manganese	---	6.8	0.15	0.22	0.31	0.34	0.37	0.35	0.394	0.391

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
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pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the miethod detection limit
H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-7 (Downgradient CCR Well)							
			11/14/2016	1/12/2017	2/21/2017	3/16/2017	4/7/2017	5/3/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	0.15	0.051	0.039J	0.038B	0.034J	0.039J	0.033J	0.0316J	<0.0500
Calcium	---	63.9	36	30	25	24	24	23	20.9	19.6
Chloride	---	46	11	11	10	10	9.4	9.7	9.2	10
Fluoride	NA	0.26	**0.49**	**0.37**	**0.35**	0.26	**0.30**	**0.31**	0.20	0.22
pH (std units)	---	4.04 -7.16	6.48	6.60	6.15	6.34	6.34	6.36	6.32	6.20
Sulfate	---	7.7	**110**	**74**	**51**	**53**	**47**	**48**	**38.9**	**41.9**
TDS	---	450	300	260	210	200B	200	210	177	180
CCR Assessment Constituents										
Antimony	0.006	---	0.00037J	<0.0020	<0.0020	<0.0020	0.00032B	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0015J	0.0017J	0.0012J	0.0012J	0.0013J	0.0011J	0.00090J	0.0011
Barium	2	---	0.075	0.073	0.072	0.075	0.081	0.072	0.0752	0.0694
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	<0.0020	0.00090B	<0.0020	<0.0020	<0.0020	<0.0020	0.0016J	<0.0050
Cobalt	---	0.0069	0.0031	0.0033	0.0031	0.0036	0.0038J	0.0031	0.0042	0.0043
Fluoride	4.0	--	0.49	0.37	0.35	0.26	0.30	0.31	0.20	0.22
Lead	---	0.001	<0.0010	0.00030B	<0.0010	0.00022J	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0066J	0.0090	0.0078J	0.0074J	0.0082	0.0088	0.0080J	0.0087J
Mercury	0.002	---	<0.00020	0.00017B	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0095J	0.0046J	0.0033J	0.0031J	0.0029J	0.0022J	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.37	1.02	0.742	0.887	0.778	0.791	<1.57	<1.73
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	0.0053	**0.0056**	0.0045	0.0051	0.0040	0.0038	**0.0070**	**0.0060**
Silver	---	0.005	<0.0010	<0.0010	<0.0010	0.00011J	0.0014	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	**5.6**	<0.10	<0.10
Tin	---	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0074J+	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.10	<0.10
Manganese	---	6.8	0.23	0.37	0.37	0.38	0.40	0.32	0.27	0.26

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the miethod detection limit
H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-10 (Downgradient CCR Well)							
			10/5/2016	11/17/2016	1/12/2017	2/21/2017	4/4/2017	5/15/2017	6/21/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.15	**0.25**	0.072	0.069J	**0.17**	**0.20**	**0.18**	**0.196**	**0.176**
Calcium	---	63.9	36	22	22	27	30	29	32.8	33.3
Chloride	---	46	34	20	23	19	20	21	19.0	17.8
Fluoride	NA	0.26	**0.31**	0.064B	0.065B	0.085	0.093	0.087	0.082J	<0.10
pH (std units)	---	4.04 -7.16	5.87	5.35	5.23	5.73	5.52	5.73	5.73	5.85
Sulfate	---	7.7	**87**	**46**	**59**	**49**	**48**	**49**	**47.0**	**47.7**
TDS	---	450	320	190	220	**600**	230	230	206	211
CCR Assessment Constituents										
Antimony	0.006	---	0.0013J	0.00072J	0.00027J	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0066	0.0017J	0.00083J	0.00049J	0.00039J	<0.0050	<0.0010	0.00076J
Barium	2	---	0.160	0.091	0.095	0.110	0.120	0.110	0.116	0.109
Beryllium	0.004	---	0.00056J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	0.00045J	0.00060J	0.00046J	0.00048J	0.00036J	<0.00080	<0.00080
Chromium	0.1	---	0.013	0.0013J	0.00069B	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0069	**0.026**	**0.021**	**0.018**	**0.016**	**0.015**	**0.015**	**0.0144**	**0.0145**
Fluoride	4.0	--	0.31	0.064B	0.065B	0.085	0.093	0.087	0.082J	<0.10
Lead	---	0.001	**0.0058**	0.00059J	0.00047B	0.00017J	0.00017J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.013J	<0.0080	0.0026J	0.0018J	0.0021J	<0.0080	0.00093	0.0025J
Mercury	0.002	---	<0.00020	<0.00020	0.00016B	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0037J	0.0015J	0.0025J	0.0014J	0.0013J	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.09	<0.467	0.182	0.503	<0.491	0.408	<1.42	<1.38
Selenium	0.05	---	0.0015J	0.00089J	0.00061J	<0.0050	0.0011J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.018	0.0013B	0.00086B	0.00044	0.00046J	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	0.0020J	0.0092J	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	**0.014**	**0.0087**	**0.011**	**0.0098**	**0.0092**	**0.0087**	**0.0080**	**0.0089**
Silver	---	0.005	0.00038J	0.00012J	0.000059J	0.00033J	0.00044J	0.00017J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.012	<0.010	0.0039J	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	**0.019**	0.0019J	0.0013J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	0.041B	0.0097J	0.010B	0.0066J	0.0075J	<0.020	0.0077J	0.0122
VPDES Parameters										
Ammonia	---	15	1.1J	<2.0	1.7J	<2.0	<2.0	0.84J	0.51	0.47
Manganese	---	6.8	1.9	0.87	0.61	0.96	1.3	1.3	1.40	1.32

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
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MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-14 (Downgradient CCR Well)							
			10/7/2016	11/16/2016	1/10/2017	2/20/2017	4/3/2017	5/15/2017	6/19/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.15	0.088B	0.041J	0.051J	0.058J	0.056J	0.049J	0.0419J	0.0330J
Calcium	---	63.9	2.8	3.5	9.4	16	19	8.2	4.38	3.92
Chloride	---	46	1.4	1.1	1.5	2.6	3.2	1.6	1.1	1.3
Fluoride	NA	0.26	<0.20	0.084J	0.082	0.074	0.12J	0.11	0.10	0.10
pH (std units)	---	4.04 -7.16	5.87	6.28	6.02	6.35	6.25	6.47	6.46	6.27
Sulfate	---	7.7	**8.4**	**9.3**	**27**	**31**	**32**	**15**	**9.3**	**8.2**
TDS	---	450	94	82	160	160	180	110	80	83
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.0013J	<0.0020	<0.0020	<0.0020	<0.00050	<0.0050
Arsenic	0.010	---	0.00041J	0.00043J	0.00086J	0.00061B	<0.0050	<0.0050	0.00032	<0.0010
Barium	2	---	0.0086B	0.011	0.025	0.039	0.045	0.021	0.0121	0.0105
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000080	<0.00080
Chromium	0.1	---	<0.0020	<0.0020	0.00069B	0.00048J	0.00034J+	<0.0020	0.00027J	<0.0050
Cobalt	---	0.0069	0.00022J	0.00016J	0.00047J	0.00024B	0.00016J+	<0.0010	0.000045J	<0.0010
Fluoride	4.0	--	<0.20	0.084J	0.082	0.074	0.12J	0.11	0.10	0.10
Lead	---	0.001	0.00038B	0.00017J	**0.0016B**	0.00035B	0.00029J+	<0.0010	<0.00010	<0.0010
Lithium	---	0.05	0.0048J	0.0063J	0.013	0.019	0.021	0.0078J	0.0082	0.0099J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	0.00059J	0.0016J	<0.010	<0.010	<0.010	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.05	<0.462	0.654	0.565	0.755	<0.494	<1.15	<1.28
Selenium	0.05	---	<0.0050	<0.0050	0.00072J	<0.0050	<0.0050	<0.0050	0.0026J+	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00041B	0.00039B	0.0016B	<0.0020	0.00079J+	<0.0020	0.00015J+	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	<0.0020	<0.0020	0.0016B	0.00041B	0.00037J+	<0.0020	<0.00050	<0.0050
Silver	---	0.005	<0.0010	0.000076J	0.00067J	0.000057J	0.000086J	0.00041J	0.00011J	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	1.7J	<0.10	<0.10
Tin	---	0.012	<0.010	0.0028J	**0.017**	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	0.00075J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	0.0098J	<0.020	<0.020	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.10	<0.10
Manganese	---	6.8	0.026	0.035	0.075	0.13	0.13	0.059	0.0316	0.0274

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-16D (Downgradient CCR Well)							
			10/6/2016	11/16/2016	1/10/2017	2/20/2017	4/3/2017	5/15/2017	6/20/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.15	0.020B	0.027B	0.025J	0.034B	0.036J	0.031J	0.0330J	0.0355J
Calcium	---	63.9	4.2	3.1	3.3	8.3	10	11	12.8	12.9
Chloride	---	46	1.9	1.7	1.7	2.1	2.5	2.7	2.8	2.6
Fluoride	NA	0.26	0.23	0.016J	0.13	0.17	0.21	0.18	0.14	0.084J
pH (std units)	---	4.04 -7.16	6.91	6.40	6.34	6.60	6.58	6.55	6.27	6.64
Sulfate	---	7.7	**34**	**22**	**31**	**80**	**88**	**94**	**107**	**96.8**
TDS	---	450	130	110	140	190	230	220	223	233
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00091J	0.00070J	0.00069J	0.00077B	0.00069J	<0.0050	0.00060J	0.00091J
Barium	2	---	0.015	0.013	0.011	0.014	0.018J+	0.017	0.0148	0.0176
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.00045B	0.00035J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0069	0.00046J	0.00031J	0.00028J	0.00040B	0.00046J+	0.00035J	0.00028J	0.00059J+
Fluoride	4.0	--	0.23	0.016J	0.13	0.17	0.21	0.18	0.14	0.084J
Lead	---	0.001	0.00056B	0.00068J	0.00088B	0.00031B	0.00025J+	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.0046B	0.0041J	0.0058J	0.0076J	0.0084	0.0056J	0.0103J+	0.0090J
Mercury	0.002	---	<0.00020H	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	0.0052J	0.0027J	0.0016J	0.0022B	0.0019J	0.0020J	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	0.639	<0.432	0.721	0.495	0.277	<0.399	<1.53	1.17
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.00041B	0.00051B	0.00056B	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	<0.0020	<0.0020	<0.0020	<0.0020	0.00035J+	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.00043J	<0.0010	0.0013	0.000041J	0.00013J	<0.0010	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	1.2J+	<3.0	<0.10	<0.10
Tin	---	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.0084J	<0.0100
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	0.56J	<0.10	<0.10
Manganese	---	6.8	0.11	0.078	0.075	0.17	0.19J+	0.18	0.177	0.242

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
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3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
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pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the miethod detection limit
H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-3D (Downgradient CCR Well)							
			10/17/2016	11/17/2016	1/11/2017	2/21/2017	4/4/2017	5/16/2017	6/20/2017	7/25/2017
CCR Detection Constituents										
Boron	---	0.15	**0.57**	**1.3**	**0.93**	**1.7**	**1.9**	**1.9**	**2.09**	**1.86**
Calcium	---	63.9	57	9.6	11	8.4	8.0	8.6	7.43	8.33
Chloride	---	46	**93**	**69**	40	45	**51**	**51**	**52.1**	**50.5**
Fluoride	NA	0.26	0.44J	**0.75**	**0.27**	**0.47**	**0.45**	**0.41**	**0.41**	**0.42**
pH (std units)	---	4.04 -7.16	**7.51**	**7.23**	7.05	6.93	6.89	6.83	6.92	7.04
Sulfate	---	7.7	**9J**	**140**	**150**	**180**	**240**	**220**	**207**	**209**
TDS	---	450	**1300**	**600**	**560**	**1000**	**710**	**680**	**698**	**714**
CCR Assessment Constituents										
Antimony	0.006	---	0.0010J	0.00034J	<0.0020	<0.0020	<0.0020	0.00069J	<0.0050	<0.0050
Arsenic	0.010	---	<u>**0.013**</u>	0.00089J	0.00041J	0.00046J	0.00052J	0.0013J	0.00055J	<0.0010
Barium	2	---	0.830	0.064	0.045	0.045	0.045	0.043	0.0287	0.0266
Beryllium	0.004	---	<u>**0.034**</u>	0.0013	0.00089J	<0.0010	<0.0010	0.0037	<0.0010	<0.0010
Cadmium	0.005	---	0.00046J	<0.0010	<0.0010	<0.0010	<0.0010	0.00050J	<0.00080	<0.00080
Chromium	0.1	---	<u>**0.19**</u>	0.01	0.0044	0.0019J	0.0011J	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0069	**0.038**	0.0018	0.00096J	0.00052J	0.00059J	0.0012	0.00031J	0.00019J
Fluoride	4.0	--	0.44J	0.75	0.27	0.47	0.45	0.41	0.41	0.42
Lead	---	0.001	**0.048**	**0.0025**	**0.0011**	0.00073J	0.00036J	**0.0013**	<0.0010	<0.0010
Lithium	---	0.05	**0.16**	0.015J	0.010	0.016	0.020	0.0024	0.0225J	0.0250J
Mercury	0.002	---	0.00012J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	**0.051**	**0.058**	0.0042B	**0.013**	**0.011**	**0.014**	0.0087	**0.0109**
Radium 226/228 (pCi/L)	5	---	<12.2	1.69	1.59	0.624	0.666	0.427	<1.32	<1.31
Selenium	0.05	---	0.0083	0.00078J	<0.0050	<0.0050	0.00069J	0.0013J	<0.0050	<0.0050
Thallium	0.002	---	0.0020	<0.0010	<0.0010	<0.0010	<0.0010	0.00036J	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.13	0.0060	0.0088	0.0027	0.0023	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	**0.060**	0.0047	0.0032B	0.0014	0.0016J	<0.0020	<0.0050	<0.0050
Silver	---	0.005	0.00018J	0.0021	0.000066J	0.00035J	0.0019	0.00027J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	0.12
Tin	---	0.012	**0.016**	<0.010	<0.010	<0.010	<0.010	0.0055J	<0.0050	<0.0050
Vanadium	---	0.005	**0.16**	**0.0076**	0.0036J	0.0017J	0.00058J	0.0010J	<0.0050	<0.0050
Zinc	---	0.054	**0.26**	0.021	0.017B	<0.020	<0.020	<0.020	<0.0100	0.0188
VPDES Parameters										
Ammonia	---	15	<2.0	<2.0	<2.0	<2.0	<2.0	2.2	0.15	0.11
Manganese	---	6.8	4.7	0.20	0.17	0.18	0.24	0.29	0.257	0.233

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the miethod detection limit
H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>**Bolded and Underlined**</u> detections are greater than the applicable MCL.

Table TM6-16
CCR Compliance Data
Upper Ash Pond, Potomac and Triassic Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-6D (Downgradient CCR Well)							
			10/12/2016	11/18/2016	1/12/2017	2/20/2017	4/4/2017	5/15/2017	6/20/2017	7/24/2017
CCR Detection Constituents										
Boron	---	0.15	**1.0**	**1.3**	**1.4**	**1.8**	**2.2**	**1.8**	**1.90**	**1.96**
Calcium	---	63.9	52	46	46	50	**93J+**	45	46.3	45.3
Chloride	---	46	41	27	11	12	10	13	10.4	9.5
Fluoride	NA	0.26	**0.27J**	**0.39J**	**0.27**	0.15	0.16	<0.50	0.15	0.095J
pH (std units)	---	4.04 -7.16	6.19	6.82	6.71	6.31	5.96	6.37	6.34	**7.80H**
Sulfate	---	7.7	**550**	**500**	**560**	**680**	**780**	**740**	**729**	**658**
TDS	---	450	**990**	**1000**	**1000**	**1100**	**1300J+**	**1300**	**1290**	**1280**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	0.0015J	0.00045J	0.00062J	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0034J	0.0012J	0.00092J	0.00042B	0.00073J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.21	0.083	0.060	0.066	0.063	0.051	0.0307	0.0251
Beryllium	0.004	---	**0.0045**	0.0013	<0.0010	<0.0010	0.00040J	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium	0.1	---	0.065	0.013	0.0018B	<0.0020	0.0025	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0069	**0.029**	**0.018**	**0.021**	**0.019**	**0.072**	**0.020**	**0.0234**	**0.0230**
Fluoride	4.0	--	0.27J	0.39J	0.27	0.15	0.16	<0.50	0.15	0.095J
Lead	---	0.001	**0.012**	**0.0032**	0.00095J	0.00043B	0.00093J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	**0.11**	**0.087**	**0.10**	**0.12**	**0.17**	**0.088**	**0.105**	**0.107**
Mercury	0.002	---	<0.00020	<0.00020	0.00012B	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	**0.032**	**0.028**	**0.017**	0.0071J	0.0044J	0.0038J	0.0026J	<0.0050
Radium 226/228 (pCi/L)	5	---	4.98	3.95	1.03	0.686	1.52	0.651	<1.71	<1.53
Selenium	0.05	---	0.0025J	0.00094J	0.00082J	0.00049B	0.0015J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	0.00032J	<0.0010	0.00028J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.03	0.0091	0.0024B	0.00073B	0.0023	0.0039	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	**0.011**	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0053	**0.025**	**0.0091**	**0.0085**	**0.0076B**	**0.026J+**	**0.0077**	**0.0070**	**0.0074**
Silver	---	0.005	0.0042	0.00020J	0.000094J	0.00088J	0.00012J	0.00047J	<0.0050	<0.0050
Sulfide	---	3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.012	0.0035B	<0.010	0.0054J	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.005	**0.04**	**0.0091**	0.0014J	<0.0050	0.0019J	<0.0050	<0.0050	<0.0050
Zinc	---	0.054	**0.055**	0.017J	0.011B	<0.020	0.022	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	15	2.5	<2.0	<2.0	<2.0	<2.0	0.56J	0.30	0.28
Manganese	---	6.8	1.9	1.2	1.3	1.4	3.1J+	1.4	1.39	1.31

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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H - Analyzed outside method hold time
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

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Table TM6-17
CCR Compliance Data
UAP Bedrock Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-31U (Background)							
			10/13/2016	11/16/2016	1/9/2017	2/20/2017	4/3/2017	5/15/2017	6/19/2017	7/24/2017
CCR Detection Constituents										
Boron	---	1.53	0.94	0.86	1.1	1.1	1.2J+	1.1	1.06	1.16
Calcium	---	13.41	9.7	9.2	11	11	11	10	10.1	11.0
Chloride	---	314	220	53	280	290	270	310	314	265
Fluoride	NA	1.6	1.3	0.22	1.2	1.2	1.2	1.2	1.2	0.98
pH (std units)	---	6.30 - 8.00	7.35	7.07	7.44	7.63	7.32	7.28	7.00	7.71
Sulfate	---	260	13	1.5	46	11	11	10	10.9	10.4
TDS	---	787.7	550	550	630	620	630	700	680	610
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	<0.0020	0.00059J	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0017J	0.00089J	0.00066J	0.00086B	0.00095J	<0.0050	0.00064J	<0.0010
Barium	2	---	0.18	0.15	0.18	0.21	0.20	0.19	0.173	0.178
Beryllium	0.004	---	0.00058J	0.00049J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.015	0.0077	0.0053	0.0040	0.0037	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0034	0.0037	0.0018	0.0013	0.00080B	0.00093J	0.00023J	0.00026J	<0.0010
Fluoride	4.0	---	1.3	0.22	1.2	1.2	1.2	1.2	1.2	0.98
Lead	---	0.0047	0.0056	0.0027	0.0022B	0.0015B	0.0015	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	<0.050	0.018J	0.020	0.020	0.020	0.011	0.0136J	0.0144J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.11	0.017	0.020	0.0074J	0.0071J	0.0074J	0.0069J	0.0078	0.0073
Radium 226/228 (pCi/L)	5	---	2.95	1.45	2.22	3.37	2.46	1.50	1.37	1.33
Selenium	0.05	---	0.00078J	<0.0050	<0.0050	<0.0050	0.00091J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00036J	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0094B	0.0056	0.0042	0.0028B	0.0029B	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0145	0.0093	0.0067	0.0039	0.0022B	0.0023	<0.0020	<0.0050	<0.0050
Silver	---	0.0097	0.00020J	0.00013J	0.000083J	0.00033J	0.00036J	0.000068J	<0.0050	<0.0050
Sulfide	---	5.02	<3.0	<3.0	<3.0	<3.0	1.6J+	1.7J	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0033J	<0.010	<0.0050	<0.0050
Vanadium	---	0.012	0.012	0.0057	0.0044J	0.0030J	0.0026J	<0.0050	<0.0050	<0.0050
Zinc	---	0.038	0.038	0.027	0.020	0.011J	0.018J	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	2	<2.0	1.1J	<2.0	1.4B	<2.0	0.84J	0.46	0.40
Manganese	---	0.27	0.27	0.20	0.18	0.16	0.15	0.13	0.137	0.131

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
H - Analysis conducted outside the EPA method holding time.
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-17
CCR Compliance Data
UAP Bedrock Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-35B (Background)							
			2/6/2017	2/23/2017	3/16/2017	4/7/2017	5/3/2017	6/6/2017	7/5/2017	8/10/2017
CCR Detection Constituents										
Boron	---	1.53	0.23	0.35	0.41	0.49	0.61	0.55	0.583	0.609
Calcium	---	13.41	9.2	12	10	10	9.3	9.0	7.88	7.47
Chloride	---	314	50	46	47	45	38	39	32	31
Fluoride	NA	1.6	1.4	1.5	1.4	1.4B	1.3	1.3	0.87	0.97
pH (std units)	---	6.30 - 8.00	6.81	7.20	7.28	6.87	6.96	6.72	6.81	6.22
Sulfate	---	260	260	230	200	200	190	180	140	70.1
TDS	---	787.7	700	680	640	690	690	650	614	524
CCR Assessment Constituents										
Antimony	0.006	---	0.0015J	0.00027J	0.00042J	0.00046B	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0015J	0.0016J	0.0011J	0.00081J	<0.0050	<0.0050	<0.0010	<0.0010
Barium	2	---	0.089	0.066	0.043	0.043	0.050	0.044	0.0328	0.029
Beryllium	0.004	---	0.00044J	<0.0010	<0.0010	<0.0010	<0.0010	0.00044J	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.0033	0.0024B	0.00068J	0.00049J	<0.0020	<0.0020	<0.0050	<0.0050
Cobalt	---	0.0034	0.0010	0.00062J	0.00030B	0.00013J	0.00024J	0.00019J	<0.0010	<0.0010
Fluoride	4.0	---	1.4	1.5	1.4	1.4B	1.3	1.3	0.87	0.97
Lead	---	0.0047	0.0051	0.0028	0.0011B	0.00063J	<0.0010	0.00047J	<0.0010	<0.0010
Lithium	---	0.05	0.032	0.028	0.020	0.019	0.022	0.019	0.0183J	0.0162J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.11	0.11	0.10	0.084	0.067	0.046	0.040	0.0245	0.0170
Radium 226/228 (pCi/L)	5	---	3.25	1.67	1.10	0.775	<0.433	1.08	2.07	<2.17
Selenium	0.05	---	0.0020J	0.0015J	0.0011J	0.00049J	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0047	0.0070	0.0016B	0.0018B	0.0023B	0.0039	<0.0050	<0.0050
Cyanide	---	0.01	0.0020J	<0.010	0.0048J	<0.010	0.0058J	0.0024J	<0.0080	<0.0080
Nickel	---	0.0145	0.0024B	0.0023	0.00069B	0.0016B	<0.0020	<0.0020	<0.0050	<0.0050
Silver	---	0.0097	0.00032J	0.000059J	0.00057J	0.00023J	0.000062J	0.00043J	<0.0050	<0.0050
Sulfide	---	5.02	<3.0	1.3J	3.2	4.0	3.2	<3.0	2.6	2.3
Tin	---	0.01	0.0081J	0.0070B	0.0081B	0.0058J	0.0052J	0.0043J	<0.0050	<0.0050
Vanadium	---	0.012	0.0032J	0.0019J	0.00072J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.038	0.022B	0.0096J	<0.020	<0.020	<0.020	<0.020	0.0223J+	<0.0100
VPDES Parameters										
Ammonia	---	2	<2.0	<2.0	<2.0	<2.0	<2.0	0.56J+	0.17	0.20
Manganese	---	0.27	0.052	0.040	0.026	0.026	0.027	0.031	0.0318	0.0313

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
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pCi/L - picocuries per liter
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MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-17
CCR Compliance Data
UAP Bedrock Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-1DD (Downgradient)							
			10/14/2016	**11/17/2016**	**1/11/2017**	**2/21/2017**	**4/4/2017**	**5/17/2017**	**6/21/2017**	**7/24/2017**
CCR Detection Constituents										
Boron	---	1.53	0.73	0.78	0.86	0.93	0.92	0.97J+	0.893	0.900
Calcium	---	13.41	7.2	6.8	8.6	6.1	6.4	6.1	3.17	6.23
Chloride	---	314	240	260	260	260	240	250	250	223
Fluoride	NA	1.6	1.0	1.0	0.99	1.2	1.2	1.3J+	1.3	1.0
pH (std units)	---	6.30 - 8.00	6.48	6.67	6.72	6.72	6.67	7.25	7.10	7.41
Sulfate	---	260	190	200	200	180	180	190	188	166
TDS	---	787.7	**960**	**850**	**860**	**890**	**860**	**830**	738	**816**
CCR Assessment Constituents										
Antimony	0.006	---	0.00033J	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0014J	0.0011J	0.00048J	0.00051J	0.00043J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.048	0.044	0.026	0.025	0.028	0.024	0.0137	0.0128
Beryllium	0.004	---	0.00076J	0.00069J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.016	0.010	0.0042	0.0034	0.0033	0.0012J	<0.0050	0.0015J
Cobalt	---	0.0034	**0.0036**	0.0025	0.0015	0.00083J	0.00083J	0.00041J	<0.0010	0.00013J
Fluoride	4.0	---	1.0	1.0	0.99	1.2	1.2	1.3J+	1.3	1.0
Lead	---	0.0047	0.0040	0.0029	0.00088B	0.00069J	0.00068BJ	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	0.028J	0.016J	0.016	0.015	0.014	0.015	0.0062J	0.0112J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.11	0.0085J	0.0074J	0.0029B	0.0072J	0.0083J	0.0071J	0.0060	0.0058
Radium 226/228 (pCi/L)	5	---	<2.93	1.63	1.45	0.978	0.983	0.629	<1.42	1.64
Selenium	0.05	---	0.00062J	0.00064J	<0.0050	<0.0050	0.00048J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.012B	0.0088	0.0093	0.0037	0.0038	<0.0020	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0145	0.0088	0.0062	0.0040	0.0022	0.0036	<0.0020	<0.0050	<0.0050
Silver	---	0.0097	<0.0010	<0.0010	0.00049J	0.000094J	0.00029J	<0.0010	0.0010J	<0.0050
Sulfide	---	5.02	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0033J	<0.010	<0.0050	<0.0050
Vanadium	---	0.012	**0.016**	0.012	0.0032J	0.0020J	0.0018J	0.0011J	<0.0050	<0.0050
Zinc	---	0.038	0.020	0.026	0.016B	<0.020	<0.020	<0.020	<0.0100	0.0310
VPDES Parameters										
Ammonia	---	2	<2.0	<2.0	<2.0	<2.0	<2.0	0.56J	0.29	0.25
Manganese	---	0.27	**0.28**	0.22	0.23	0.16	0.18	0.16	0.167	0.168

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
H - Analysis conducted outside the EPA method holding time.
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-17
CCR Compliance Data
UAP Bedrock Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-6DD (Downgradient)							
			10/11/2016	11/18/2016	1/12/2017	2/20/2017	4/4/2017	5/15/2017	6/20/2017	7/24/2017
CCR Detection Constituents										
Boron	---	1.53	**1.8**	**2.0**	1.3	**1.5**	**1.8**	1.3	**1.66**	1.51
Calcium	---	13.41	**17**	12	7.6	7.9	9.2	7.0	6.07	7.87
Chloride	---	314	**620**	**610**	**450**	**520**	**530**	**410**	**466**	**396**
Fluoride	NA	1.6	**3.5**	**3.2**	**2.7**	**3.3**	**3.7**	**2.7**	**3.2**	**2.4**
pH (std units)	---	6.30 - 8.00	**5.74**	6.92	7.20	7.47	7.65	7.55	7.62	7.70H
Sulfate	---	260	170	170	120	150	150	130	148	126
TDS	---	787.7	**1700**	**1500**	**1100**	**1200**	**1400**	**1000**	**1180**	**1120**
CCR Assessment Constituents										
Antimony	0.006	---	0.00065B	<0.0020	0.00048J	<0.0020	0.00035J	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.0019J	0.00039J	<0.0050	0.00044B	0.00037J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.15	0.047	0.038	0.039	0.045	0.031	0.0177	0.0157
Beryllium	0.004	---	<u>**0.0043**</u>	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.040	0.0020	0.0025B	0.0018J	0.00056J	<0.0020	<0.0050	0.0012J
Cobalt	---	0.0034	**0.010**	0.00040J	0.00054J	0.00043B	<0.0010	<0.0010	<0.0010	0.00010J
Fluoride	4.0	---	3.5	3.2	2.7	3.3	3.7	2.7	3.2	2.4
Lead	---	0.0047	**0.0092**	0.00050J	0.00097J	0.00078B	0.00023J	<0.0010	<0.0010	<0.0010
Lithium	---	0.05	**0.090**	0.048J	0.028	0.032	0.031	0.024	0.0260	0.0306
Mercury	0.002	---	<0.00020	<0.00020	0.00021B	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.11	0.031	0.034	0.023	0.031	0.045	0.037	0.0564	0.0375
Radium 226/228 (pCi/L)	5	---	<2.69	0.628	0.583	<0.345	0.579	0.347	<1.63	1.21
Selenium	0.05	---	0.0016J	<0.0050	<0.0050	<0.0050	0.00054J+	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	0.00043J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.026	0.0053	0.0054B	0.0041B	0.00054	0.0028	0.0013J	0.0034J
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080
Nickel	---	0.0145	**0.024**	0.0031	0.0033B	0.0041B	0.0010J	0.0020	<0.0050	0.0111
Silver	---	0.0097	**0.077J**	**0.037J**	0.000070J	0.00036J	0.000044J	0.00022J	0.00086J	<0.0050
Sulfide	---	5.02	<3.0	<3.0	<3.0	<3.0	<3.0	3.3	<0.10	<0.10
Tin	---	0.01	0.0040B	<0.010	0.0025J	<0.010	<0.010	<0.010	<0.0050	<0.0050
Vanadium	---	0.012	**0.031**	0.0013J	0.00096J	0.0012J	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.038	**0.053**	0.019J	0.012B	<0.020	<0.020	<0.020	0.0094J	<0.0100
VPDES Parameters										
Ammonia	---	2	1.1J	<2.0	<2.0	<2.0	<2.0	1.1J	0.19	0.19
Manganese	---	0.27	**0.77**	0.16	0.12	0.12	0.19	0.09	0.106	0.0818

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
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MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>**Bolded and Underlined**</u> detections are greater than the applicable MCL.

Table TM6-17
CCR Compliance Data
UAP Bedrock Aquifers - Chesterfield Power Station

Parameter	MCL	Preliminary Background	MW-16DD (Downgradient)							
			10/13/2016	11/16/2016	1/10/2017	2/21/2017	4/3/2017	5/16/2017	6/20/2017	7/24/2017
CCR Detection Constituents										
Boron	---	1.53	0.93	1.0	1.0	1.0	1.1J+	1.1J	1.10	1.03
Calcium	---	13.41	3.3	4.8	3.8	3.4	3.6	3.2	2.54	2.43
Chloride	---	314	140	150	150	140	140	150	140	126
Fluoride	NA	1.6	1.5	1.3	**1.7**	**1.7**	**1.7**	**1.8J+**	**1.7**	1.5
pH (std units)	---	6.30 - 8.00	7.82	7.03	7.13	7.09	7.19	7.15	7.11	6.74
Sulfate	---	260	83	88	93	85	82	88	81.0	82.1
TDS	---	787.7	620	610	630	660	600	580	550	560
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	0.00029J	<0.0020	<0.0020	<0.0050	<0.0050
Arsenic	0.010	---	0.00072J	0.00082J	0.00062J	0.00074B	0.00088J	0.00076J	0.00056J	0.00079J
Barium	2	---	0.033	0.038	0.032	0.029	0.037	0.034	0.0203	0.0182
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080
Chromium, Total	0.1	---	0.0018B	0.0027	0.0012B	0.00054J	0.0024	0.0016J	<0.0050	<0.0050
Cobalt	---	0.0034	0.00061J	0.0010	0.00045J	0.00031J	0.00067J+	0.00042J	0.00014J	<0.0010
Fluoride	4.0	---	1.5	1.3	1.7	1.7	1.7	1.8J+	1.7	1.5
Lead	---	0.0047	0.0010B	0.00099J	0.00058B	0.00026J	0.00093B	0.00080J	<0.0010	<0.0010
Lithium	---	0.05	<0.050	0.0062J	0.0054J	0.0055J	0.0072J+	0.0070J	0.0061J	0.0044J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	0.00020
Molybdenum	---	0.11	0.022	0.033	0.029	0.023	0.021	0.020	0.0183	0.0158
Radium 226/228 (pCi/L)	5	---	<1.44	<0.472	0.300	<0.436	0.186	<0.352	<1.63	<1.20
Selenium	0.05	---	0.00062J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0044B	0.0048	0.0036B	0.00086	0.0051J+	0.0053J+	<0.0050	<0.0050
Cyanide	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0021J	<0.010	<0.0080	<0.0080
Nickel	---	0.0145	**0.016**	0.0064	0.0033B	0.0015	0.0026	0.0019J	<0.0050	<0.0050
Silver	---	0.0097	0.00011J	0.00019J	0.00011J	0.00010J	**0.0010**	0.00065J	<0.0050	<0.0050
Sulfide	---	5.02	1.5B	<3.0	<3.0	<3.0	1.2J+	<3.0	<0.10	<0.10
Tin	---	0.01	<0.010	<0.010	<0.010	<0.010	0.0025J	<0.010	<0.0050	<0.0050
Vanadium	---	0.012	0.0017J	0.0025J	<0.0050	<0.0050	0.0019J	0.0012J	<0.0050	<0.0050
Zinc	---	0.038	0.018J	0.020	<0.020	<0.020	0.022J+	<0.020	<0.0100	<0.0100
VPDES Parameters										
Ammonia	---	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.20	0.13
Manganese	---	0.27	0.052B	0.087	0.076	0.064	0.080	0.064	0.0432	0.0356

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
H - Analysis conducted outside the EPA method holding time.
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detectable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

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Table TM6-C18
Surface Water Sampling Results
Chesterfield Power Station

Parameter	Use Designation				June 14, 2016							
	Aquatic Life		Human Health									
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	CPS-UPS01	CPS-UPS02	CPS-DWS01	CPS-DWS02	CPS-FG01	CPS-FG02	CPS-FG03	CPS-Q01
	Acute (µg/l)	Chronic (µg/l)										
Aluminum	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	--	--	5.6	640	0.30 J, B	0.28 J, B	0.20 J, B	0.26 J, B	0.30 J, B	0.23 J, B	0.20 J, B	0.22 J, B
Arsenic	340	150	10	--	0.43 J	0.84 J	0.67 J	0.61 J	1.2	0.73 J	0.68 J	1.0
Barium	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	--	100	--	0.54 J	0.45 J	0.41 J	0.51 J	0.60 J	0.81 J	0.50 J	ND
Copper[1]	13	9.0	1,300	--	1.9 J	1.3 J	1.3 J	1.5 J	1.8 J	1.4 J	1.4 J	1.2 J
Hardness	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Iron	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Lead[1]	120	14	15	NS	0.51 J	0.37 J	0.40 J	0.42 J	0.58 J	0.43 J	0.36 J	0.21 J
Magnesium	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Nickel[1]	180	20	610	4,600	0.94 J	0.84 J	0.81 J	0.90 J	1.1	0.92 J	0.74 J	0.69 J
Potassium	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	0.79 J	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	--	0.24	0.47	0.041 J	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	3.1 J	5.0	4.0 J	2.8 J	3.5 J	3.2 J	2.2 J	ND
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	0.077 J	ND	ND	ND	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	3.1 J	ND	ND	ND	ND

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the DEQ, the James River is classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-C18
Surface Water Sampling Results
Chesterfield Power Station

Parameter	Use Designation				April 17, 2017							
	Aquatic Life		Human Health		ES-2CJMC003.61-041717		ES-2CXQW000.82-041717		ES-2CJM000.00-041717		ES-2CJMS098.16-041717	
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)								
	Acute (µg/l)	Chronic (µg/l)			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Aluminum	--	--	--	--	190	16 J	88	ND	270	ND	81	ND
Antimony	--	--	5.6	640	1.1 J	1.1 J	1.1 J	0.21 J	0.18 J	ND	ND	ND
Arsenic	340	150	10	--	0.78 J	0.68 J	0.81 J	0.63 J	0.72 J	0.37 J	0.30 J	0.31 J
Barium	--	--	--	--	33	29	31	28	32	27	30	28
Beryllium	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	--	--	--	--	21000 B	20000 B	21000 B	21000 B	20000 B	19000 B	19000 B	19000 B
Chromium	--	--	100	--	0.51 J	0.34 J	0.38 J	0.14 J	0.68 J	0.18 J	0.28 J	0.20 J
Copper[1]	13	9.0	1,300	--	1.9 J	1.3 J	1.6 J	1.2 J	2.1	1.2 J	1.4 J	1.2 J
Hardness	--	--	--	--	65000	64000	66000	65000	62000	61000	61000	61000
Iron	--	--	--	--	450	58	270	41 J	720	48 J	310	59
Lead[1]	120	14	15	NS	0.69 J	ND	0.33 J	ND	0.70 J	ND	0.37 J	ND
Magnesium	--	--	--	--	3300	3200	3400	3300	3200	3100	3100	3100
Manganese	--	--	--	--	68	39	66	3.1 J	76	30	72	47
Nickel[1]	180	20	610	4,600	1.1	1.1	1.2	0.89 J	1.3	0.63 J	0.77 J	0.64 J
Potassium	--	--	--	--	1900	1900	1900	1900	1900	1800	1800	1800
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	--	--	--	--	10000	10000	10000	10000	9500	9500	9300	9300
Strontium	--	--	--	--	72	72	79	77	70	68	68	68
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	24	4.6 J	10	3.2 J	29	2.2 J	2.5 J	1.7 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND	ND	ND	ND
Chromium III[1]	570	74	--	--	NA	NA	NA	NA	NA	NA	NA	NA
Chromium VI[1]	16	11	--	--	NA	NA	NA	NA	NA	NA	NA	NA

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the DEQ, the James River is classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Figures

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LEGEND

Approximate Property Boundary

Approximate Pond Boundary

Topographic Contours, 10 ft intervals

Topography Source: U.S. Geological Survey, 2016, Topo TNM Style Template: USGS - National Geospatial Technical Operations Center (NGTOC), Rolla, MO and Denver, CO

N

0 1,000 2,000 4,000
Feet

AECOM

Figure TM6-7
Site Topography

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Chesterfield Power Station

DATE:	DEPT:
10/26/2017	Environment

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LEGEND

- Approximate Property Boundary
- Approximate Ash Pond
- Potentiometric Contours

Compliance Program

- CCR Network Well
- CCR Network Background Well

AECOM

Figure TM6-8
Potentiometric Surface
Uppermost Aquifer, April 2017

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Chesterfield Power Station

DATE:	DEPT:
11/8/2017	Environment

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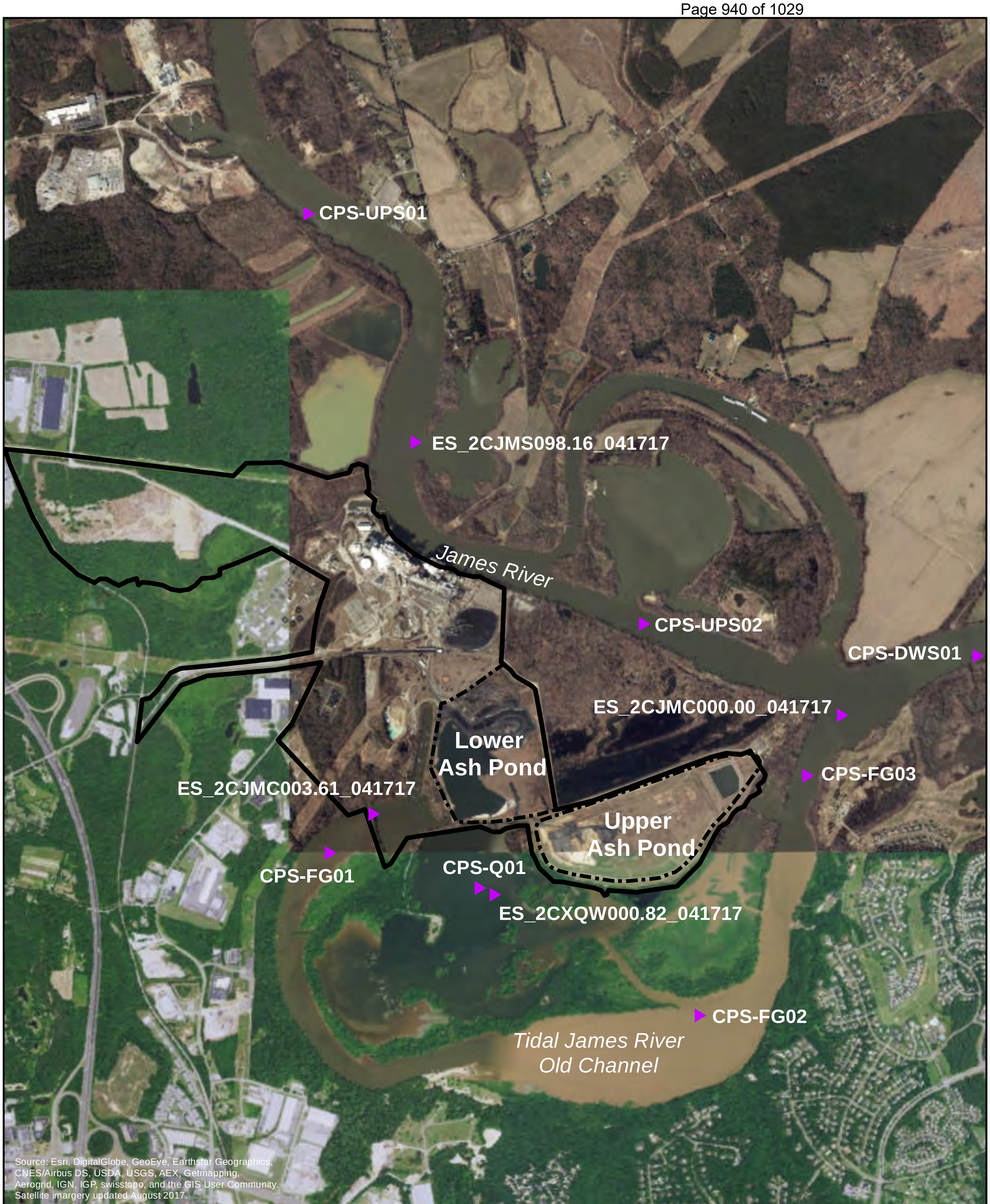

LEGEND

Approximate Property Boundary

Approximate Pond Boundary

Surface Water Sample

N

0 1,250 2,500 5,000
Feet

AECOM

Figure TM6-9
Surface Water Sampling Locations

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CTM	DFM	REV. 0

Chesterfield Power Station

DATE:	DEPT:
10/26/2017	Environment

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5. Possum Point Power Station

5.1 Location and Background

5.1.1 Facility Location

The Possum Point Power Station is located at 19000 Possum Point Road, Dumfries, Prince William County, VA. The station is situated on 650 acres at the southern tip of Possum Point peninsula and is bordered to the east by the Potomac River, which is also the Maryland state line. Quantico Creek is to the south, as is the Marine Corps Base Quantico. The facility location is shown on Figure TM6-10.

The general area is zoned for heavy industrial and agricultural uses. Although the land north of the station is zoned Planned Mixed Residential, it consists predominantly of undeveloped vacant woodland. There are residential homes directly west of the station and Ash Pond E.

5.1.2 Coal Combustion Residuals Background

In 2003, the Possum Point Power Station converted its boilers from coal-fired to natural gas-fired; thus, the station no longer generates CCR. CCR has historically been stored in five ash ponds known as Ponds A, B, C, D, and E. CCR materials have been substantially removed from four of the five ash ponds at the station (Ponds A, B, C, and E) and consolidated in Ash Pond D, which has a clay liner. Once consolidation is completed, the original ash footprint of 126 acres will be reduced to 70 acres of lined storage, a nearly 50% reduction in total area used for ash ponds.

Ponds A, B, and C are small ponds with a combined footprint of approximately 18 acres. The ponds were constructed in 1955 and were taken out of service in the mid-1960s. Approximately 40,000 CY of residual ash remaining in Ponds A, B, and C will be relocated to Pond D.

Ash Pond E is approximately 38 acres and was constructed in 1967 and used until 2003. In 2015 and 2016, ash was removed from Pond E and relocated to Pond D. Approximately 2,500 CY of ash that remains in Pond E beneath temporary water storage tanks that will be relocated to Ash Pond D.

Ash Pond D was constructed in 1988 to replace a pre-existing unlined ash pond at the same location. The ash is isolated from the groundwater-bearing zone by slurry walls and an overlying side-wall clay liner in the replacement pond, which prevent horizontal flow through the ash and act as a container sealing the pre-existing and relocated ash from contact with groundwater. The liner consists of 2 feet of low-permeability compacted clay placed on the side slopes of Pond D, which has a footprint of approximately 70 acres.

5.2 Physical Setting

The Possum Point Power Station is located within the Chesapeake Bay watershed. Much of the station footprint lies on the triangular-shaped Possum Point peninsula, which points south. Quantico Creek forms the northwest to southeast boundary, and the Potomac River forms the northeast to southwest boundary on the east, which is also the Maryland state line.

The Potomac River is a tidal river that feeds into the Chesapeake Bay. The main stem of the Potomac River is regulated as Maryland waters. Maryland has designated this portion of the Potomac River as Use II waters, meaning the state regulates what is discharged to the river to make sure the river can continue to support estuarine and marine aquatic life and shellfish harvesting. Due to elevated total nitrogen and total phosphorus, this portion of the Potomac River is listed as Category 4 impaired for open-water fish and shellfish, and seasonal migratory fish spawning and nursery; the Potomac River is also listed as Category 4 impaired for fishing due to PCBs in fish tissue (MDE, 2015). A water body is considered “impaired” when it cannot support its designated use. Typical causes of increased nitrogen and phosphorus include nonpoint source runoff from agricultural and residential areas. The Potomac River is considered impaired for nitrogen, phosphorus, and PCBs from Washington DC to the Chesapeake Bay.

Quantico Creek is a tidally influenced tributary to the Potomac River. According to 9VAC25-260, Quantico Creek is considered tidal freshwater. The Quantico area of the Potomac River experiences a tidal range of approximately 1.5 feet (NOAA, 2013). DEQ has classified Quantico Creek and its tributaries as Class II estuarine waters. The creek is listed as a Category 4 and 5 impaired water body for fish consumption due to levels of PCBs and for aquatic life due to estuarine bioassessments and sediment bioassays (DEQ, 2017). Typical sources include industrial and municipal point source discharges.

Beaver Pond, which is west of Ash Pond E, is a tributary to Quantico Creek. Beaver Pond flows into Quantico Creek through a culvert under Possum Point Road.

Groundwater is not used at the station, nor is it used immediately downgradient. There are residential properties to the west of Beaver Pond, some of which have private groundwater wells that may be used as drinking water sources. These wells are not believed to be downgradient of the ash ponds, as inferred from the potentiometric surface presented on Figure TM6-11.

5.3 Geology and Hydrogeology

5.3.1 Geology

The Coastal Plain is an eastward-thickening wedge of marine and fluvial sedimentary deposits overlying crystalline basement rock. Sediment thickness varies from extremely thin at the Fall Line (the line between the Piedmont and Coastal Plain provinces) to an accumulation of several thousand feet at the Atlantic Ocean. The province slopes gently toward the Atlantic Ocean and is characterized by little topographic relief and a dendritic drainage pattern, indicative of somewhat homogeneous, horizontally bedded sedimentary deposits.

There are two distinct geologic settings at the Possum Point Power Station. In the upland area around Ash Pond D, the geology is dominated by the sediments of the Cretaceous Potomac Formation, which consist of unconsolidated clay, silt, sand, and gravel layers ranging up to 600 feet thick. In the low areas adjacent to the rivers/creek, the Potomac has been cut into valleys by multiple periods of stream erosion. Some of the older, deeper valleys became filled with sand, gravel, silts, and other alluvial deposits that were themselves cut by later streams. The result is a series of alluvial terraces adjacent to major streams. The Possum Point Power Station and lower-elevation ash ponds are situated on one such terrace, and are therefore underlain by 20 to 30 feet of alluvial deposits.

5.3.2 Hydrogeology

In the upland area adjacent to Ash Pond D, the uppermost aquifer consists of the first saturated sandy materials of the Potomac Formation. These are generally found at depths ranging from 17 feet bgs in lowland areas to 170 feet bgs in the upland area based on existing monitoring well information. Groundwater flow in this aquifer tends to roughly mimic the topography of the pre-construction ground surface, flowing in a downhill direction because of the dynamic of flow from upland recharge areas to lowland discharge. In the Ash Pond D area, this direction is generally to the southwest, with local deviation depending on the influence of localized topographic relief. A groundwater potentiometric surface map for the bedrock aquifer in the vicinity of the Ash Pond D is included as Figure TM6-11.

In the vicinity of Ash Ponds A, B, C, and E, the uppermost aquifer is found in the permeable zones of the terrace deposits underlying those units. The depth to groundwater in these areas ranges from 12 to 23 feet bgs, and groundwater flow is distinctly southwesterly from the upland area across the lowland area.

Based on available information, the hydraulic conductivity of the sediments comprising the uppermost aquifer is expected to be variable ranging from 1E-05 cm/s for poorly sorted clay, silt, and sand to 1E-02 cm/s for well sorted sand and sandy gravel deposits, with an average value of 3.16E-04 cm/s.

5.4 Groundwater and Surface Water Evaluations

5.4.1 Groundwater Monitoring Programs

The Possum Point Power Station is currently monitored under the VPDES permit program and the CCR Rule. In accordance with the VPDES permit, groundwater sampling is conducted semi-annually, and a report is submitted to DEQ annually.

As part of the VPDES compliance monitoring program, the monitoring wells are sampled for the constituents listed in Table TM6-19.

Table TM6-19: Possum Point Power Station VPDES Monitoring Constituents

Dissolved Metals	Water Quality Parameters	Field Measurements
• Arsenic • Barium • Cadmium • Copper • Iron • Lead • Manganese • Mercury • Nickel • Selenium • Silver • Vanadium • Zinc	• Chloride • Fluoride • Hardness • Phenolics • Potassium • Sodium • Sulfate • Total Organic Carbon	• Groundwater elevation • pH • Conductivity • Temperature

CCR Rule baseline monitoring has been performed at the Possum Point Power Station since 2016 in accordance with the Groundwater Monitoring Plan finalized in October 2017 (Golder, 2017c). Modifications have been made to the standard CCR Rule sampling protocol to conform to anticipated VSWMR and DEQ requirements. This sampling will be conducted semi-annually after the eight background sampling events that were completed by October 2017. CCR reports will be submitted annually, and VSWMR reports will be submitted semi-annually. CCR monitoring network wells are shown in Table TM6-20 (refer to Figure TM6-11 for well locations).

Table TM6-20: Possum Point Power Station CCR Monitoring Well Networks

Background Ash Pond D CCR Monitoring Wells	Downgradient Ash Pond D CCR Monitoring Wells		Background Ash Pond A/B/C CCR Monitoring Wells	Downgradient Ash Pond A/B/C CCR Monitoring Wells	Background Ash Pond E CCR Monitoring Wells	Downgradient Ash Pond E CCR Monitoring Wells
ED-1612	ED-1D	SD-1604	ABC-1602	ABC-1607	ED-24R	ES-3D
ED-24R	ED-9R	ED-1605		ABC-1608	ED-26	ES-1609
	SD-1603	ED-1606		ABC-1614		ES-1613

In addition, there will be two Ash Pond D VSWMR sentinel wells added to the network as proposed in the draft SWP for the ash pond closure. At the time of this report, no data have been collected from these supplemental well locations.

As part of the CCR/VSWMR compliance monitoring program, the wells are sampled for the CCR analytes listed in Table TM6-2 on page 1-3. Additional VSWMR and VPDES constituents include the following:

- VSWMR assessment constituents: copper, cyanide, nickel, silver, sulfide, tin, vanadium, zinc
- Historic VPDES parameters: alkalinity, iron, hardness, manganese, sodium, and total organic carbon (TOC)

All of the metals constituents for the CCR baseline monitoring are being analyzed as total metals, as opposed to the VPDES program, which specifies analysis for dissolved (filtered) metals.

In addition, in accordance with a directive by DEQ, Dominion has been completing biweekly groundwater monitoring at a limited set of wells on the western side of the station and west of Beaver Pond to observe potential impacts to groundwater.

5.4.2 Groundwater Quality

VPDES groundwater data have been collected on a semi-annual basis since the permit was issued. Several dissolved metals and anions were historically (2001 through 2010) greater than background levels established under the VPDES program to the south and east of Pond D, and to the south and southwest of Pond E. However, more recently (2010 to 2016), the number and frequency of detections of iron and nickel above background have reduced considerably. Only cadmium has been detected above the MCL, southwest of Pond E, between 2007 and 2014. There have been no other detections greater than the MCL as part of the VPDES groundwater monitoring, nor has there been a detection greater than the MCL for any constituent since 2014.

Groundwater analytical results for CCR wells are summarized in Tables TM6-21 through TM6-23 located at the end of Section 5. The CCR baseline data set includes eight monitoring events dating back to November 2016. For the purposes of this discussion, a preliminary background level has been calculated from background data for each CCR/VSWMR constituent listed in Section 5.4.1.

The quantitative evaluations in the subsections below summarize groundwater quality using CCR compliance data (as opposed to the VPDES dataset) for the following reasons:

- CCR groundwater data are analyzed for total metals, which is a more conservative measure of constituent concentrations than the dissolved metals analysis used for VPDES data.
- The CCR groundwater data set is more representative of current conditions.
- Many of the VPDES network wells were installed during early investigations of site conditions and not for the explicit function of monitoring ash pond impacts to groundwater. The monitoring well network used for the CCR compliance sampling was designed and constructed to meet the requirements of the CCR Rule.

5.4.2.1 Ponds A, B, C

The Ponds A, B, and C CCR background dataset is provided in Table TM6-21 located at the end of Section 5. These data show that several detection monitoring constituents have been detected in downgradient wells above preliminary background levels. The ash from Ponds A, B, and C is in the process of being removed.

CCR assessment monitoring constituents cobalt and lithium have been detected above preliminary background levels, and arsenic has been detected above the MCL. However, as described in Section 5.4.3, there are no impacts to surface water, with arsenic concentrations well below the Virginia Surface Water Quality Standards for aquatic life and human health in Quantico Creek. As noted above, the ash from Ponds A, B, and C is in the process of being removed.

Nickel and tin are the only VSWMR assessment constituents to have been detected downgradient above background levels. Historic VPDES constituents alkalinity, iron, hardness, manganese, sodium, and TOC have all been detected downgradient above background levels.

5.4.2.2 Pond D

The Pond D CCR baseline dataset is provided in Table TM6-22 located at the end of Section 5. These data show that detection monitoring constituents boron, calcium, chloride, sulfate, and TDS have been detected in downgradient wells at levels above preliminary background. If these detections are validated during future sampling events, the CCR Rule will direct Pond D into assessment monitoring.

CCR assessment monitoring constituents cobalt, lithium, and radium have been detected downgradient above background levels. Radium detections above the MCL were limited to the first round of background sampling, and therefore may not be representative of current groundwater conditions (there have been no detections above the MCL since fall 2016). If these detections are validated during future sampling events, the CCR Rule will direct Pond D into corrective measures. No assessment monitoring constituents have been detected at concentrations above the MCL.

VSWMR assessment constituents nickel, sulfide, tin, and zinc have been detected above background levels. Historic VPDES constituents alkalinity, hardness, iron, manganese, sodium, and TOC have all been detected above background levels.

5.4.2.3 Pond E

The Pond E CCR baseline dataset is provided in Table TM6-23 located at the end of Section 5. These data show that detection monitoring constituents boron, calcium, chloride, fluoride, sulfate, and TDS have been detected in downgradient wells at levels above preliminary background. The CCR assessment monitoring constituent cobalt has also been detected above background levels. No assessment monitoring constituents have been detected at concentrations above the MCL. As discussed above, ash from Pond E is being removed.

VSWMR assessment constituents nickel, tin, and zinc have been detected above background levels. Historic VPDES constituents alkalinity, hardness, iron, manganese, sodium, and TOC have all been detected above background levels.

At the request of the DEQ, data have been collected biweekly since September 2016 from background wells north of Pond D and north to northeast of Pond E, and wells immediately west of Pond E and west of Beaver Pond, in the vicinity of private residences. Only one monitoring well on the northern border of Pond E has had detections greater than MCLs (for beryllium and cadmium). However, this well is not hydrologically downgradient of Pond D or Pond E, and was not properly installed, suggesting that it is not likely to be representative of the uppermost aquifer (the well only has a 1-foot screen and is potentially representative of perched groundwater conditions in the immediate vicinity of Pond E). The only beryllium detection greater than MCL occurred in November 2016, and subsequent results have all been below the MCL. Cadmium has been detected above the MCL only twice during more than 1 year of biweekly sampling. All monitoring wells downgradient of Pond E or on the western side of Beaver Pond have remained below MCLs for all constituents.

5.4.3 Surface Water Monitoring

Dominion conducted surface water sampling of Quantico Creek, the Potomac River, and Powell’s Creek (approximately 2 miles north of Pond D) from May 2016 through March 2017 to monitor surface water quality (see Figure TM6-12 for sample locations). Monitored constituents include antimony, arsenic, cadmium, chromium (total and speciated), copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. Boron was added to the program in March 2017.

5.4.4 Surface Water Quality

As summarized in Table TM6-24 located at the end of Section 5, all constituent concentrations were below Virginia Surface Water Quality Standards for aquatic life and human health during the surface water monitoring program. In addition, there is generally no increase in constituent levels in the downstream samples compared to the upstream samples.

5.5 Summary of Findings

The Possum Point Power Station, located in Dumfries, VA, began operation prior to 1955, and ceased burning coal in 2003. CCR materials have been substantially removed from four of the five ash ponds at the station (Ponds A, B, C, and E) and consolidated in lined Ash Pond D. However, there has been no new coal ash produced on site since 2003. The station and ash ponds are located on a peninsula bordered by the Potomac River to the east and Quantico Creek to the west.

Locally, the geology consists of a thick sequence of aged sediments, dominated by alternating layers of silty sand and sandy clay, overlying a clay-rich confining unit. Where saturated, these sediments represent the uppermost aquifer subject to groundwater monitoring per the CCR Rule. Groundwater generally flows from topographic high points located north of the station toward the low-lying areas to the south and southwest.

Several dissolved metals have been detected at concentrations greater than background downgradient of Ponds D and E during the historic VPDES groundwater monitoring. These detections have become less frequent in recent years. Of those metals detected greater than background, only cadmium was historically detected above the MCL, but it has been below the MCL since 2014.

CCR groundwater sampling has demonstrated that there are detections above background levels of several detection and assessment monitoring constituents east, west, and south of Ponds D and E, as well as to the west of Ponds A, B, and C. However, the only constituent detected above an MCL is arsenic at wells downgradient of Ponds A, B, and C. The ash from these ponds is currently in the process of being removed. There have been no other exceedances of an MCL for any other constituents, or at any other well location, during the CCR groundwater sampling program. Based on the data presented, surface water quality has not been affected by arsenic. The biweekly groundwater samples collected from the uppermost aquifer west of Pond E and in the vicinity of residences with private wells also exhibit no detections above MCLs for any monitored constituent.

The surface water samples were collected to evaluate the potential for site closure operations to have an impact on nearby waterways. All of the sample results were below risk criteria, and downstream sample results were generally similar to upstream sample results.

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Tables

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Table TM6-21
CCR Compliance Data
Ponds A, B, C - Possum Point Power Station

Parameter	MCL	Preliminary Background	ABC-1602 (Background)							
			11/4/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.25	0.0246J	0.0350B	0.0414J	0.0453J	0.0185J	0.0936J+	<0.050	<0.050
Calcium	---	7.33	4.70	5.00B	5.57	6.07	6.28	5.43	5.80	6.38
Chloride	---	5.89	5.0	5.1	3.1	3.6	2.6	2.6	2.5	2.8
Fluoride	NA	0.1	0.035J	0.093	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.71-6.26	5.46	5.65	4.98	4.95	4.82	4.60	4.67	4.73
Sulfate	---	71	25.3	28.8	28.4	40.4	53.8J+	49.1	47.9	46.5
TDS	---	124	116	122	67.0	45.0	124J+	109	113	109
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	0.00063J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0529	0.0530B	0.0673	0.0776	0.0810	0.0814	0.0758	0.0733
Beryllium	0.004	---	0.00040J	0.00061B	0.00036J	0.00070J	0.00065J	0.00076J	0.00090J	0.00067J
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	0.0011B	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cobalt	---	0.0277	0.0035	0.0057	0.0092	0.0110	0.0136	0.0153	0.0184	0.0188J+
Fluoride	4.0	---	0.035J	0.093	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0103J	0.0098J	0.0104J	0.0112J	0.0107J+	0.0150J+	0.0105J	0.0104J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	2.82	<1.23	<1.02	<1.01	<0.941	1.63	2.79	1.56
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00030J	0.00031J	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0013J	0.0024B	0.0101	0.0160	0.0175J+	0.0144	0.0136	0.0129
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.0123	<0.0050	<0.0050	0.0054B	0.0072	0.0082	0.0075	0.0089	0.0099
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0011J	0.0014J	<0.0050
Sulfide	---	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0114	<0.0050	0.0025J	<0.0050	0.0047J	0.0114	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	0.0012J	0.0012J+	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	18.9	15.5	9.1	8.2	4.7J	2.3J	<5.0	2.4J	3.0J
Iron	---	2.91	1.23	1.89	1.95	0.683	0.188J	<0.500	<0.500	0.124J
Hardness	---	37.6	23.8	24.9B	28.5	30.6	32.6	28.7	30.0	31.8
Manganese	---	0.34	0.261	0.285	0.309	0.257	0.236	0.225	0.219	0.238
Sodium	---	10.07	7.88	9.01B	9.45	8.73	8.93	8.09	8.55	8.33
TOC	---	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-21
CCR Compliance Data
Ponds A, B, C - Possum Point Power Station

Parameter	MCL	Preliminary Background	ABC-1607 (Downgradient)							
			11/4/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.25	**0.280**	0.211J	**0.279**	**0.437**	**0.277**	**0.340**	**0.275**	**0.256**
Calcium	---	7.33	**33.1**	**22.5**	**18.6**	**19.1**	**14.8**	**15.1**	**15.0**	**13.9**
Chloride	---	5.89	**17.4**	**14.4**	**16.6**	**15.9**	**16.8**	**16.7**	**16.9**	**17.4**
Fluoride	NA	0.1	0.028J	0.063	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.71-6.26	5.66	5.72	5.04	5.24	5.36	5.34	5.30	5.30
Sulfate	---	71	51.9	41.6	44.1	40.8	41.8	44.5	41.8	42.3
TDS	---	124	**206**	**173**	**200**	**145**	**156**	**139**	**137**	**137**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.00088J	0.0011	0.00098J	0.0013	0.0015J+	0.0011	0.0015	0.00095J
Barium	2	---	0.0341	0.0339B	0.0314	0.0450	0.0339	0.0351	0.0313	0.0294
Beryllium	0.004	---	0.00020J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00011
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	0.0010J+	<0.0050	<0.0050	<0.0050
Cobalt	---	0.0277	0.0083	0.0076	0.0078	0.0102	0.0076	0.0079	0.0075	0.0078
Fluoride	4.0	---	0.028J	0.063	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0057B	0.0013B	0.0037J	0.0043J	0.0039J+	0.0053J+	0.0044J+	0.0032J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<1.27	<0.796	<0.948	1.70	<0.810	<0.768	1.28	<1.09
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.000034J
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	0.0013B	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.0123	0.0076	0.0071	0.0080	0.0113	0.0081	0.0086	0.0081	0.0091
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0114	<0.0050	<0.0050	<0.0050	0.0020J	0.0014J+	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	0.00087B	<0.0050	0.0013J	0.0011J+	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	0.0254J	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	18.9	**87.1**	**55.6**	**41.0**	**33.2**	**32.1**	**30.9**	**33.6**	**29.6**
Iron	---	2.91	2.33	2.77	2.86	**3.50**	**3.70**	**3.78**	**3.86**	**4.00**
Hardness	---	37.6	**118**	**79.8**	**67.8**	**71.7**	**56.1**	**55.8**	**55.5**	**53.0**
Manganese	---	0.34	**0.425**	0.320	0.276	0.309	0.247	0.248	0.245	0.239
Sodium	---	10.07	**22.7**	**20.3**	**19.1**	**23.8**	**18.4**	**18.4**	**20.0**	**20.0**
TOC	---	1.0	**1.4**	0.94J	**1.1**	0.87J	**1.7**	0.97J	**1.1**	0.72J

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>**Bolded and Underlined**</u> detections are greater than the applicable MCL.

Table TM6-21
CCR Compliance Data
Ponds A, B, C - Possum Point Power Station

Parameter	MCL	Preliminary Background	ABC-1608 (Downgradient)							
			11/4/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/23/2017
CCR Detection Constituents										
Boron	---	0.25	0.234J	0.230J	**0.311**	**0.339**	0.232J	**0.284**	0.226	0.212
Calcium	---	7.33	**19.1**	**29.8**	**29.0**	**28.6**	**22.5**	**21.7**	**21.9**	**23.6**
Chloride	---	5.89	**59.5**	**47.0**	**53.1**	**53.1**	**56.9**	**54.9**	**53.8**	**60.2**
Fluoride	NA	0.1	0.064J	**0.23**	**0.15**	0.091J	0.098J	**0.12**	0.093J	0.10
pH (std units)	---	3.71-6.26	5.94	**6.35**	5.74	5.90	5.86	5.85	5.81	5.91
Sulfate	---	71	29.2	16.1	20.9	23.8	28.2	27.9	28.2	29.5
TDS	---	124	**279**	**305**	**284**	**248**	**254**	**234**	**246**	**240**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.0068	**<u>0.0493</u>**	**<u>0.0360</u>**	**<u>0.0241</u>**	**<u>0.0150</u>**	**<u>0.0115</u>**	**<u>0.0122</u>**	**<u>0.0124</u>**
Barium	2	---	0.157	0.150	0.132	0.125	0.0899	0.0951	0.0930	0.0962
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cobalt	---	0.0277	**0.0361**	**0.0364**	**0.0354**	**0.0360**	**0.0285**	0.0277	**0.0300**	**0.0306**
Fluoride	4.0	---	0.064J	0.23	0.15	<0.10	0.098J	0.12	0.093J	0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0174J	0.0153J	0.0182J	0.0204J	0.0189J+	0.0186J+	0.0184J	0.0160J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.005	<0.0050	0.0022J	0.0013J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<1.16	<0.241	<0.783	<1.26	<1.20	<0.737	0.949	1.56
Selenium	0.05	---	<0.0050	0.0035J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0019J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.0123	**0.0230**	**0.0245**	**0.0252**	**0.0274**	**0.0206**	**0.0211**	**0.0219**	**0.0220**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0114	<0.0050	<0.0050	<0.0050	0.0016J	0.0020J+	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	0.002J	<0.0050	<0.0050	0.00089J	<0.0050	0.0012J	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	18.9	**104**	**179**	**129**	**98.5**	**70.0**	**104**	**87.7**	6.6
Iron	---	2.91	**20.4**	**34.0**	**29.9**	**21.9**	**15.1**	**15.3**	**14.9**	**15.2**
Hardness	---	37.6	**97.4**	**154**	**145**	**139**	**105**	**102**	**104**	**109**
Manganese	---	0.34	0.283	0.261	0.238	0.233	0.183	0.186	0.181	0.190
Sodium	---	10.07	**40.9**	**39.6**	**38.2**	**40.2**	**32.8**	**31.5**	**35.2**	**36.3**
TOC	---	1.0	**2.9**	**1.8**	**2.0**	**1.5**	**3.0**	**1.5**	**1.4**	**1.4**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-21
CCR Compliance Data
Ponds A, B, C - Possum Point Power Station

Parameter	MCL	Preliminary Background	ABC-1614 (Downgradient)							
			11/4/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.25	0.218J	**0.269**	**0.251**	**0.265**	0.194J	0.223J	**0.256**	0.242
Calcium	---	7.33	**68.4**	**78.9**	**62.2**	**59.6**	**53.9**	**55.9**	**63.1**	**60.5**
Chloride	---	5.89	**19.1**	**15.0**	**16.0**	**14.6**	**15.5**	**18.1**	**19.3**	**20.0**
Fluoride	NA	0.1	**0.15**	**0.23**	**0.12**	0.10	**0.13**	**0.14**	**0.14**	**0.16**
pH (std units)	---	3.71-6.26	**6.60**	**6.79**	6.19	**6.39**	**6.47**	**6.41**	**6.40**	**6.44**
Sulfate	---	71	58.3	44.7	49.5	44.1	46.8	44.4	37.8	36.7
TDS	---	124	**389**	**465**	**334**	**294**	**316**	**365**	**321**	**330**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	**<u>0.0254</u>**	**<u>0.0281</u>**	**<u>0.0374</u>**	**<u>0.0395</u>**	**<u>0.0328</u>**	**<u>0.0310</u>**	**<u>0.0317</u>**	**<u>0.0369</u>**
Barium	2	---	0.230	0.263	0.222	0.236	0.203	0.208	0.243	0.251
Beryllium	0.004	---	0.00026J	0.00058B	<0.0010	0.00028J	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	0.0023B	<0.0050	<0.0050	<0.0050	0.0012J
Cobalt	---	0.0277	0.0173	0.0192	0.0171	0.0192	0.0185	0.0212	0.0259	0.0250
Fluoride	4.0	---	0.15	0.23	0.12	0.10	0.13	0.14	0.14	0.16
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	**0.0253**	0.0220J	**0.0269**	**0.0279**	**0.0255**	**0.0251**	**0.0292J+**	**0.0312J+**
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.005	0.0025J	0.0034J	0.0022J	0.0025J	0.0019J	0.00017J	0.0018J	0.0021J
Radium 226/228 (pCi/L)	5	---	<1.28	<0.402	<0.678	<0.588	<0.616	<0.632	<0.737	1.96
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	0.00024J	<0.0010	0.00028J	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	0.0027J+	0.00013J+	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.0123	**0.0156**	**0.0155**	**0.0151**	**0.0163**	**0.0141**	**0.0156**	**0.0188**	**0.0183**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0114	<0.0050	0.0024J	<0.0050	0.0073	**0.0123**	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	0.0014J	<0.0050	<0.0050	0.0020J	0.0017J+	0.0010J	0.00074J	0.00070J
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	18.9	**270**	**267**	**198**	**183**	**197**	**208**	**229**	**210**
Iron	---	2.91	**15.1**	**20.9**	**19.7**	**23.5**	**24.3**	**28.2**	**37.7**	**37.3**
Hardness	---	37.6	**259**	**289**	**228**	**220**	**199**	**210**	**235**	**226**
Manganese	---	0.34	**0.599**	**0.720**	**0.592**	**0.753**	**0.570**	**0.596**	**0.670**	**0.642**
Sodium	---	10.07	**25.1**	**25.2**	**23.6**	**21.0**	**20.6**	**22.5**	**23.5**	**22.9**
TOC	---	1.0	**5.9**	**5.4**	**4.2**	**3.8**	**4.1**	**4.1**	**4.7**	**3.8**

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-1612 (Background)							
			11/3/2016	12/12/2016	1/25/2017	3/6/2017	4/20/2017	5/30/2017	7/10/2017	8/21/2017
CCR Detection Constituents										
Boron	---	0.28	0.0774J	<0.250	0.0603J	0.0178B	0.0321J	0.0294J	0.0308J	<0.050
Calcium	---	19.3	19.3	18.1	15.8	12.3	16.2	17.1	16.4	12.7
Chloride	---	11.3	11.3	8.7	7.7	6.1	6.1	6.4	6.3	4.9
Fluoride	NA	0.32	0.22	0.32	0.26	0.21	0.27	0.24	0.25	0.25
pH (std units)	---	3.48-7.31	6.15	6.02	5.61	5.89	5.73	6.05	6.20	5.81
Sulfate	---	31.5	28.5	25.5	26.0	23.8	27.0	31.5	30.4	22.4
TDS	---	206	206	176	166	155	161	169	143	153
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.0023	0.0019	0.0014	0.0018	0.0025J+	0.0019	0.0017	0.0014
Barium	2	---	0.0689	0.0597B	0.0488	0.0407	0.0458	0.0470	0.0462	0.0366
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	0.00038J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cobalt	---	0.001	0.00062J	0.00056B	0.00038J	0.00040J	0.00079J	0.00077J	0.00051J	0.00028J
Fluoride	4.0	---	0.22	0.32	0.26	0.21	0.27	0.24	0.25	0.25
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0179J	0.0132J	0.0129J	0.0103J	0.0145J	0.0144J	0.0129J	0.0092J
Mercury	0.002	---	0.00011J	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	0.0058	0.0042J	0.0041J	0.0034J	0.0052	0.0044J	0.0037J	0.0028J
Radium 226/228 (pCi/L)	5	---	1.93	<0.449	<1.10	<1.03	<0.552	1.56	1.27	1.48
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.011	<0.0050	<0.0050	<0.0050	0.0108	0.0110	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	0.00071J	<0.0050	<0.0050	0.0014J	0.00088J+	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	95.7	95.7	72.0	60.2	51.5	56.0	62.6	66.3	50.8
Iron	---	7.35	7.35	6.35	5.10	4.16	6.01	5.29	5.13	3.88
Hardness	---	74.6	74.6	69.0	60.5	47.1	63.2	65.1	63.2	48.4
Manganese	---	0.604	0.604	0.500	0.417	0.335	0.430	0.451	0.419	0.335
Sodium	---	23.7	23.7	21.1	18.1	12.9	16.7	16.6	17.4	13.5
TOC	---	7.2	7.2	5.8	4.6	3.5	3.5	3.5	3.3	2.5

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-24R (Background)							
			11/2/2016	12/12/2016	1/25/2017	3/6/2017	4/20/2017	5/30/2017	7/10/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.28	0.0596J	<0.250	0.0461J	0.154J	0.0065J	0.0124J	<0.050	<0.050
Calcium	---	19.3	1.88J	1.53B	1.81J	1.79J	1.85J	1.83J	1.82J	1.78
Chloride	---	11.3	2.5	<5.0	2.8	2.7	2.9	2.8	2.8	2.9
Fluoride	NA	0.32	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.48-7.31	4.90	4.57	4.62	4.69	4.98	4.74	5.12	5.20
Sulfate	---	31.5	1.6	<5.0	1.6	1.7	2.3J+	2.2	2.0	2.1
TDS	---	206	45.0	39.0	55.0	26.0	45.0	43.0	39.0	35.0
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0140	0.0126B	0.0148	0.0145	0.0141	0.0166	0.0146	0.0177
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	0.0022	0.0019B	0.0023B	0.0017B	0.0017J+	0.0036J+	0.0020J+	0.0023J
Cobalt	---	0.001	0.00032J	0.00043B	0.00023J	0.00028J	0.00029J	0.00044J+	0.00035J	0.00051J+
Fluoride	4.0	---	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0019B	<0.0250	0.0021J	0.0019J	0.0016J+	0.0014J+	0.0015J	0.0015J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<1.58	<0.643	<0.125	<0.872	<1.39	<0.407	<0.802	<0.778
Selenium	0.05	---	<0.0050	0.0036J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0012J+	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.011	<0.0050	<0.0050	<0.0050	0.0015J	0.0101	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	0.00078J	<0.0050	<0.0050	0.00098J	0.0012J+	0.00074J	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0028J
VPDES Parameters										
Alkalinity	---	95.7	6.8	5.5	6.3	6.7	6.7	4.0J	5.3	6.5
Iron	---	7.35	<0.50	<0.50	<0.50	0.132J	<0.50	<0.50	<0.50	<0.50
Hardness	---	74.6	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	11.2
Manganese	---	0.604	0.0094	0.0091B	0.0090	0.0089	0.0080	0.0102J+	0.0102	0.0111
Sodium	---	23.7	2.25J	1.94B	2.22J	1.82J	2.15J	2.19J	2.29J+	2.14J
TOC	---	7.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-1D (Downgradient)							
			11/4/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/23/2017
CCR Detection Constituents										
Boron	---	0.28	**0.744**	**0.643**	**0.789**	**0.763**	**0.785**	**0.691**	**0.701**	**0.719**
Calcium	---	19.3	18.4	16.7	19.1	18.1	18.2	18.3	17.6	18.3
Chloride	---	11.3	**65.6**	**59.3**	**66.6**	**62.3**	**65.9**	**64.6**	**64.7**	**65.6**
Fluoride	NA	0.32	0.042J	0.073	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.48-7.31	5.44	4.62	4.01	4.06	4.60	4.61	4.52	4.59
Sulfate	---	31.5	**68.7**	**62.4**	**66.2**	**64.4**	**63.4**	**65.6**	**62.5**	**62.6**
TDS	---	206	**253**	**231**	**230**	**229**	**253**	**229**	**256**	**214**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0735	0.0386B	0.0424	0.0346	0.0360	0.0352	0.0360	0.0364
Beryllium	0.004	---	0.00036J	0.0014	0.0017	0.0018	0.0018	0.0016	0.0018	0.0018
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	0.0012B	0.0011J+	<0.0050	<0.0050	0.0021J
Cobalt	---	0.001	**0.0081**	**0.0053**	**0.0059**	**0.0055**	**0.0048**	**0.0049**	**0.0049**	**0.0048**
Fluoride	4.0	---	0.042J	0.073	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0077J	0.0038B	0.0078J	0.0076J	0.0080J+	0.0080J+	0.0073J	0.0062J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.73	<0.923	<0.581	1.32	<1.14	1.57	1.98	2.07
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	0.0042B	0.0072	0.0042J	0.0051	0.0051	0.0042J	0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	**0.0093**	**0.0104**	**0.0129**	**0.0126**	**0.0110**	**0.0108**	**0.0111**	**0.0114**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.011	<0.0050	<0.0050	<0.0050	0.0050J	0.0017J+	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	0.0010J	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	**0.068**	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	95.7	22.2	2.2J	2.0J	2.4J	2.2J	1.8J	2.7J	2.3J
Iron	---	7.35	1.48	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Hardness	---	74.6	**85.2**	**83.6**	**95.1**	**90.4**	**90.2**	**90.2**	**87.8**	**90.6**
Manganese	---	0.604	0.505	0.112	0.110	0.0997	0.0907	0.0867	0.0849	0.0862
Sodium	---	23.7	**39.9**	**30.9**	**33.2**	**28.8**	**29.1**	**27.7**	**30.4**	**32.1**
TOC	---	7.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:
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MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-9R (Downgradient)							
			11/4/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/23/2017
CCR Detection Constituents										
Boron	---	0.28	0.0483J	0.0431J	0.0770J	0.124J	0.0373J	0.0901J+	0.0715	0.0662
Calcium	---	19.3	**53.4**	**58.7**	**58.0**	**66.2**	**49.8**	**54.7**	**51.8**	**54.0**
Chloride	---	11.3	**43.3**	**37.6**	**43.4**	**43.6**	**44.8**	**46.5**	**46.0**	**46.2**
Fluoride	NA	0.32	<0.10	0.091	0.023J	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.48-7.31	5.13	4.99	4.49	4.62	5.17	5.19	5.15	5.05
Sulfate	---	31.5	**194**	**174**	**189**	**178**	**173**	**168**	**157**	**148**
TDS	---	206	**380**	**387**	**396**	**370**	**399J+**	**427J+**	**367**	**390**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0279	0.0335B	0.0290	0.0486	0.0300	0.0305	0.0279	0.0304
Beryllium	0.004	---	0.00026J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	0.0022B	<0.0050	0.0045J	0.0015J+	<0.0050	<0.0050	0.0022J
Cobalt	---	0.001	0.00051J	0.00041B	0.00033J	0.00072J	0.00035J	0.00048J	0.00042J	0.00052J
Fluoride	4.0	---	<0.10	0.091	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	0.00097J	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	**0.0348**	**0.0359**	**0.0357**	**0.0347**	**0.0281**	**0.0311**	**0.0275**	**0.0270**
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	2.80	<1.47	<1.68	1.50	1.85	3.00	2.05	3.09
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0014J	0.0022B	0.0014J	0.0036J	0.0017J+	0.0012J	<0.0050	0.0015J
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.0042J	<0.0080	<0.0080
Nickel	---	0.005	**0.0151**	**0.0164**	**0.0151**	**0.0188**	**0.0136**	**0.0143**	**0.0139**	**0.0144**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.39**	**0.33**	<0.10
Tin	---	0.011	<0.0050	<0.0050	<0.0050	<0.0050	**0.0126**	0.0011J	<0.0050	<0.0050
Vanadium	---	0.005	0.0019J	0.0020B	0.0012J	0.0047J	0.0029J+	0.0011J	<0.0050	0.0022J
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	95.7	16.4	12.0	8.7	15.8	15.0	18.2	18.1	17.4
Iron	---	7.35	0.443J	0.420B	<0.50	1.21	0.419J	0.421J	0.326J	0.575
Hardness	---	74.6	**235**	**254**	**249**	**283**	**215**	**237**	**223**	**231**
Manganese	---	0.604	0.0293	0.0266B	0.0227	0.0373	0.0195	0.0244	0.0233	0.0259
Sodium	---	23.7	5.54	5.70B	5.72	5.78	5.14	5.56	5.11	5.28
TOC	---	7.2	<1.0	<1.0	<1.0	0.54J	<1.0	0.52J+	0.65J	<1.0

Notes:
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< - Not detected at the reporting limit (or MDC for radium)
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B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	SD-1603 (Downgradient)							
			5/18/2017	6/1/2017	6/14/2017	6/28/2017	7/11/2017	7/26/2017	8/9/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.28	**0.536**	**0.547**	**0.362**	**0.422**	**0.530**	**0.440**	**0.515**	**0.499**
Calcium	---	19.3	**35.9**	**33.8**	**40.2**	**39.0**	**36.8**	**40.0**	**33.7**	**35.0**
Chloride	---	11.3	**61.4**	**66.1**	**63.7**	**63.7**	**64.1**	**60.3**	**67.8**	**66.8**
Fluoride	NA	0.32	0.13	<0.10	0.13	0.17	0.077J	0.054J	0.066J	0.072J
pH (std units)	---	3.48-7.31	5.80	5.25	5.38	5.60	5.64	6.85	5.65	5.64
Sulfate	---	31.5	**47.7**	**46.4**	**42.9**	**43.6**	**43.2**	**40.9**	**46.5**	**45.2**
TDS	---	206	**290**	**332J+**	**357**	**355**	**333**	**338**	**285**	**325**
CCR Assessment Constituents										
Antimony	0.006	---	0.0016J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.0020	0.0019	0.0026	0.0022	0.0023	0.0025	0.0021	0.0020
Barium	2	---	0.0886	0.0965	0.113	0.116	0.110	0.117J+	0.102	0.100
Beryllium	0.004	---	0.00096J	0.0012	0.00092J	0.00086J	0.0013	0.0016	0.0016	0.0018
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	0.0011J+	<0.0050	<0.0050	0.0024J+	<0.0050	<0.0050	<0.0050	<0.0050
Cobalt	---	0.001	**0.0028**	**0.0015**	**0.0011**	0.00074J	0.00065J	0.00077J	0.00065J	0.00081J
Fluoride	4.0	---	0.13	<0.10	0.13	0.17	0.077J	0.054J	0.066J	0.072J
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0216J	**0.0252J+**	0.0235J	0.0229J	0.0235J+	**0.0286**	0.0248J	0.0239J+
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	0.0017J	0.0011J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<1.37	<1.53	<1.33	1.06	1.94	<1.30	<0.534	1.63
Selenium	0.05	---	<0.0050	<0.0050	0.0041J+	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	0.0042J+	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	**0.0092**	0.0048J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.10	<0.10	**0.13**	<0.10	**0.11**	**0.14**	<0.10	**0.14**	<0.10
Tin	---	0.011	<0.0050	0.00087J	<0.0050	0.0033J	<0.0050	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	0.0011J+	<0.0050	0.00078J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	**0.0707**	0.0422J	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	95.7	84.4	86.6	**131J+**	**114**	95.0	**103**	80.2	72.0
Iron	---	7.35	**14.4**	**19.8**	**27.3**	**24.4**	**24.4**	**25.8**	**21.5**	**21.3**
Hardness	---	74.6	**165**	**160**	**191**	**186**	**175**	**192**	**164**	**167**
Manganese	---	0.604	**0.840**	**0.867**	**1.02**	**1.19**	**0.899**	**0.967**	**0.789**	**0.774**
Sodium	---	23.7	11.8	7.49	8.45	8.42	5.77	5.85	4.67	4.62
TOC	---	7.2	1.7	1.3	0.73J	0.75J	0.84J	0.74J	0.79J	0.62J

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	SD-1604 (Downgradient)							
			5/18/2017	6/1/2017	6/14/2017	6/28/2017	7/11/2017	7/26/2017	8/9/2017	8/23/2017
CCR Detection Constituents										
Boron	---	0.28	**1.47**	**1.37**	**1.32**	**1.52J+**	**1.47**	**1.38**	**1.60**	**1.39**
Calcium	---	19.3	**47.5**	**44.7**	**44.7**	**43.2**	**44.3**	**44.5**	**43.6**	**45.4**
Chloride	---	11.3	**129**	**132**	**136**	**115**	**134**	**131**	**137**	**133**
Fluoride	NA	0.32	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.48-7.31	5.02	5.13	5.07	4.83	5.04	4.99	4.93	4.91
Sulfate	---	31.5	**88.1**	**87.8**	**88.6**	**80.0**	**85.7**	**82.1**	**87.6**	**85.5**
TDS	---	206	**386**	**376**	**404**	**414J+**	**398**	**404**	**396**	**396**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.00064J	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.219	0.201	0.209	0.200	0.205	0.200	0.201	0.202
Beryllium	0.004	---	0.00066J	0.00077J	0.00066J	0.00065J	0.00068J	0.00081J	0.00075J	0.00071J
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	0.0014J+	<0.0050	0.0023J+	<0.0050	<0.0050	<0.0050	0.0010J
Cobalt	---	0.001	0.00026J	0.00025J	**0.0013**	0.00019J	<0.0010	0.00019J	0.00034J	0.00019J
Fluoride	4.0	---	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0192J	0.0184J	0.0191J	0.0181J	0.0186J	0.0187J	0.0188J	0.0175J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	3.08	4.26	2.62	2.97	4.04	2.94	4.33	2.51
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00024J	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**0.0071**	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.011	<0.0050	0.00075J	<0.0050	0.0036J	<0.0050	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	0.00097J+	<0.0050	0.00089J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	0.0283J+	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	95.7	14.7	10.8	15.3J+	14.8	14.6	12.7	13.8	12.3
Iron	---	7.35	**20.2**	**18.7**	**19.9**	**17.8**	**19.4**	**18.5**	**18.1**	**19.3**
Hardness	---	74.6	**226**	**214**	**215**	**208**	**211**	**211**	**208**	**216**
Manganese	---	0.604	**1.29**	**1.24**	**1.26**	**1.57J+**	**1.25**	**1.24**	**1.22**	**1.27**
Sodium	---	23.7	17.0	16.1	16.6	20.7J+	15.7	16.0	15.5	16.3
TOC	---	7.2	<1.0	0.54J+	<1.0	<1.0	<1.0	0.72J	<1.0	<1.0

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-1605 (Downgradient)							
			11/3/2016	12/13/2016	1/26/2017	3/7/2017	4/21/2017	6/1/2017	7/11/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.28	**0.628**	**0.653**	**0.781**	**0.855**	**0.708**	**0.704**	**0.772**	**0.742**
Calcium	---	19.3	**33.3**	**36.5**	**37.5**	**47.0**	**34.6**	**33.3**	**37.4**	**37.9**
Chloride	---	11.3	**78.3**	**76.8**	**80.2**	**82.0**	**83.1**	**78.9**	**84.2**	**88.6**
Fluoride	NA	0.32	0.032J	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.48-7.31	4.46	4.22	3.63	3.77	4.30	4.43	4.36	4.34
Sulfate	---	31.5	**110**	**97.2**	**109**	**111**	**87.4**	**99.4**	**115**	**103**
TDS	---	206	**328**	**340**	**314**	**358**	**349**	**305**	**329**	**388**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.103	0.0942	0.0859	0.0886	0.0550	0.0542	0.0671	0.0548
Beryllium	0.004	---	0.0021	0.0027	0.0027	0.0032	0.0028	0.0027	0.0027	0.0030
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	0.0015B	0.0011J	<0.0050	0.0010J+	0.0014J
Cobalt	---	0.001	**0.0064**	**0.0068**	**0.0066**	**0.0084**	**0.0062**	**0.0063**	**0.0071**	**0.0069**
Fluoride	4.0	---	0.032J	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0244J	0.0228J	0.0232J	**0.0258**	0.0209J	0.0188J	0.0202J	0.0207J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	**<u>6.29</u>**	4.09	2.43	4.04	3.72	<1.20	2.52	3.45
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0049J	0.0030B	0.0048J	0.0065	0.0050J	0.0052	0.0051	0.0054
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	0.0042J	<0.0080
Nickel	---	0.005	**0.0122**	**0.0116**	**0.0131**	**0.0168**	**0.0114**	**0.0118**	**0.0132**	**0.0129**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.011	0.00084B	0.0023J	<0.0050	0.00097B	0.0015J	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	0.0016B	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	**0.0596**	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	95.7	4.7J	5.1	2.0J	2.4J	1.6J	1.7J	2.9J	2.7J
Iron	---	7.35	0.530	0.129B	<0.50	0.224J	<0.50	<0.50	<0.50	<0.50
Hardness	---	74.6	**162**	**174**	**181**	**221**	**162**	**163**	**178**	**180**
Manganese	---	0.604	**0.846**	**0.904**	**0.977**	**1.20**	**0.878**	**0.885**	**0.977**	**0.978**
Sodium	---	23.7	13.4	13.4	14.1	16.0	11.7	12.7	13.8	13.8
TOC	---	7.2	<1.0	<1.0	<1.0	<1.0	**7.6**	0.54J	<1.0	1.1

Notes:
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2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
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B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL

Table TM6-22
CCR Compliance Data
Pond D - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-1606 (Downgradient)							
			11/4/2016	12/13/2016	1/26/2017	3/7/2017	4/21/2017	6/1/2017	7/11/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.28	**1.06**	**1.04**	**1.08**	**1.09**	**1.10**	**1.01**	**1.10**	**0.992**
Calcium	---	19.3	**23.8**	**24.6**	**25.4**	**24.7**	**24.8**	**23.6**	**24.8**	**24.7**
Chloride	---	11.3	**102**	**95.0**	**97.8**	**96.7**	**102**	**80.8**	**99.6**	**98.8**
Fluoride	NA	0.32	<0.10	0.073	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std units)	---	3.48-7.31	4.40	4.30	3.71	3.85	4.23	4.37	4.37	4.35
Sulfate	---	31.5	**55.6**	**53.4**	**56.9**	**58.5**	**59.2**	**62.6**	**59.9**	**58.8**
TDS	---	206	**282**	**297**	**284**	**291**	**303J+**	**283**	**289**	**297**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0558	0.0486B	0.0476	0.0475	0.0411	0.0336	0.0401	0.0394
Beryllium	0.004	---	0.0018	0.0016	0.0013	0.0015	0.0014	0.0015	0.0014	0.0016
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	0.0012B	0.0011J+	<0.0050	<0.0050	<0.0050
Cobalt	---	0.001	**0.0028**	**0.0024**	**0.0022**	**0.0024**	**0.0023**	**0.0023**	**0.0023**	**0.0025**
Fluoride	4.0	---	<0.10	0.073	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0118J	0.0090J	0.0092J	0.0088J	0.0099J	0.0080J	0.0080J	0.0075J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	4.26	3.40	<1.53	1.83	2.86	3.02	2.88	3.05
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.000070J
VSWMR Assessment Constituents										
Copper	1.3	---	0.0039J	0.0016B	0.0028J	0.0025J	0.0034J	0.0034J	0.0025J	0.0035J
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	**0.0093**	**0.0073**	**0.0085**	**0.0106**	**0.0093**	**0.0089**	**0.0080**	**0.0099**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0012
Sulfide	---	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.011	<0.0050	0.0075	<0.0050	0.0049J	0.0014J	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	0.0018B	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	95.7	4.3J	2.0J	2.4J	2.8J	6.5	2.6J	3.5J	<5.0
Iron	---	7.35	0.662	0.302B	0.248J	0.302J	0.291J	<0.50	<0.50	<0.50
Hardness	---	74.6	**120**	**123**	**124**	**124**	**122**	**119**	**121**	**119**
Manganese	---	0.604	0.236	0.190	0.186	0.204	0.186	0.173	0.177	0.168
Sodium	---	23.7	**33.6**	**34.4**	**35.0**	**34.7**	**35.0**	**33.0**	**35.3J+**	**33.8**
TOC	---	7.2	<1.0	<1.0	<1.0	<1.0	0.53J	<1.0	<1.0	<1.0

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL

Table TM6-23
CCR Compliance Data
Pond E - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-24R (Background)							
			11/2/2016	12/12/2016	1/25/2017	3/6/2017	4/20/2017	5/30/2017	7/10/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.26	0.0596J	<0.250	0.0461J	0.154J	0.0065J	0.0124J	<0.050	<0.050
Calcium	---	7.92	1.88J	1.53B	1.81J	1.79J	1.85J	1.83J	1.82J	1.78
Chloride	---	5	2.5	<5.0	2.8	2.7	2.9	2.8	2.8	2.9
Fluoride	NA	0.26	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
pH (std unit)	---	3.84-6.73	4.90	4.57	4.62	4.69	4.98	4.74	5.12	5.2
Sulfate	---	5	1.6	<5.0	1.6	1.7	2.3J+	2.2	2.0	2.1
TDS	---	131	45.0	39.0	55.0	26.0	45.0	43.0	39.0	35.0
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.0140	0.0126B	0.0148	0.0145	0.0141	0.0166	0.0146	0.0177
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	0.0022	0.0019B	0.0023B	0.0017B	0.0017J+	0.0036J+	0.0020J+	0.0023J
Cobalt	---	0.001	0.00032J	0.00043B	0.00023J	0.00028J	0.00029J	0.00044J+	0.00035J	0.00051J+
Fluoride	4.0	---	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0019B	<0.0250	0.0021J	0.0019J	0.0016J+	0.0014J+	0.0015J	0.0015J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<1.58	<0.643	<0.125	<0.872	<1.39	<0.407	<0.802	<0.778
Selenium	0.05	---	<0.0050	0.0036J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0012J+	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	1.6	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0101	<0.0050	<0.0050	<0.0050	0.0015J	0.0101	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	0.00078J	<0.0050	<0.0050	0.00098J	0.0012J+	0.00074J	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0028J
VPDES Parameters										
Alkalinity	---	33.8	6.8	5.5	6.3	6.7	6.7	4.0J	5.3	6.5
Iron	---	3.1	<0.50	<0.50	<0.50	0.132J	<0.50	<0.50	<0.50	<0.50
Hardness	---	38	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	<5.41	11.2
Manganese	---	0.095	0.0094	0.0091B	0.0090	0.0089	0.0080	0.0102J+	0.0102	0.0111
Sodium	---	2.34	2.25J	1.94B	2.22J	1.82J	2.15J	2.19J	2.29J+	2.14J
TOC	---	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
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J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-23
CCR Compliance Data
Pond E - Possum Point Power Station

Parameter	MCL	Preliminary Background	ED-26 (Background)							
			11/2/2016	12/12/2016	1/25/2017	3/6/2017	4/19/2017	5/31/2017	7/10/2017	8/21/2017
CCR Detection Constituents										
Boron	---	0.26	0.010J	0.015J	<0.10	<0.10	0.0149J	0.0105J	<0.050	<0.050
Calcium	---	7.92	6.70	7.00	7.40	7.10	6.32	7.92	7.22	7.75
Chloride	---	5	2.2	2.6	2.5	2.3	2.3	2.3	2.2	2.2
Fluoride	NA	0.26	0.19J	0.24	0.26	0.16	0.20	0.20	0.20	0.18
pH (std unit)	---	3.84-6.73	5.70	5.69	5.58	5.06	5.82	5.99	5.86	6.00
Sulfate	---	5	1.9	2.4	2.5	2.2	2.1	2.1	1.9	1.7
TDS	---	131	99.0	89.0	97.0	94.0	82.0	88.0	83.0	75.0
CCR Assessment Constituents										
Antimony	0.006	---	<0.0020	<0.0020	<0.0020	0.00028J	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0050	<0.0050	<0.0050	<0.0050	0.00053J	<0.0050	<0.0010	<0.0010
Barium	2	---	0.033	0.029	0.027	0.026	0.0256	0.0286	0.0243	0.0274
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium	0.005	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	0.0016J	<0.0050	<0.0050
Cobalt	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.00016J	<0.0010	<0.0010	<0.0010
Fluoride	4.0	---	0.19J	0.24	0.26	0.16	0.20	0.20	0.20	0.18
Lead	---	0.001	<0.0010	<0.0010	0.00021B	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0090	0.012	0.010	0.012	0.0105J	0.0133J	0.0133J	0.0110J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	<5.00	0.703	0.820	0.368	<1.04	<0.837	1.63	<0.545
Selenium	0.05	---	0.00048J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	<0.0020	<0.0020	<0.0020	<0.0020	0.0019J	<0.0020	<0.0050	<0.0050
Cyanide	---	0.008	<0.010	<0.010	<0.010	<0.010	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	<0.0020	<0.0020	<0.0020	<0.0020	<0.0050	<0.0050	<0.0050	<0.0050
Silver	---	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0010	<0.0050	<0.0050
Sulfide	---	1.6	1.6J	<1.0	<1.0	<1.0	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0101	<0.010	<0.010	0.0059B	0.0030B	0.0077J+	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	0.00099J+	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.020	<0.020	<0.020	<0.020	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	33.8	32.0	33.0	32.0	32.0	30.3	28.8	33.8	30.4
Iron	---	3.1	3.1	2.6	2.7	2.3	2.7	3.0	2.7	2.84
Hardness	---	38	30.0	30.0	38.0	34.0	25.4	31.0	29.2	30.4
Manganese	---	0.095	0.094	0.077	0.077	0.078	0.0711	0.0832	0.0803	0.0950
Sodium	---	2.34	1.70	1.70	2.10	1.70	1.68J	1.95J	2.02J	1.79J
TOC	---	1	0.24J	0.42B	0.15J	0.19B	0.57J	<1.0	<1.0	<1.0

Notes:
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B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-23
CCR Compliance Data
Pond E - Possum Point Power Station

Parameter	MCL	Preliminary Background	ES-3D (Downgradient)							
			11/3/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.26	**1.07**	**0.930**	**0.605**	**1.11**	**0.909**	**1.12J+**	**0.652**	**0.577**
Calcium	---	7.92	**29.1**	**29.2**	**18.0**	**29.3**	**23.5**	**25.6**	**19.0**	**17.4**
Chloride	---	5	**212**	**188**	**120**	**174**	**205**	**194**	**137**	**133**
Fluoride	NA	0.26	0.05J	0.12	**0.28**	0.17	0.15	0.16	0.24	**0.30**
pH (std unit)	---	3.84-6.73	5.00	5.37	4.99	5.18	5.62	5.79	5.32	5.57
Sulfate	---	5	**91.8**	**87.7**	**51.6**	**71.4**	**79.8**	**79.3**	**53.1**	**56.6**
TDS	---	131	**512**	**537**	**347**	**501**	**548J+**	**534**	**391**	**383**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	0.00083J	0.00093J	0.0019	0.0033	0.0024	0.0018	0.0020	0.0020
Barium	2	---	0.0969	0.0773B	0.0888	0.129	0.0866	0.0858	0.0733	0.0791
Beryllium	0.004	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00017
Cadmium	0.005	---	<0.0008	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0012J+	0.0013J
Cobalt	---	0.001	**0.0573**	**0.0492**	**0.0225**	**0.0411**	**0.0360**	**0.0303**	**0.0147**	**0.0157**
Fluoride	4.0	---	0.05J	0.12	0.28	0.17	0.15	0.16	0.24	0.30
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0143J	0.0082J	0.0095J	0.0126J	0.0102J	0.0126J	0.0098J	0.0097J
Mercury	0.002	---	0.0004	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0011J	<0.0050
Radium 226/228 (pCi/L)	5	---	3.39	<1.12	<0.950	<0.669	<0.946	1.42	<0.847	<0.766
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.000075J
VSWMR Assessment Constituents										
Copper	1.3	---	<0.005	<0.0050	<0.0050	<0.0050	0.0014J+	<0.0050	<0.0050	0.0015
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	**0.0493**	**0.0442**	**0.0203**	**0.0358**	**0.0305**	**0.0237**	**0.0138**	**0.0132**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	1.6	<0.10	<0.10	<0.10	<0.10	<0.10	0.25	<0.10	<0.10
Tin	---	0.0101	<0.0050	<0.0050	<0.0050	<0.0050	0.0119	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	0.0012J	0.0012J+	0.00097J	0.00070J	0.0015J
Zinc	---	0.05	**0.168**	**0.119**	**0.0572**	**0.135**	**0.125**	**0.122**	**0.0863**	**0.106**
VPDES Parameters										
Alkalinity	---	33.8	28.3	31.9	23.4	**37.4**	31.0	**54.5**	**34.9**	28.8
Iron	---	3.1	**21.1**	**26.4**	**19.1**	**39.7**	**32.4**	**37.1**	**29.8**	**25.6**
Hardness	---	38	**161**	**160**	**93.4**	**161**	**134**	**142**	**103**	**91.8**
Manganese	---	0.095	**1.41**	**1.36**	**0.686**	**1.34**	**1.15**	**1.27**	**0.820**	**0.748**
Sodium	---	2.34	**101**	**98.3**	**60.8**	**109**	**98.4**	**98.5**	**78.4**	**70.4**
TOC	---	1	0.63J	**1.1**	0.93J	**1.4**	**1.4**	1.0	0.98J	**2.0**

Notes:
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MCL - Maximum Contaminant Level, the USEPA drinking water Standard
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NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

Table TM6-23
CCR Compliance Data
Pond E - Possum Point Power Station

Parameter	MCL	Preliminary Background	ES-1609 (Downgradient)							
			11/3/2016	12/13/2016	1/26/2017	3/7/2017	4/20/2017	5/31/2017	7/11/2017	8/22/2017
CCR Detection Constituents										
Boron	---	0.26	**1.10**	**1.15**	**1.37**	**1.31**	**1.47J+**	**1.56J+**	**1.57**	**1.38**
Calcium	---	7.92	**23.8**	**22.7**	**23.7**	**22.7**	**23.4**	**23.7**	**22.0**	**22.7**
Chloride	---	5	**201**	**184**	**219**	**214**	**219**	**204**	**213**	**206**
Fluoride	NA	0.26	0.055J	0.069	0.057J	0.037J	<0.10	0.066J	0.050J	<0.10
pH (std unit)	---	3.84-6.73	5.89	5.97	5.58	5.53	5.20	5.76	4.98	5.12
Sulfate	---	5	**71.9**	**64.3**	**65.8**	**67.0**	**70.6**	**74.0**	**72.1**	**73.2**
TDS	---	131	**478**	**492**	**540**	**479**	**456**	**499**	**494**	**498**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	0.00051J	0.00084J	0.00084J	<0.0010	<0.0010	<0.0010	<0.0010
Barium	2	---	0.103	0.0900	0.107	0.0990	0.0806	0.105	0.0865	0.0886
Beryllium	0.004	---	0.00053J	0.00036B	<0.0010	0.00057J	0.0011	0.00052J	0.0010	0.0011
Cadmium	0.005	---	<0.0080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	0.0019B	0.0013J+	<0.0050	<0.0050	<0.0050
Cobalt	---	0.001	**0.0142**	**0.0139**	**0.0130**	**0.0157**	**0.0204**	**0.0158**	**0.0198**	**0.0217J+**
Fluoride	4.0	---	0.055J	0.069	<0.10	<0.10	<0.10	0.066J	0.050J	<0.10
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0138J	0.0090J	0.0113J	0.0102J	0.0103J	0.0103J	0.0088J	0.0092J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.92	<0.496	<1.48	<0.936	<1.54	1.80	2.81	2.27
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0012J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	**0.0135**	**0.0105**	**0.0098**	**0.0129**	**0.0143**	**0.0125**	**0.0148**	**0.0149**
Silver	---	0.005	<0.0050	<0.0050	0.00081J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	1.6	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0101	<0.0050	<0.0050	<0.0050	0.0048J	0.0015J+	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	0.0012J	<0.0050	0.00089J	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	0.0254J	<0.050	<0.050	0.0351J
VPDES Parameters										
Alkalinity	---	33.8	**37.1**	**37.3**	32.0	19.0	8.4	21.5	6.5	8.0
Iron	---	3.1	**31.8**	**32.9**	**40.8**	**31.1**	**22.8**	**30.7**	**22.6**	**20.4**
Hardness	---	38	**114**	**109**	**116**	**111**	**109**	**111**	**106**	**108**
Manganese	---	0.095	**0.820**	**0.753**	**0.841**	**0.789**	**0.699**	**0.751**	**0.673**	**0.673**
Sodium	---	2.34	**99.5**	**106**	**109**	**104**	**116J+**	**108**	**117J+**	**118**
TOC	---	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
<u>Bolded and Underlined</u> detections are greater than the applicable MCL.

Table TM6-23
CCR Compliance Data
Pond E - Possum Point Power Station

Parameter	MCL	Preliminary Background	ES-1613 (Downgradient)							
			11/3/2016	12/13/2016	1/26/2017	3/7/2017	4/21/2017	5/31/2017	7/11/2017	8/23/2017
CCR Detection Constituents										
Boron	---	0.26	**2.31**	**2.23**	**2.32**	**2.02**	**2.02**	**1.86**	**2.13**	**1.91**
Calcium	---	7.92	**35.6**	**37.2**	**37.0**	**31.2**	**33.3**	**29.9**	**30.9**	**31.1**
Chloride	---	5	**228**	**192**	**194**	**180**	**179**	**159**	**163**	**161**
Fluoride	NA	0.26	0.078J	0.15	0.083J	0.065J	0.097J	0.096J	0.099J	0.076J
pH (std unit)	---	3.84-6.73	5.27	4.93	4.44	4.41	4.96	5.04	4.89	4.90
Sulfate	---	5	**124**	**100**	**97.0**	**94.6**	**91.6**	**92.3**	**88.4**	**85.0**
TDS	---	131	**565**	**546**	**520**	**496**	**528**	**523**	**434**	**449**
CCR Assessment Constituents										
Antimony	0.006	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	0.010	---	<0.0010	<0.0010	0.00057J	0.00081J	0.00059J+	<0.0010	<0.0010	<0.0010
Barium	2	---	0.124	0.0854	0.0773	0.0656	0.0628	0.0531	0.0624	0.0644
Beryllium	0.004	---	0.00046J	0.00078B	0.00069J	0.00088J	0.00088J	0.00083J	0.00093J	0.00090J
Cadmium	0.005	---	<0.0080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Chromium	0.1	---	<0.0050	<0.0050	<0.0050	0.0010B	<0.0050	<0.0050	<0.0050	<0.0050
Cobalt	---	0.001	**0.0182**	**0.0253**	**0.0258**	**0.0236**	**0.0232**	**0.0223**	**0.0229**	**0.0219**
Fluoride	4.0	---	0.078J	0.15	<0.10	<0.10	0.097J	0.096J	0.099J	0.076J
Lead	---	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lithium	---	0.025	0.0243J	0.0241J	0.0245J	0.0220J	0.0243J	0.0218J	0.0219J+	0.0194J
Mercury	0.002	---	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	---	0.01	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Radium 226/228 (pCi/L)	5	---	1.69	<0.821	<1.19	1.29	<1.57	2.48	1.57	1.85
Selenium	0.05	---	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thallium	0.002	---	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
VSWMR Assessment Constituents										
Copper	1.3	---	0.0016J	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide	---	0.008	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Nickel	---	0.005	**0.0208**	**0.0287**	**0.0308**	**0.0299**	**0.0280**	**0.0270**	**0.0265**	**0.0254**
Silver	---	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sulfide	---	1.6	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	---	0.0101	<0.0050	<0.0050	<0.0050	0.0056	0.0014J	<0.0050	<0.0050	<0.0050
Vanadium	---	0.005	<0.0050	<0.0050	<0.0050	0.0011J	0.00071J+	<0.0050	<0.0050	<0.0050
Zinc	---	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
VPDES Parameters										
Alkalinity	---	33.8	22.2	12.5	14.1	12.8	11.0	12.2	6.8	12.8
Iron	---	3.1	**22.6**	**18.1**	**17.2**	**14.3**	**14.9**	**13.6**	**14.2**	**14.4**
Hardness	---	38	**178**	**188**	**187**	**161**	**165**	**155**	**157**	**156**
Manganese	---	0.095	**1.07**	**1.04**	**1.02**	**0.968**	**0.915**	**0.858**	**0.883**	**0.866**
Sodium	---	2.34	**79.4**	**86.9**	**86.4**	**78.5**	**77.7**	**73.0**	**75.2**	**76.3**
TOC	---	1	<1.0	<1.0	0.61J	0.52J	**4.7**	0.55J	0.64J	<1.0

Notes:
1. Results reported in milligrams per liter unless otherwise noted.
2. This table includes data from monitoring wells designed to monitor groundwater in accordance with the CCR Rule and Virginia Solid Waste Management Regulations. Monitoring wells that are part of the Virginia Pollutant Discharge Elimination System network and other wells are not included.
3. Data reported herein has been compared to applicable MCLs. When an MCL has not been defined, a site-specific preliminary background value has been calculated and applied in place of the MCL.
4. An MCL has not been defined for copper. The USEPA action level is applied in place of the MCL.

pCi/L - picocuries per liter
< - Not detected at the reporting limit (or MDC for radium)
J - Result is less than the reporting limit, but greater or equal to the method detection limit
J+ - Estimated result biased high
B - Compound was found in the blank and the sample
MCL - Maximum Contaminant Level, the USEPA drinking water Standard
MDC - minimum detecable concentration
NA - Not applicable, MCL is less than the background value or does not apply to detection monitoring phase
Bolded detections are greater than the applicable preliminary background.
Bolded and Underlined detections are greater than the applicable MCL.

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Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				May 6, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.23 J, B	0.83 J, B	0.36 J, B	0.26 J, B	0.20 J, B	0.20 J, B	0.19 J, B
Arsenic	340	150	10	--	0.77 J	1.0	1.0	0.73 J	0.68 J	1.0	0.81 J
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	1.3 J	0.69 J	0.55 J	0.79 J	0.67 J	1.3 J	0.82 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.9 J, B	3.0 B	1.5 J, B	1.6 J, B	1.5 J, B	1.7 J, B	1.9 J, B
Lead[1]	120	14	15	--	0.81 J, B	1.1 B	0.45 J, B	0.67 J, B	0.78 J, B	0.22 J, B	0.98 J, B
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	1.7 B	1.1 B	1.0 B	1.3 B	1.5 B	1.8 B	1.5 B
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	0.021 J, B	ND	0.016 J, B	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	5.6	10.2	5.0	3.0 J	5.3	6.5	5.0

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				May 25, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.081 J	ND	0.074 J	ND	ND	0.28 J	0.058 J
Arsenic	340	150	10	--	1.0	0.66 J	1.3	1.1	1.2	1.1	0.92 J
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	1.2 J	1.4 J	1.3 J	1.3 J	1.3 J	1.1 J	1.0 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	2.1	6.0	2.8	2.1	1.5 J	1.9 J	1.5 J
Lead[1]	120	14	15	--	0.24 J	1.1	0.52 J	0.21 J	0.26 J	0.21 J	0.21 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	0.054 J	ND	0.066 J
Nickel[1]	180	20	610	4,600	1.7	2.2	2.0	1.3	1.2	1.2	2.9
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	4.2 J	22.3	7.2	3.3 J	3.3 J	3.5 J	2.4 J

[1] Freshwater values are a function of total hardness as calcium carbonate
CaCO3 mg/L and the Water Effect Ratio
[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.
[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.
NS = Not sampled
ND = Not detected at the reporting limit
J = Result is less than the reporting limit but greater or equal to the minimum detection limit
B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				June 6, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.19 J	0.32 J	0.27 J	0.17 J	0.16 J	0.18 J	0.15 J
Arsenic	340	150	10	--	0.60 J	0.78 J	1.0	0.53 J	0.49 J	0.53 J	0.43 J
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	0.58 J	0.57 J	0.73 J	ND	ND	ND	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.7 J, B	4.4 B	2.4 B	1.8 J, B	1.5 J, B	1.6 J, B	1.2 J, B
Lead[1]	120	14	15	--	0.49 J	1.3	0.54 J	0.55 J	0.46 J	0.28 J	0.27 J
Mercury[1]	1.4	0.77	--	--	0.060 J	ND	0.056 J	0.059 J	0.058 J	0.063 J	0.056 J
Nickel[1]	180	20	610	4,600	1.6	2.7	1.8	1.2	1.2	1.1	0.86 J
Selenium[1]	20	5.0	170	4,200	ND	0.43 J	0.58 J	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	0.12 J	0.052 J	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	0.018 J	0.018 J	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	2.3 J	11.3	2.9 J	3.6 J	4.3 J	1.9 J	1.3 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				June 24, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.28 J	0.26 J	0.25 J	0.19 J	0.36 J	0.26 J	0.17 J
Arsenic	340	150	10	--	0.75 J	0.68 J	1.2	0.93	0.79 J	0.80 J	0.81 J
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	ND	0.51 J	0.36 J	0.47 J	ND	ND	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.7 J	3.4	2.9	2.3	1.8 J	2.1	1.6 J
Lead[1]	120	14	15	--	0.37 J	0.98 J	0.49 J	0.52 J	0.32 J	0.41 J	0.35 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	1.5	1.7	1.4	1.7	1.4	1.4	1.4
Selenium[1]	20	5.0	170	4,200	ND	ND	0.38 J	ND	0.39 J	0.81 J	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	10.5	8.2	3.3	4.1 J	3.0 J	3.5 J	4.8 J

[1] Freshwater values are a function of total hardness as calcium carbonate
CaCO3 mg/L and the Water Effect Ratio
[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.
[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.
NS = Not sampled
ND = Not detected at the reporting limit
J = Result is less than the reporting limit but greater or equal to the minimum detection limit
B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				July 21, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.27 J, B	0.28 J, B	0.18 J, B	0.29 J, B	0.20 J, B	0.38 J, B	0.31 J, B
Arsenic	340	150	10	--	1.1	1.0	1.2	1.0	0.78 J	0.89 J	0.92 J
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	ND	ND	ND	ND	0.37 J	ND	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	2.7 B	3.3 B	1.9 J, B	2.3 B	1.7 J, B	3.4 B	2.5 B
Lead[1]	120	14	15	--	0.25 J	0.37 J	0.072 J	0.38 J	0.36 J	0.48 J	0.37 J
Mercury[1]	1.4	0.77	--	--	0.053 J	0.063 J	0.057 J	0.061 J	0.056 J	ND	ND
Nickel[1]	180	20	610	4,600	1.1	0.61 J	0.59 J	1.5	1.1	1.3	1.4
Selenium[1]	20	5.0	170	4,200	0.67 J, B	ND	ND	ND	ND	0.63 J, B	ND
Silver[1]	3.4	--	--	--	ND	0.14 J	ND	ND	ND	0.40 J	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	ND	3.3 J	ND	3.1 J	2.4 J	3.0 J	2.6 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio
[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.
[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.
NS = Not sampled
ND = Not detected at the reporting limit
J = Result is less than the reporting limit but greater or equal to the minimum detection limit
B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				August 23, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.33 J, B	0.29 J, B	0.34 J, B	0.35 J, B	0.36 J, B	0.47 J, B	0.39 J, B
Arsenic	340	150	10	--	1.1	0.57 J	1.7	1.1	1.0	1.1	1.2
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	ND	ND	ND	ND	ND	ND	0.45 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	1.5 J, B	2.0 B	1.6 J, B	1.6 J, B	1.5 J, B	1.6 J, B	1.7 J, B
Lead[1]	120	14	15	--	0.30 J	0.16 J	0.11 J	0.59 J	0.42 J	0.57 J	0.51 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	1.8	0.93 J	1.4	1.9	2.0	1.9	1.9
Selenium[1]	20	5.0	170	4,200	0.41 J	ND	ND	ND	0.48 J	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	ND	3.2 J	ND	3.4 J	ND	ND	ND

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				September 27, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.30 J, B	0.46 J, B	0.40 J, B	0.44 J, B	0.31 J, B	0.40 J, B	0.32 J, B
Arsenic	340	150	10	--	0.92 J	0.64 J	0.98 J	1.2	1.0	1.1	1.1
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	0.34 J	0.69 J	ND	0.36 J	ND	0.34 J	ND
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	0.0023 J	ND	ND	0.0023 J	ND	0.0023 J
Copper[1]	13	9.0	1,300	--	2.9 B	6.5 B	2.6 B	3.4 B	2.4 B	3.1 B	2.9 B
Lead[1]	120	14	15	--	0.53 J, B	3.1 B	0.29 J, B	0.68 J, B	0.49 J, B	0.72 J, B	0.58 J, B
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	2.1	1.4	1.4	2.0	2.2	2.1	2.0
Selenium[1]	20	5.0	170	4,200	0.42 J	ND	ND	1.4 J	ND	0.97 J	0.82 J
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	4.2 J	30.4	2.5 J	3.6 J	3.5 J	3.2 J	3.8 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio
[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.
[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.
NS = Not sampled
ND = Not detected at the reporting limit
J = Result is less than the reporting limit but greater or equal to the minimum detection limit
B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				December 13, 2016						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (µg/l)[3]	All Other Surface Waters (µg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (µg/l)	Chronic (µg/l)									
Antimony	--	--	5.6	640	0.29 J	0.25 J	0.23 J	0.25 J	0.30 J	0.32 J	0.32 J
Arsenic	340	150	10	--	0.62 J	0.41 J	0.54 J	0.67 J	0.70 J	0.69 J	0.82 J
Boron	--	--	--	--	NS	NS	NS	NS	NS	NS	NS
Cadmium[1]	3.9	1.1	5	--	ND	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	0.46 J	0.77 J	ND	0.57 J	0.81 J	0.58 J	0.76 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	2.5 B	5.7 B	2.7 B	3.4 B	3.1 B	3.1 B	3.4 B
Lead[1]	120	14	15	--	0.46 J	1.1	0.29 J	0.69 J	0.90 J	0.62 J	0.76 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	2.1	1.6	2.0	2.3	2.4	2.3	2.4
Selenium[1]	20	5.0	170	4,200	ND	0.79 J	ND	1.0 J	0.37 J	0.41 J	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	ND	ND	ND	ND	ND	ND	ND
Zinc[1]	120	120	7,400	26,000	3.2 J	28.7	5.4	5.0	6.9	5.3	5.3

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio

[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.

[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.

NS = Not sampled

ND = Not detected at the reporting limit

J = Result is less than the reporting limit but greater or equal to the minimum detection limit

B = Compound was found in the blank and the sample

Table TM6-24
Surface Water Sampling Results
Possum Point Power Station

Parameter	Use Designation				March 21, 2017						
	Aquatic Life		Human Health		Upstream			Downstream			
	Freshwater[2]		Public Water Supply (μg/l)[3]	All Other Surface Waters (μg/l)	PPPS-POWELL1	PPPS-UPS01	PPPS-UPS02	PPPS-DWS01	PPPS-POTOMAC1	PPPS-POTOMAC2	PPPS-POTOMAC3
	Acute (μg/l)	Chronic (μg/l)									
Antimony	--	--	5.6	640	ND	ND	ND	ND	ND	ND	ND
Arsenic	340	150	10	--	0.47 J	0.30 J	0.50 J	0.40 J	0.44 J	0.33 J	0.38 J
Boron	--	--	--	--	39.5 J	13.6 J	43.2 J	84.1	72.9 J	64.5 J	83.6
Cadmium[1]	3.9	1.1	5	--	1.1	ND	ND	ND	ND	ND	ND
Chromium	--	--	100	--	0.85 J	0.85 J	ND	0.52 J	0.44 J	ND	0.47 J
Chromium III[1]	570	74	--	--	ND	ND	ND	ND	ND	ND	ND
Chromium VI[1]	16	11	--	--	ND	ND	ND	ND	ND	ND	ND
Copper[1]	13	9.0	1,300	--	2.6	5.5	2.1	1.8 J	1.4 J	1.4 J	1.3 J
Lead[1]	120	14	15	--	0.86 J	0.93 J	0.62 J	0.58 J	0.51 J	0.46 J	0.50 J
Mercury[1]	1.4	0.77	--	--	ND	ND	ND	ND	ND	ND	ND
Nickel[1]	180	20	610	4,600	2.1	2.0	1.6	1.4	1.1	1.6	1.5
Selenium[1]	20	5.0	170	4,200	ND	ND	ND	ND	ND	ND	ND
Silver[1]	3.4	--	--	--	ND	ND	ND	ND	ND	ND	ND
Thallium	--	--	0.24	0.47	0.13 J	ND	ND	ND	0.078 J	ND	ND
Zinc[1]	120	120	7,400	26,000	6.5	23.4	5.5	3.9 J	2.7 J	ND	3.6 J

[1] Freshwater values are a function of total hardness as calcium carbonate CaCO3 mg/L and the Water Effect Ratio
[2] According to the DEQ and MDE, the Potomac River and Quantico Creek are classified as Class II waters, tidal freshwater. As specified in 9VAC25-260-140, these waters are subject to Freshwater Aquatic Life water quality criteria.
[3] There are no public water supply areas within the sampled area; these criteria are provided for informational purposes only.
NS = Not sampled
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J = Result is less than the reporting limit but greater or equal to the minimum detection limit
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Figures

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LEGEND

Approximate Property Boundary

Approximate Pond Boundary

Topographic Contours, 20 ft intervals

Topography Source: U.S. Geological Survey, 2016, Topo TNM Style Template: USGS - National Geospatial Technical Operations Center (NGTOC), Rolla, MO and Denver, CO

N

0 750 1,500 3,000

Feet

AECOM

Figure TM6-10
Site Topography

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CKS	DFM	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/26/2017	Environment

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LEGEND

- Approximate Property Boundary
- Approximate Pond Boundary
- Potentiometric Contours

Compliance Program

- CCR Network Well
- CCR Network Background Well

AECOM

Figure TM6-11
Potentiometric Surface
Uppermost Aquifer, April 2017

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CKS	DFM	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/26/2017	Environment

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LEGEND

Approximate Property Boundary

Approximate Ash Pond Boundary

Surface Water Sample

AECOM

Figure TM6-12
Surface Water Sampling Locations

DRAWN BY:	REVIEWED BY:	APPROVED BY:	REVISION NUMBER:
RIP	CKS	DFM	REV. 0

Possum Point Power Station

DATE:	DEPT:
10/26/2017	Environment

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7. Abbreviations

bgs	below ground surface
CAP	Corrective Action Plan
CASE	Corrective Action Site Evaluation
CCR	coal combustion residuals
CFR	Code of Federal Regulations
cm/s	centimeters per second
CSX	CSX Corporation
CY	cubic yards
DEQ	(Virginia) Department of Environmental Quality
EDR	Environmental Data Resources, Inc.
ft/ft	feet per foot
ft/year	feet per year
GPS	Groundwater Protection Standards
MCL	Maximum Contaminant Levels
MNA	monitored natural attenuation
msl	above mean sea level
PCBs	polychlorinated biphenyls
PVC	polyvinyl chloride
SB 1398	Senate Bill 1398
SBER	Southern Branch of the Elizabeth River
SWP	solid waste permit
TDS	total dissolved solids
TOC	total organic carbon
USEPA	U.S. Environmental Protection Agency
VAC	Virginia Administrative Code
VPDES	Virginia Pollutant Discharge Elimination System
VSWMR	Virginia Solid Waste Management Regulations

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Senate Bill 1398 Response

Coal Combustion Residuals Ash Pond Closure Assessment

TECHNICAL MEMORANDUM 7

Groundwater Corrective Measures

November 2017

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Senate Bill 1398 Response:
Coal Combustion Residuals Ash Pond Closure Assessment

Technical Memorandum 7: Groundwater Corrective Measures

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Table of Contents

Tables

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1. Introduction and Summary of Findings

Virginia Senate Bill 1398 (SB 1398) requires “that every owner or operator of a coal combustion residuals (CCR) surface impoundment that is located within the Chesapeake Bay watershed … conduct an assessment of each such CCR surface impoundment (CCR unit) regarding the closure of any such unit.” The assessment must include describing groundwater and surface water conditions surrounding the surface impoundments (ash ponds) and evaluating corrective measures to restore water quality (if needed), evaluating the clean closure (closure by removal) of the CCR unit by recycling/reusing the ash or moving it to a landfill and demonstrating the long-term safety of the CCR unit if it is closed in place.

SB 1398 is applicable to eleven CCR surface impoundments (referred to as ash ponds in this report) at four Dominion Energy (Dominion) power stations. On behalf of Dominion, AECOM conducted an evaluation of the groundwater and surface water on all eleven ponds and an assessment of closure options on the five ponds that have been slated for closure. Ash has been removed or is in the process of being removed from the other six ponds; therefore, these ponds are being closed by removal. Table TM7-1 provides information on the Dominion power stations and ash ponds that were included in the study.

Table TM7-1: Ash Ponds included in the Study

Power Station	CCR Units	Remaining CCR Volume (CY)[1]	Operating Status	Area (acres)
Bremo Power Station	North Ash Pond[2]	4,800,000	Slated for closure	68
	East Ash Pond	1,400,000	Ash being actively removed and transported to North Ash Pond	27
	West Ash Pond	0	Ash removed	22
Chesapeake Energy Center[3]	Bottom Ash Pond[2]	60,000	Committed to closure by removal	5
Chesterfield Power Station	Lower Ash Pond[2]	3,600,000	Slated for closure	101
	Upper Ash Pond[2]	11,300,000	Slated for closure	112
Possum Point Power Station	Ash Pond A Ash Pond B Ash Pond C	40,000	Residual ash to be removed from Ash Ponds A, B, and C and transported to Ash Pond D	18
	Ash Pond D[2]	4,009,250	Slated for closure	70
	Ash Pond E	2,250	Residual ash to be removed and transported to Ash Pond D	38
	Total Volume	**25,211,500**		

(1) CCR volumes are based on Dominion estimates as of July 10, 2017

(2) Assessed for closure options

(3) While not subject to the assessment required by SB 1398, the CCR landfill at the Chesapeake Energy Center is slated for closure in accordance with VSWMR. Virginia DEQ issued a draft solid waste permit in June 2016 for closure of the landfill, which process was later suspended at Dominion’s request. The draft permit required Dominion to evaluate and propose alternative corrective measures to address groundwater impacts. In addition, in connection with a July 31, 2017, court order, Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, to include proposed additional corrective measures to address site-wide groundwater impacts.

CCR = coal combustion residuals; CY = cubic yards; DEQ = Department of Environmental Quality; VSWMR = Virginia Solid Waste Management Regulations

1.1 Study Objective

The objective of the study was to comply with the following SB 1398 requirements to ensure the long-term safety of the ash ponds while protecting public health and the environment:

- Evaluate closure by removal with recycling or reuse (beneficial use) of the CCR material
- Evaluate closure by removal with placement of CCR material in a permitted landfill
- Evaluate closure-in-place addressing long-term safety, structural, and extreme weather event resiliency
- Describe groundwater and surface water quality surrounding each ash pond, and evaluate corrective measures if needed

AECOM was tasked with critically reviewing existing information, identifying additional studies that may be needed, performing the studies, and preparing a report that addresses the requirements of SB 1398 for each of the eleven Dominion ash ponds listed in Table TM7-1.

The objective of the SB 1398 requirements is to provide members of the legislature, environmental regulators, local government officials, and the local communities with an assessment of ash pond closure options as set forth in the legislation. Specifically, the report describes how the various options could meet the objectives of safe closure, compliance with applicable federal and state rules, and protection of public health and the environment. This report is not intended, and must not be construed, to provide recommendations or conclusions regarding the selection of the options detailed herein.

AECOM developed a series of Technical Memoranda that provide a detailed analysis of the primary technical information needed to comply with SB 1398 requirements. The Technical Memoranda provide an assessment of closure by removal options (including recycling/beneficial use and landfilling); ash sampling results to supplement the beneficial use study; and evaluations of closure-in-place, groundwater and surface water conditions, and potential groundwater corrective measures. The memoranda are included as attachments to the report and are referenced as appropriate.

1.2 Technical Memorandum 7 Objective

Technical Memorandum 7 provides an evaluation of potential corrective measures to remediate the groundwater impacts related to the ash ponds, describes how these measures can address the items outlined in 40 CFR § 257.96, and outlines how these measures could potentially be implemented to remediate groundwater impacts to levels below station-specific standards, as described in Section 3.

This Technical Memorandum is presented in response to SB 1398 requirement 1:

> Identify and describe any groundwater or surface water pollution located at or stemming from the CCR unit, including pollution identified through past monitoring, and evaluate corrective measures to resolve such pollution. Any such evaluation shall address the issues set forth in 40 CFR § 257.96(c) and shall describe and demonstrate how the proposed corrective measures will restore groundwater and surface water quality.

1.3 Summary of Findings for Technical Memorandum 7

As described in Technical Memorandum 6, impacts are defined as constituents that are above Maximum Contaminant Levels (MCLs) established by the U.S. Environmental Protection Agency (USEPA) as the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, allowing an adequate margin of safety. While the groundwater at these stations is not used for drinking water, the MCL is the standard applied by the CCR Rule.

In addition to MCLs, impacts are also defined as constituents that have a statistically significant increase above the background levels established during baseline sampling.

Analytical results from the eight rounds of background sampling events in accordance with the CCR Rule will be used to establish station-specific Groundwater Protection Standards (GPS), which are expected to consist of the following:

- The MCL will be used for parameters that have an MCL established by USEPA
- For constituents that do not have an MCL, a statistically significant increase above background is defined as an analytical result greater than the 95% Upper Prediction Limit

Based on the groundwater data and site-specific conditions, a number of potential corrective measures exist to address the groundwater impacts associated with the ash ponds, as listed below.

- Permeable reactive barrier (PRB)
- In situ stabilization/solidification (ISS)
- ISS to create bottom and side containment cell
- Vertical engineered barrier (VEB)
- Hydraulic containment via pump-and-treat methods
- Monitored natural attenuation (MNA)

Table TM7-2 provides a general overview of the projected schedule, costs, benefits, and impacts of groundwater corrective measures options for each of the ash ponds that could potentially be closed in place.

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Table TM7-2: Corrective Measures Technology Summary

Evaluation Factor		Permeable Reactive Barrier (PRB)	In Situ Solidification/ Stabilization (ISS)	ISS to Create Bottom and Side Containment around Cell	Vertical Engineered Barrier (VEB) – Slurry Wall	Pump and Treat with Multiple Treatment Technologies	Monitored Natural Attenuation (MNA) with Risk Assessment
General Technology Specifications		PRB wall to depth of confining layer installed downgradient of CCR unit; deep trenching technology for installation	Full-contact mixing of entire CCR volume in ash pond over full surface area to bottom depth of pond	Approximately 5-foot-thick ISS layer at bottom of CCR over the entire surface area; sidewalls to full depth around unit; cap on top	Slurry wall installed downgradient of CCR unit, keyed into confining layer if possible; deep trenching technology for installation	Multiple extraction wells with overlapping radii of influence; anticipated treatment technologies include aeration, pH adjustment, coagulation/flocculation, filtration, adsorptive media, and ion exchange resin	Downgradient of CCR unit using existing monitoring well network
Additional Requirements		May require up to three parallel walls with different reactive media to treat various constituents	Manage stability over standing water; large-diameter auger mixing ~10% Portland cement	Manage stability over standing water; large-diameter auger mixing ~10% Portland cement	Hydraulic control: multiple extraction wells behind VEB to prevent hydraulic pressure on VEB; includes groundwater treatment	Wells located along full downgradient edge of CCR unit	Risk assessment would be performed to verify that MNA would be protective of human health and the environment
Schedule	**Implementation Schedule**	Moderate duration for implementation	Moderate duration for implementation; rapid curing/reaction	Moderate duration for implementation; rapid curing/reaction	Moderate duration for implementation	Moderate duration for construction	No construction needed
	Anticipated Duration to Reach GPS	Removal of constituents as they pass through the PRB should allow downgradient constituent levels to quickly reach GPS; duration for remedial implementation depends on depletion of source contact with groundwater over time; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Continued indefinite monitoring; for the purposes of this evaluation, a 10- to 30-year time frame is assumed
Potential Corrective Measure Benefits		• Removes contamination within PRB amendments (in situ) • Designed to treat multiple constituents in situ to remove constituents and protect human health and the environment • Length of PRB could potentially be reduced with detailed delineation investigation	• Complete source immobilization by physical encapsulation and chemical stabilization • Solidified/stabilized matrix with leachate testing provides proven long-term reliability	• Complete source containment by constructing an impermeable cell • Solidified/stabilized containment with leachate testing provides proven long-term reliability • Impacts primarily limited to on-site	• Slurry wall combined with pumping will provide source containment • Extraction designed to minimize hydraulic pressure on slurry wall and prevent groundwater from flowing around the edges of the wall • Source containment by preventing groundwater flow from ash pond	• Proven technology for hydraulic control and removal of constituents from groundwater • Reduces downgradient risks to human health and the environment • Source containment by hydraulically controlling groundwater flow from ash pond footprint	• Relies on natural attenuation mechanisms for performance • No technology construction is needed
Potential Corrective Measure Challenges		• Ash remains in place • Needs extensive bench-scale/pilot testing to verify the correct amendment mixtures/geochemistry • May require amendment replacement as capacity to remove constituents is consumed • Multiple amendments may be required to remove all contamination • Treating one constituent may mobilize others • Multiple passes could be needed to install multiple PRBs	• Ash fully encapsulated, but remains in place • Requires full, stable access across entire ash pond surface area • Requires deep augering to full depth of pond necessary in an overlapping pattern across the entire surface area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction, dust, and odor control • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Unproven technology for CCR units • Difficult to prove continuous solidification along bottom surface with no gaps • Requires understanding of depth profile of ash • Requires full, stable access across the entire ash pond surface area • Requires deep augering to full depth of pond necessary in an overlapping pattern across the surface area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction, dust, and odor control • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Geology dependent • Requires deep trenching • Entails complete source containment, not removal • Requires heat of reaction, dust, and odor control • May require additional measures for downgradient plume • Pump testing required to design extraction well network • Bench-scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed– duration unknown, ongoing O&M/treatment costs • Requires periodic changes in and/or regeneration of filtration/treatment media • Requires an approximately 20-foot wide corridor for installation	• Ash remains in place • Requires installation of multiple extraction wells and subsurface piping network to a centralized groundwater treatment system housed in a building • Pump testing required to design extraction well network • Bench-scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed– duration unknown, ongoing O&M/treatment costs • Requires periodic changes in and/or regeneration of filtration/treatment media • Limited downgradient space to install monitoring wells to verify constituent capture	• Ash remains in place • Monitoring/sampling required • Routinely evaluate for changing conditions

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2. Corrective Measures Screening

To determine the corrective measure technologies that are potentially feasible for meeting the requirements of SB 1398, the available technologies must be screened to determine whether they could be used to treat the impacted groundwater associated with the hydrogeological conditions and space constraints/physical locations of the individual ash ponds. This section describes the regulatory framework for the screening evaluation, discusses the general technologies that are typically used for remediation of inorganics in groundwater, and provides the screening decision and rationale for each technology. Screening decisions are either to eliminate the technology from further evaluation or carry it forward for full evaluation, which is provided in Section 3.

This corrective measures evaluation applies to the following ash ponds that currently contain CCR materials and assumes that these ponds will be closed in place:

- Bremo Power Station North Ash Pond
- Chesterfield Power Station Lower Ash Pond
- Chesterfield Power Station Upper Ash Pond
- Possum Point Power Station Ash Pond D

CCR materials are being removed from six other ash ponds that are being assessed under SB 1398 (Bremo East and West Ash Ponds and Possum Point Ash Ponds A, B, C, and E). Closure by removal is therefore the selected closure method for these units; groundwater related to these units will continue to be monitored as required by the CCR Rule and other federal or state regulations.

The Chesapeake Energy Center has been in corrective action driven by Virginia Department of Environmental Quality (DEQ) solid waste regulations since 2011. The removal of the Bottom Ash Pond will address the SB 1398 corrective measures requirement. However, the pond is underlain and surrounded by historic ash that is not subject to the CCR Rule but is being addressed under the Virginia Solid Waste Management Regulations due to the adjacent permitted landfill. Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, that will include proposed additional corrective measures to address site-wide groundwater impacts.

Table TM7-3 provides a summary of the groundwater conditions associated with the ash ponds that may be closed in place and the Chesapeake Energy Center, including the constituents above MCLs or statistically significant increases above background.

Preliminary groundwater results indicate that CCR constituent concentrations were detected above USEPA MCLs or background levels in groundwater monitoring wells associated with the ash ponds at all four stations. Additional monitoring is required before these results are confirmed. However, the detections were isolated to areas adjacent to the ash ponds and do not affect drinking water supplies. Additionally, surface water data indicate that all constituent concentrations are below Virginia Surface Water Quality Standards (aquatic and human health) at each of the four stations. Based on the groundwater data and site-specific conditions, various potential corrective measure technologies could be implemented in conjunction with closure-in-place to address the groundwater conditions surrounding the ash ponds.

Table TM7-3: Summary of Groundwater Conditions

Groundwater-Related Condition	Bremo Power Station North Ash Pond	Chesapeake Energy Center Peninsula	Chesterfield Power Station Lower Ash Pond	Chesterfield Power Station Upper Ash Pond	Possum Point Power Station Ash Pond D
General Shallow Soil Description	River alluvium and saprolite, sandy silt, well-graded sand	Fill, alluvium, clayey fine sand, silts, and peat	Mixed sand/silt/clay materials	Mixed sand/silt/clay materials	Unconsolidated silty sand with silt/clay beds
Average Confining Layer Depth Downgradient of CCR Unit	Approximately 30 feet	Unknown	Approximately 80 feet	Approximately 100 feet	Approximately 60 feet
CCR Constituents Potentially above USEPA MCLs	None	Arsenic Beryllium Selenium	Arsenic Radium	Arsenic Beryllium Chromium Radium	None
CCR Constituents Potentially Above Background Levels[(1)]	Boron Calcium Cobalt Lead Lithium Molybdenum pH Sulfate TDS	Cobalt	Boron Calcium Chloride Cobalt Lead Molybdenum pH Sulfate TDS	Boron Calcium Chloride Cobalt Lead Lithium Molybdenum pH Sulfate TDS	Boron Calcium Chloride Cobalt Lithium Sulfate TDS
Solid Waste Constituents Potentially above Background Levels[(1)]	Nickel Silver	Sulfide	Ammonia Cyanide Manganese Nickel Vanadium Zinc	Cyanide Manganese Nickel Sulfide Tin Vanadium Zinc	Hardness Iron Manganese Nickel Sodium Sulfide Tin TOC Zinc

[(1)] No USEPA MCLs for these constituents

CCR = coal combustion residuals; MCL = Maximum Contaminant Level; TDS = total dissolved solids; TOC = total organic carbon; USEPA = U.S. Environmental Protection Agency

2.1 Corrective Measures Screening Requirements

Title 40 CFR § 257.96 describes the requirements for the evaluation of corrective measures for CCR units (ash ponds), with the SB 1398-referenced subsection (c) stating the following:

> Include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 257.97 addressing at least the following:
>
> (1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;
>
> (2) The time required to begin and complete the remedy;
>
> (3) The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

The referenced 40 CFR § 257.97, Selection of Remedy, provides the following requirements:

(b) Remedies must:

(1) Be protective of human health and the environment;

(2) Attain the groundwater protection standard as specified pursuant to § 257.95(h);

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV to this part into the environment;

(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems;

(5) Comply with standards for management of wastes as specified in § 257.98(d).

(c) In selecting a remedy that meets the standards of paragraph (b) of this section, the owner or operator of the CCR unit shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing risks;

(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;

(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;

(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;

(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;

(vii) Long-term reliability of the engineering and institutional controls; and

(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) The extent to which containment practices will reduce further releases; and

(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) Degree of difficulty associated with constructing the technology;

(ii) Expected operational reliability of the technologies;

(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) Availability of necessary equipment and specialists; and

(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

2.2 Corrective Measures Screening Process

Potential corrective measure remedies were evaluated and screened against the criteria listed in 40 CFR § 257.96. As shown in Table TM7-2 and described in Technical Memorandum 6 (Groundwater and Surface Water Evaluation), each of the five ash ponds has varied and multiple constituents (heavy metals and other inorganic compounds) to be considered for corrective measures. Treatment technologies differ for many of these constituents such that multiple or iterative technologies may be required to treat all of the constituents at a given site. Each site has complex groundwater conditions, as described in Technical Memorandum 6, including aquifer thicknesses that range from 25 to 100 feet immediately downgradient of the ash ponds and adjacent physical features that limit the area available for the construction of corrective measures. Groundwater corrective measures would typically be implemented immediately downgradient of the ash ponds, between the ash pond berms and the downgradient features such as rivers.

The following sections describe technologies that have historically been used to remediate groundwater impacted with CCR constituents and provide rationales to determine the potential corrective measures to carry forward for consideration as potentially feasible options to evaluate in greater detail in Section 3.

2.3 In Situ Chemical and Biological Treatment

In general, metals in groundwater do not tend to be amenable to common in situ treatment technologies such as oxidation, chemical degradation, or microbial treatment (enhanced bioremediation). Organic constituents like volatile organic compounds can be chemically or biologically broken down into non-toxic compounds (i.e., carbon dioxide and water). In contrast, in situ treatment of heavy metals can manipulate the valence state of the compounds to decrease the mobility and/or the toxicity of metals in groundwater, but this type of treatment does not destroy or physically remove the metals from the groundwater. Therefore, in situ chemical oxidation and enhanced bioremediation technologies have not been carried forward in this study.

However, in situ chemical reduction amendments can be used to manipulate the valence state of metals or modify the subsurface geochemical conditions such that the dissolved metals bind and precipitate out of solution into adjacent soils. This approach can be utilized in the installation of PRBs, as discussed in the next section.

2.4 Permeable Reactive Barriers

A PRB is a subsurface trench filled with reactive material installed to intercept and react with impacted groundwater. PRBs can also be established through direct-push injection (on closely spaced grids) of reactive material. PRBs are typically installed to the depth of impacted groundwater (often the bottom of the shallow aquifer) and along the length of the impacted zone. The amendment used to generate the PRB is generally as permeable as or more permeable than the surrounding material, allowing impacted groundwater to flow through the reactive material in the barrier. The reactive material then causes chemical reactions to occur within the PRB, resulting in adsorption, precipitation, or degradation to a harmless compound. PRBs are commonly used to control organic contamination in groundwater, and they have recently been successfully used to remediate metals.

PRBs have been shown to be effective for treating some of the constituents associated with the ash ponds at the four power stations. However, the combination of constituents at each of the sites would require either combining multiple reactants within a single PRB or constructing multiple PRB treatment zones, which would consist of several trenches installed downgradient of each other. Typical reactive materials used in PRBs have been shown to have dramatic effects on the downgradient groundwater chemistry, most commonly pH changes that could have a significant impact on the effectiveness of subsequent treatment zones or adversely affect the downgradient geochemistry. Bench-scale, column, and pilot-testing processes would need to be performed during the design of a PRB to determine the effectiveness of the different treatment zones and the geochemistry changes in groundwater as it passes through the successive zones.

Although significant additional data, studies, and engineering would be required to properly design a PRB system, this technology has been successful in treating CCR-related constituents and is considered under the corrective measure evaluation conducted in Section 3.

2.5 Source Containment

A contaminant source can be contained by either physically/chemically rendering the material immobile or creating a barrier to prevent the downgradient flow of impacted groundwater. Physical/chemical containment includes ISS and related technologies, and groundwater barriers include slurry walls or sheet pile walls.

2.5.1 Physical/Chemical Containment of CCR Materials

ISS would be performed on the CCR materials themselves to physically and chemically bind the metals and other inorganic constituents, preventing them from leaching into the groundwater and thus effectively removing the sources. Binding agents such as cement, lime, or other reactive materials can be injected and mixed into the CCR material using large-diameter augers on an overlapping pattern through the entire depth of the ash pond to ensure complete contact between the binding agent and the CCR materials. The stabilization process chemically bonds the metals to the binding agent, and solidification physically binds the inorganic compounds in a solid block of material and traps it in place. Bench-scale leachate testing would be performed on samples of the mixture using the Synthetic Precipitation Leaching Procedure to show that the constituents would not seep out of the stabilized structure when exposed to groundwater. ISS of the entire CCR mass is a viable corrective measure option that is carried forward for evaluation in Section 3.

A relatively new concept of containment that has been used at hazardous waste sites, though not specifically for ash pond remediation, is the use of ISS technology to solidify/stabilize CCR materials at the bottom and sides of the ash pond only and then capping the unit and creating a containment cell around the remaining CCR materials. The primary concern with this technology would be to ensure a continuous layer of stabilized material throughout the entire bottom layer of the ash pond, eliminating any potential gaps in low-permeable material that would allow CCR constituents to flow out of the unit.

Although this technology is unproven for CCR, it may be a more cost-effective way to provide CCR containment than performing ISS on the entire ash mass within the pond. Therefore, ISS cell containment technology is carried forward for additional evaluation in Section 3.

2.5.2 Vertical Engineered Barriers

A VEB is a wall constructed below the ground surface to control or restrict the flow of groundwater. One type of VEB is a slurry wall constructed using excavators or deep trenching equipment to thoroughly mix a bentonite/cement slurry to create a homogenized impermeable wall that prevents impacted groundwater from flowing downgradient from the ash pond. Where possible, the bottom of the slurry wall would be keyed into the low-permeability soil or bedrock (confining layer) at the bottom of the aquifer, keeping groundwater from seeping beneath the wall. Another type of VEB that has been used for groundwater containment is a subsurface barrier construction such as sheet pile walls.

To provide hydraulic control of the impacted groundwater behind (upgradient of) the VEB and prevent impacted water from flowing around the edges of the wall, extraction wells would be installed behind the wall, and the extracted groundwater would be processed through a treatment system constructed adjacent to the ash pond (ex situ groundwater treatment technologies are described in the next section). The extraction flow rates for this option would be much lower than for the pump-and-treat only option (described below), as the pumping rates would only need to keep up with groundwater flow rates (rather than providing a hydraulic barrier, as sought in the pump-and-treat only option). However, pumping would need to be performed indefinitely to maintain water levels behind the wall. VEBs can also be used in a funnel-and-gate arrangement to direct the flow of groundwater to a small area of the VEB (i.e., the gate), where reactive material can be used to treat the metals in situ (using PRB technology).

Given the confining layer depths and the length of the walls that would be required for containment at these sites, slurry walls would be more practical and cost-effective than sheet pile for a VEB application. The slurry wall option is therefore carried forward for evaluation in Section 3.

2.6 Hydraulic Containment: Groundwater Pump-and-Treat System

The contaminant source can be hydraulically contained using groundwater extraction and treatment (pump-and-treat) technologies. This option would also provide containment and removal of dissolved-phase constituents downgradient of the ash pond.

Pump-and-treat technology has historically been the most common method for cleaning up groundwater impacted with metals and other inorganics. Groundwater is pumped from wells or collection trenches to an aboveground treatment system, which removes the contaminants. The extraction network would be designed to provide containment of the impacted groundwater, preventing it from flowing downgradient toward off-site receptors. Depending on the aquifer characteristics, wells would be spaced with an overlapping radius of influence, and flow rates would be optimized to provide the maximum pumping influence around each well. The resulting groundwater would be pumped through a subsurface piping network to a centralized treatment system, which would be housed in a building in the vicinity of the ash pond. The treatment technologies would be designed to remove the specific constituents from the groundwater to meet the regulatory discharge requirements; the treatment options for the varied constituents found at these facilities may include pH adjustment, filtration, coagulation/chemical precipitation, membrane filtration, ion exchange, carbon adsorption, reverse osmosis, or chemical reduction. Multiple treatment technologies would be needed for each ash pond to remove the different types of contaminants.

Once treated groundwater meets regulatory standards, it would be discharged under a Virginia Pollutant Discharge Elimination System (VPDES) permit. Other wastes produced as a result of treatment, such as sludge and used filters, would be properly disposed of at a permitted facility.

Pump-and-treat technology is typically a long-term corrective measure, but in certain cases dissolved-phase concentrations have been shown to be effectively reduced over time to meet groundwater cleanup standards. Such reductions allow the system to be shut down while continuing with groundwater monitoring for several years to verify that the constituents have been effectively removed.

Pump-and-treat technology is therefore carried forward for evaluation in Section 3.

2.7 Monitored Natural Attenuation

MNA covers a variety of physical and biological processes that naturally reduce the concentration, toxicity, or mobility of constituents in groundwater. Although biological processes are not particularly effective on metals, CCR constituents are typically attenuated by chemical reactions with other dissolved constituents and the soil media. Implementation of MNA typically requires additional investigation, risk assessment, and modeling to show how the constituents are expected to attenuate and how impact to receptors is mitigated.

The Chesapeake Energy Center has been in corrective action driven by DEQ solid waste regulations since 2011. The removal of the Bottom Ash Pond will address the SB 1398 corrective measures requirement. However, the pond is underlain and surrounded by historic ash that is not subject to the CCR Rule but is being addressed under the Virginia Solid Waste Management Regulations due to the adjacent permitted landfill. Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, that will include proposed additional corrective measures to address site-wide groundwater impacts.

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3. Evaluation of Feasible Corrective Measure Options

As described in in the previous section, several technologies that could potentially remediate the groundwater at the ash ponds are carried forward for further evaluation. These technologies are:

- PRB
- ISS
- ISS to create bottom and side containment around cell
- VEB, which is containment via slurry walls
- Hydraulic containment via pump-and-treat methods
- MNA

The evaluations of the potential corrective measure remedies are based on the individual CCR-related constituents associated with each ash pond that are above MCLs or background levels. This level of screening does not include evaluations of risks to human health or the environment that would be performed during the design process for individual corrective measure remedies.

Station-specific evaluation summary tables are provided as Tables TM7-4 through TM7-7 for the five ash ponds evaluated as part of the SB 1398 response. Although corrective measure technologies that could potentially remediate the groundwater around the Chesapeake Energy Center peninsula will be further evaluated in conjunction with the revised solid waste permit application to be submitted to DEQ in March 2018, Table TM7-8 provides a summary of potential corrective measures. The ISS containment option is not evaluated for Chesapeake because of the need to maintain the integrity of the landfill liner.

Each table provides columns for the six identified potential corrective measure options, and the table rows consist of the required evaluation criteria. The evaluation criteria are listed as the five primary technical criteria set forth in 40 CFR § 257.97(b), then the implementability effectiveness criteria specified by 40 CFR § 257.96(c), and finally the additional evaluation factors outlined in 40 CFR § 257.96(c). Some of the references between subsections 96(c) and 97(b) are duplicative and have been combined in the tables.

The individual cells in the tables describe and demonstrate how each proposed corrective measure technology can potentially be designed to restore groundwater quality, including potential obstacles and limitations in the implementation of each technology. Any potential corrective measure technology requires a comprehensive remedial design process, which would include acquisition of additional data as needed, laboratory bench-scale testing, and potentially pilot testing before designing and implementing the full-scale construction of the selected remedial technology. Combinations of technologies could be tested, and additional emerging technologies could be evaluated as their effectiveness on CCR constituents such as metals is proven.

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Table TM7-4: Bremo Power Station Corrective Measures Evaluation

Evaluation Factors		Permeable Reactive Barrier (PRB)	In Situ Solidification/Stabilization (ISS)	ISS to Create Bottom and Side Containment around Cell	Vertical Engineered Barrier (VEB) - Slurry Wall	Pump and Treat with Multiple Treatment Technologies	Monitored Natural Attenuation (MNA) with Risk Assessment
General Technology Specifications		Approximately 4,000-linear-foot (LF) wall 30 feet deep downgradient of ash pond; deep trenching technology for installation	Approximately 6.2M CY CCR over 68 acres, 75 feet deep	Approximately 5-foot-thick ISS layer at bottom of CCR over 67.5 acres; 75-foot-deep sidewalls around unit; cap on top	Approximately 4,000 LF wall 30 feet deep downgradient of ash pond; deep trenching technology for installation	Approx. 80 extraction wells at 80 gallons per minute (gpm) total flow; anticipated treatment technologies include pH adjustment, aeration, coagulation/flocculation, bag/cartridge filtration, and adsorptive media (crushed limestone and activated alumina) resin	Downgradient of ash pond using existing monitoring well network
Additional Requirements		May require up to three parallel walls with different reactive media to treat various constituents	Approximately 34 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Approximately 34 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Hydraulic control; approx. 80 extraction wells at 40 gpm total flow behind VEB with groundwater treatment	Wells located along approx. 7,500 LF downgradient edge of ash pond	Risk assessment would be performed to verify that MNA would be protective of human health and the environment
Feasibility		Feasible	Not Feasible >50 feet deep	Not Feasible >50 feet deep	Feasible	Feasible	Feasible
Cost Estimate		$77M	NA	NA	$59M	$65M	$2.4M
Schedule	**Construction**	Moderate duration for implementation (approx. 1 year)	Moderate duration for implementation (approx. 2 to 3 years); rapid curing/reaction	Moderate duration for implementation (approx. 2 to 3 years); rapid curing/reaction	Moderate duration for implementation (approx. 1 year)	Moderate duration for construction (approx. 1 to 2 years)	No construction needed
	Anticipated Duration to Reach GPS	Removal of constituents as they pass through the PRB should allow downgradient constituent levels to quickly reach GPS; duration for remedial implementation depends on depletion of source contact with groundwater over time; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Continued indefinite monitoring; for the purposes of this evaluation, a 10- to 30-year time frame is assumed
Potential Corrective Measure Benefits		• Removes contamination within PRB amendments (in situ) • Designed to treat multiple contaminants in situ to remove contaminants and protect human health and the environment • Length of PRB could potentially be reduced with detailed delineation investigation • Impacts primarily limited to on site	• Complete source immobilization by physical encapsulation and chemical stabilization • Solidified/stabilized matrix with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Complete source containment by constructing an impermeable cell • Solidified/stabilized containment with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Slurry wall combined with pumping designed to provide source containment • Extraction designed to minimize hydraulic pressure on slurry wall and prevent groundwater from flowing around the edges of the wall • Complete source containment by preventing groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Pump-and-treat proven technology for hydraulic control and removal of contaminants from groundwater, reducing downgradient risks to human health and the environment • Complete source containment by hydraulically controlling groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Relies on natural attenuation mechanisms for performance • No technology construction is required
Potential Corrective Measure Challenges		• Ash remains in place • Greatly depends on bench scale/pilot testing to ensure the correct amendment mixtures/geochemistry • May require amendment replacement as capacity to reduce/remove contaminants is consumed • Multiple amendments may be required to remove all contamination • Treating one constituent may mobilize others • Potentially multiple passes to install multiple PRBs	• Ash fully encapsulated, but remains in place • Requires full, stable access across the entire ash pond surface area • Requires deep augering to approximately 75 feet in an overlapping pattern across a 68-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Unproven technology for ash ponds • Difficult to prove continuous solidification along bottom surface with no gaps • Requires understanding of depth profile of ash within pond • Requires full, stable access across the entire ash pond surface area • Requires deep augering to approximately 75 feet in an overlapping pattern across a 68-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Geology dependent • Requires deep trenching along 4,000 LF • Entails complete source containment, but not removal • Requires heat of reaction control, dust control; reaction may produce odors • May require additional measures for downgradient plume • Monitoring/sampling required • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed – duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media • Requires an approximately 20-foot wide corridor for installation	• Ash remains in place • Requires installation of 80 extraction wells and subsurface piping network to centralized groundwater treatment system housed in a building • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed– duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media	• Ash remains in place • Monitoring/sampling required • Routinely evaluate for changing conditions

Table TM7-5: Chesterfield Power Station Lower Ash Pond Corrective Measures Evaluation

Evaluation Factor		Permeable Reactive Barrier (PRB)	In Situ Solidification/ Stabilization (ISS)	ISS to Create Bottom and Side Containment around Cell	Vertical Engineered Barrier (VEB) - Slurry Wall	Pump and Treat with Multiple Treatment Technologies	Monitored Natural Attenuation (MNA) with Risk Assessment
General Technology Specifications		Approximately 9,600 LF wall 80 feet deep surrounding ash pond; deep trenching technology for installation	Approximately 3.6M CY CCR over 101 acres, 20 feet deep	Approximately 5-foot-thick ISS layer at bottom of CCR over 101 acres; 20-foot-deep sidewalls around unit; cap on top	Approximately 9,600 LF wall 80 feet deep surrounding ash pond; deep trenching technology for installation	Approx. 10 extraction wells at 200 gpm total flow; anticipated treatment technologies include chemical oxidation or aeration, pH adjustment, coagulation/flocculation, bag/cartridge filtration, and targeted adsorptive media	Downgradient of ash pond using existing monitoring well network
Additional Requirements		May require up to three parallel walls with different reactive media to treat various constituents	Approximately 41 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Approximately 41 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Hydraulic control; approx. 10 extraction wells at 100 gpm total flow behind VEB with groundwater treatment	Wells located along approx. 9,600 LF perimeter of ash pond	Risk assessment would be performed to verify that MNA would be protective of human health and the environment
Feasibility		Not Feasible (too deep, not enough space for multiple treatment barriers)	Feasible	Feasible	Feasible	Feasible	Feasible
Cost Estimate		NA	$791M	$284M	$126M	$96M	$4.5M
Schedule	**Construction**	Moderate duration for implementation (approx. 1 to 2 years)	Moderate duration for implementation (approx. 2 to 3 years); rapid curing/reaction	Moderate duration for implementation (approx. 2 to 3 years); rapid curing/reaction	Moderate duration for implementation (approx. 1 to 2 years)	Moderate duration for construction (approx. 1 to 2 years)	No construction needed
	Anticipated Duration to Reach GPS	Removal of constituents as they pass through the PRB should allow downgradient constituent levels to reach GPS; duration depends on depletion of source contact with groundwater over time; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10-to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10-to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Continued indefinite monitoring; for the purposes of this evaluation, a 10-to 30-year time frame is assumed
Potential Corrective Measure Benefits		• Removes contamination within PRB amendments (in situ) • Designed to treat multiple contaminants in situ to remove contaminants and protect human health and the environment • Length of PRB could potentially be reduced with detailed delineation investigation • Impacts primarily limited to on site	• Complete source immobilization by physical encapsulation and chemical stabilization • Solidified/stabilized matrix with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Complete source containment by constructing an impermeable cell • Solidified/stabilized containment with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Slurry wall combined with pumping designed to provide source containment • Extraction designed to minimize hydraulic pressure on slurry wall and prevent groundwater from flowing around the edges of the wall • Complete source containment by preventing groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Pump-and-treat proven technology for hydraulic control and removal of contaminants from groundwater, reducing downgradient risks to human health and the environment • Complete source containment by hydraulically controlling groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Relies on natural attenuation mechanisms for performance • No technology construction is required
Potential Corrective Measure Challenges		• Ash remains in place • Greatly depends on bench scale/pilot testing to ensure the correct amendment mixtures/geochemistry • May require amendment replacement as capacity to reduce/remove contaminants is consumed • Multiple amendments may be required to remove all contamination • Treating one constituent may mobilize others • Multiple passes could be needed to install multiple PRBs	• Ash fully encapsulated, but remains in place • Requires full, stable access across the entire ash pond surface area • Requires augering to approximately 20 feet in an overlapping pattern across a 101-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Unproven technology for ash ponds • Difficult to prove continuous solidification along bottom surface with no gaps • Requires understanding of depth profile of ash within pond • Requires full, stable access across the entire ash pond surface area • Requires augering to approximately 20 feet in an overlapping pattern across a 101-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • Requires monitoring for remedial effectiveness • Becomes cost prohibitive is applied deeper than approximately 50 feet	• Ash remains in place • Geology dependent • Requires deep trenching along 9,600 LF • Entails complete source containment, but not removal • Requires heat of reaction control, dust control; reaction may produce odors • May require additional measures for downgradient plume • Monitoring/sampling required • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed– duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media • Requires an approximately 20-foot wide corridor for installation	• Ash remains in place • Requires installation of 10 extraction wells and subsurface piping network to centralized groundwater treatment system housed in a building • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed – duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media	• Ash remains in place • Monitoring/sampling required • Routinely evaluate for changing conditions

Table TM7-6: Chesterfield Power Station Upper Ash Pond Corrective Measures Evaluation

Evaluation Factor		Permeable Reactive Barrier (PRB)	In Situ Solidification/ Stabilization (ISS)	ISS to Create Bottom and Side Containment around Cell	Vertical Engineered Barrier (VEB) - Slurry Wall	Pump and Treat with Multiple Treatment Technologies	Monitored Natural Attenuation (MNA) with Risk Assessment
General Technology Specifications		Approximately 12,000 LF wall 100 feet deep downgradient of ash pond; deep trenching technology for installation	Approximately 11.3M CY CCR over 112 acres, 80 feet deep	Approximately 5-foot-thick ISS layer at bottom of CCR over 112 acres; 100-foot-deep sidewalls around unit; cap on top	Approximately 12,000 LF wall 100 feet deep surrounding ash pond; deep trenching technology for installation	Approx. 12 extraction wells at 350 gpm total flow; anticipated treatment technologies include chemical oxidation or aeration, pH adjustment, coagulation/flocculation, bag/cartridge filtration, and targeted adsorptive media	Downgradient of ash pond using existing monitoring well network
Additional Requirements		Short-term fuel use for deep trenching equipment; minimal long-term carbon footprint	Approximately 12 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Approximately 12 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Hydraulic control; approx. 12 extraction wells at 175 gpm total flow behind VEB with groundwater treatment	Wells located along approx. 9,600 LF surrounding ash pond	Risk assessment would be performed to verify that MNA would be protective of human health and the environment
Feasibility		Not Feasible (too deep)	Not Feasible >50 feet deep	Not Feasible >50 feet deep	Feasible	Feasible	Feasible
Cost Estimate		NA	NA	NA	$208M	$145M	$4.5M
Schedule	**Construction Schedule**	Moderate duration for implementation (approx. 2 to 3 years)	Moderate duration for implementation (approx. 3 to 5 years); rapid curing/reaction	Moderate duration for implementation (approx. 3 to 5 years); rapid curing/reaction	Moderate duration for implementation (approx. 2 to 3 years)	Moderate duration for construction (approx. 1 to 2 years)	No construction needed
	Anticipated Duration to Reach GPS	Removal of constituents as they pass through the PRB should allow downgradient constituent levels to quickly reach GPS; duration for remedial implementation depends on depletion of source contact with groundwater over time; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10-to 30-year time frame is assumed	Continued indefinite monitoring; for the purposes of this evaluation, a 10- to 30-year time frame is assumed
Potential Corrective Measure Benefits		• Removes contamination within PRB amendments (in situ) • Designed to treat multiple contaminants in situ to remove contaminants and protect human health and the environment • Length of PRB could potentially be reduced with detailed delineation investigation • Impacts primarily limited to on site	• Complete source immobilization by physical encapsulation and chemical stabilization • Solidified/stabilized matrix with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Complete source containment by constructing an impermeable cell • Solidified/stabilized containment with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Slurry wall combined with pumping designed to provide source containment • Extraction designed to minimize hydraulic pressure on slurry wall and prevent groundwater from flowing around the edges of the wall • Complete source containment by preventing groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Pump-and-treat proven technology for hydraulic control and removal of contaminants from groundwater, reducing downgradient risks to human health and the environment • Complete source containment by hydraulically controlling groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Relies on natural attenuation mechanisms for performance • No technology construction is required
Potential Corrective Measure Challenges		• Ash remains in place • Greatly depends on bench scale/pilot testing to ensure the correct amendment mixtures/geochemistry • May require amendment replacement as capacity to reduce/remove contaminants is consumed • Multiple amendments may be required to remove all contamination • Treating one constituent may mobilize others • Multiple passes could be needed to install multiple PRBs	• Ash fully encapsulated, but remains in place • Requires full, stable access across the entire ash pond surface area • Requires deep augering to approximately 80 feet in an overlapping pattern across a 112-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Unproven technology for ash ponds • Difficult to prove continuous solidification along bottom surface with no gaps • Requires understanding of depth profile of ash within pond • Requires full, stable access across the entire ash pond surface area • Requires deep augering to approx. 80 feet in an overlapping pattern across a 112-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • May require additional measures for downgradient plume • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Geology dependent • Requires deep trenching along 12,000 LF • Entails complete source containment, but not removal • Requires heat of reaction control, dust control; reaction may produce odors • May require additional measures for downgradient plume • Monitoring/sampling required • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed– duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media • Requires an approximately 20-foot wide corridor for installation	• Ash remains in place • Requires installation of 12 extraction wells and subsurface piping network to centralized groundwater treatment system housed in a building • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed – duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media	• Ash remains in place • Monitoring/sampling required • Routinely evaluate for changing conditions

Table TM7-7: Possum Point Power Station Corrective Measures Evaluation

Evaluation Factor		Permeable Reactive Barrier (PRB)	In Situ Solidification/ Stabilization (ISS)	ISS to Create Bottom and Side Containment around Cell	Vertical Engineered Barrier (VEB) - Slurry Wall	Pump and Treat with Multiple Treatment Technologies	Monitored Natural Attenuation (MNA) with Risk Assessment
General Technology Specifications		Approximately 7,500 LF wall 60 feet deep downgradient of ash pond; deep trenching technology for installation	Approximately 4M CY CCR over 64 acres, 60 feet deep	Approximately 5-foot-thick ISS layer at bottom of CCR over 64 acres; 60 feet deep sidewalls around unit; cap on top	Approximately 7,500 LF wall 60 feet deep downgradient of ash pond; deep trenching technology for installation	Approx. 250 extraction wells at 50 gpm total flow; anticipated treatment technologies include aeration, pH adjustment, coagulation/flocculation, sand filtration, bag filtration, adsorptive media, and ion exchange resin	Downgradient of ash pond using existing monitoring well network
Additional Requirements		May require up to three parallel walls with different reactive media to treat various constituents	Approximately 32 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Approximately 32 acres currently standing water; large-diameter auger mixing ~10% Portland cement	Hydraulic control; approx. 250 extraction wells at 25 gpm total flow behind VEB with groundwater treatment	Wells located along approx. 7,500 LF downgradient edge of ash pond	Risk assessment would be performed to verify that MNA would be protective of human health and the environment
Feasibility		Feasible	Not Feasible >50 feet deep	Not Feasible >50 feet deep	Feasible	Feasible	Feasible
Cost Estimate		$286M	NA	NA	$88M	$61M	$2.5M
Schedule	**Construction Schedule**	Moderate duration for implementation (approx. 1 to 2 years)	Moderate duration for implementation (approx. 2 to 3 years); rapid curing/reaction	Moderate duration for implementation (approx. 2 to 3 years); rapid curing/reaction	Moderate duration for implementation (approx. 1 to 2 years)	Moderate duration for construction (approx. 1 to 2 years)	No construction needed
	Anticipated Duration to Reach GPS	Removal of constituents as they pass through the PRB should allow downgradient constituent levels to quickly reach GPS; duration for remedial implementation depends on depletion of source contact with groundwater over time; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10-to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10-to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10-to 30-year time frame is assumed	Continued indefinite monitoring; for the purposes of this evaluation, a 10- to 30-year time frame is assumed
Potential Corrective Measure Benefits		• Removes contamination within PRB amendments (in situ) • Designed to treat multiple contaminants in situ to remove contaminants and protect human health and the environment • Length of PRB could potentially be reduced with detailed delineation investigation • Impacts primarily limited to on site	• Complete source immobilization by physical encapsulation and chemical stabilization • Solidified/stabilized matrix with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Complete source containment by constructing an impermeable cell • Solidified/stabilized containment with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Slurry wall combined with pumping designed to provide source containment • Extraction designed to minimize hydraulic pressure on slurry wall and prevent groundwater from flowing around the edges of the wall • Complete source containment by preventing groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Pump-and-treat proven technology for hydraulic control and removal of contaminants from groundwater, reducing downgradient risks to human health and the environment • Complete source containment by hydraulically controlling groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Relies on natural attenuation mechanisms for performance • No technology construction is required
Potential Corrective Measure Challenges		• Ash remains in place • Greatly depends on bench scale/pilot testing to ensure the correct amendment mixtures/geochemistry • May require amendment replacement as capacity to reduce/remove contaminants is consumed • Multiple amendments may be required to remove all contamination • Treating one constituent may mobilize others • Potentially multiple passes to install multiple PRBs	• Ash fully encapsulated, but remains in place • Requires full, stable access across the entire ash pond surface area • Requires deep augering to approximately 60 feet in an overlapping pattern across a 64-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Unproven technology for ash ponds • Difficult to prove continuous solidification along bottom surface with no gaps • Requires understanding of depth profile of ash within pond • Requires full, stable access across the entire ash pond surface area • Requires deep augering to approximately 60 feet in an overlapping pattern across a 64-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • May require additional measures for downgradient plume • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Geology dependent • Requires deep trenching along 7,500 LF • Entails complete source containment, but not removal • Requires heat of reaction control, dust control; reaction may produce odors • May require additional measures for downgradient plume • Monitoring/sampling required • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed– duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media • Requires an approximately 20-foot wide corridor for installation	• Ash remains in place • Monitoring/sampling required • Requires installation of 250 extraction wells and subsurface piping network to centralized groundwater treatment system housed in a building • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed – duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media	• Ash remains in place • Monitoring/sampling required • Routinely evaluate for changing conditions

Table TM7-8: Chesapeake Energy Center Corrective Measures Evaluation

Evaluation Factors		Permeable Reactive Barrier (PRB)	In Situ Solidification/Stabilization (ISS)	Vertical Engineered Barrier (VEB) - Slurry Wall	Pump and Treat with Multiple Treatment Technologies	Monitored Natural Attenuation (MNA) with Risk Assessment
General Technology Specifications		Approximately 8,100-linear-foot (LF) wall up to 100 feet deep surrounding peninsula; deep trenching technology for installation	Approximately 660,000 CY soil and ash solidified around the peninsula in all areas except for the lined landfill to maximum 40-foot depth	Approximately 8,100 LF up to 100 feet deep surrounding peninsula; deep trenching technology for installation	Approx. 160 extraction wells at 160 gallons per minute (gpm) total flow; anticipated treatment technologies include pH adjustment, aeration, coagulation/flocculation, bag/cartridge filtration, and adsorptive media (crushed limestone and activated alumina) resin	Downgradient of ash pond using existing monitoring well network; currently approved as corrective measure technology by DEQ
Additional Requirements		Will likely require up to three parallel walls with different reactive media to treat various constituents	Large-diameter auger mixing ~10% Portland cement	Hydraulic control; extraction wells behind VEB with groundwater treatment	Wells located around approx. 8,100 LF perimeter of peninsula	Risk assessment would be performed to verify that MNA would be protective of human health and the environment
Feasibility		Not Feasible with conventional PRB configuration; not enough room to install multiple barriers	Potentially Feasible	Potentially Feasible	Potentially Feasible	Feasible
Cost Estimate		NA	$161M	$119M	$87M	$2.4M
Schedule	**Construction**	Moderate duration for implementation (approx. 1 to 2 years)	Moderate duration for implementation (approx. 2 to 3 years); rapid curing/reaction	Moderate duration for implementation (approx. 1 to 2 years)	Moderate duration for construction (approx. 1 to 2 years)	No construction needed
	Anticipated Duration to Reach GPS	Removal of constituents as they pass through the PRB should allow downgradient constituent levels to quickly reach GPS; duration for remedial implementation depends on depletion of source contact with groundwater over time; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Source removal/control designed for downgradient constituent levels to reach GPS; for the purposes of this evaluation, a 10- to 30-year time frame is assumed	Continued indefinite monitoring; for the purposes of this evaluation, a 10- to 30-year time frame is assumed
Potential Corrective Measure Benefits		• Removes contamination within PRB amendments (in situ) • Designed to treat multiple contaminants in situ to remove contaminants and protect human health and the environment • Length of PRB could potentially be reduced with detailed delineation investigation • Impacts primarily limited to on site	• Complete source immobilization by physical encapsulation and chemical stabilization • Solidified/stabilized matrix with leachate testing provides proven long-term reliability • Impacts primarily limited to on site	• Slurry wall combined with pumping designed to provide source containment • Extraction designed to minimize hydraulic pressure on slurry wall and prevent groundwater from flowing around the edges of the wall • Source containment by preventing groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Pump-and-treat proven technology for hydraulic control and removal of contaminants from groundwater, reducing downgradient risks to human health and the environment • Potential for complete source containment by hydraulically controlling groundwater flow from ash pond footprint, allowing downgradient impacts to decrease • Impacts primarily limited to on site	• Relies on natural attenuation mechanisms for performance • No technology construction is required • Current approved corrective measure technology by DEQ
Potential Corrective Measure Challenges		• Ash remains in place • Greatly depends on bench scale/pilot testing to ensure the correct amendment mixtures/geochemistry • May require amendment replacement as capacity to reduce/remove contaminants is consumed • Multiple amendments may be required to remove all contamination • Treating one constituent may mobilize others • Potentially multiple passes to install multiple PRBs; not enough space on site to install multiple passes • Undefined depth to confining layer – walls would be installed as deep as possible, but potential for vertical hydraulic gradient to flow under walls	• Ash fully encapsulated to 50-foot depth surrounding the landfill, but remains in place • Landfill materials remain in place • Requires deep augering to approximately 50 feet in an overlapping pattern across a x-acre area • Requires trucking delivery of large volumes of Portland cement • Requires heat of reaction control, dust control; reaction may produce odors • Requires monitoring for remedial effectiveness • Becomes cost prohibitive if applied deeper than approximately 50 feet	• Ash remains in place • Geology and depth of confining layer dependent • Requires deep trenching along 8,100 LF • Entails complete source containment, but not removal • Requires heat of reaction control, dust control; reaction may produce odors • May require additional measures for downgradient plume • Monitoring/sampling required • Pump testing required to design extraction well network • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed – duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media • Requires an approximately 20-foot wide corridor for installation	• Ash remains in place • Requires installation of numerous extraction wells and subsurface piping network to centralized groundwater treatment system housed in a building • Pump testing required to design extraction well network • Geology dependent; will likely result in large extraction rates/volumes of water to treat and discharge • Bench scale and pilot testing required to properly design treatment train • Long-term O&M of extraction and treatment systems needed– duration unknown, ongoing O&M/treatment costs • Extraction network and treatment system periodically evaluated for effectiveness, will require periodic changes in and/or regeneration of filtration/treatment media	• Ash remains in place • Monitoring/sampling required • Routinely evaluate for changing conditions • DEQ 2016 draft solid waste permit required Dominion to evaluate and propose alternative corrective measures to address groundwater impacts. Dominion will submit a revised solid waste permit application to DEQ by March 31, 2018, to include proposed additional corrective measures beyond MNA to address site-wide groundwater impacts.

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4. Cost Estimating Assumptions

To support this assessment, AECOM developed cost estimates for various closure alternatives for each of the four power stations. These Opinions of Probable Cost are estimates of possible construction costs for informational purposes. The estimates are Class 5 Estimates (see Table TM7-9) and are limited to the conditions existing at issuance and not a guarantee of actual price or cost. Uncertain market conditions such as, but not limited to, local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions may affect the accuracy of the estimates. AECOM is not responsible for any variance from costs presented in this document or actual prices and conditions obtained.

Table TM7-9: Cost Estimate Classification Matrix

Estimate Class	Primary Characteristic	Secondary Characteristic			
	Level of Project Definition[(1)]	End Usage[(2)]	Methodology[(3)]	Expected Accuracy Range[(4)]	Preparation Effort[(5)]
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: –20% to –50% H: +30% to +100%	1
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: –15% to –30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, authorization, or control	Semi-detailed unit costs with assembly level line items	L: –10% to –20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: –5% to –15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: –3% to –10% H: +3% to +15%	5 to 100

Source: AACE (2005)

(1) Expressed as percent of complete definition

(2) Typical purpose of estimate

(3) Typical estimating method

(4) Typical variation in low and high ranges. The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

(5) Typical degree of effort relative to least cost index of 1. If the range index value of “1” represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

H = high; L = low

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5. References

AMEC (AMEC Environment & Infrastructure, Inc.). 2011. *Corrective Action Plan*, Revision 1: Chesapeake Energy Center Ash Landfill, Chesapeake, VA. June.

GES (Groundwater & Environmental Services, Inc.). 2008. *Corrective Action Plan - Dominion Generation Chesapeake Energy Center Ash Landfill, Chesapeake, VA*, Solid Waste Permit No. 440.

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6. Abbreviations

CCR	coal combustion residuals
CFR	Code of Federal Regulations
CY	cubic yard
DEQ	Virginia Department of Environmental Quality
gpm	gallons per minute
GPS	Groundwater Protection Standards
ISS	in situ stabilization/solidification
LF	linear feet
MCL	Maximum Contaminant Level
MNA	monitored natural attenuation
NA	Not applicable
O&M	operation and maintenance
PRB	permeable reactive barrier
SB 1398	Virginia Senate Bill 1398
TDS	total dissolved solids
TOC	total organic carbon
USEPA	U.S. Environmental Protection Agency
VEB	vertical engineered barrier
VPDES	Virginia Pollutant Discharge Elimination System
VSWMR	Virginia Solid Waste Management Regulations

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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing *Late-Filed Exhibit No. 4*, as filed in Docket No. E-22 Sub 562 and E-22 Sub 566, were served electronically or via U.S. mail, first-class, postage prepaid, upon all parties of record.

This, the 23rd day of September, 2019.

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