



North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

February 9, 2015

MEMORANDUM

TO: THE ENVIRONMENTAL REVIEW COMMISSION
The Honorable Mike Hager, Co-Chair
The Honorable Brent Jackson, Co-Chair

FROM: Brad Knott, Deputy Director of Legislative Affairs

SUBJECT: 2014 Coal Combustion Residual Landfill Report

DATE: February 9, 2015

Pursuant to S.L. 2014-122, section 5(b), the Department of Environment and Natural Resources shall evaluate each coal combustion residuals landfill currently operating in the State and, in particular, assess the risks to public health, safety, and welfare; the environment; and natural resources, of coal combustion residuals surface impoundments located beneath coal combustion residuals landfills to determine the advisability of continued operation of these landfills. The Department shall report to the Environmental Review Commission no later than January 15, 2015, on its findings and recommendations concerning the risk assessment of each of these sites and the advisability of continued operation of coal combustion residuals landfills. Please consider the attached as the formal submission this report.

If you have any questions or need additional information, please contact me by phone at (919) 707-9335 or via e-mail at brad.knott@ncdenr.gov.

cc: Tom Reeder, Assistant Secretary for Environment
Linda Culpepper, Director of Waste Management

2014 Coal Combustion Residual Landfill Report as Required by the Coal Ash Management Act

Session Law 2014-122, Section 5. (b)

January 15, 2015

Submitted by:

North Carolina Department of Environment and Natural Resources

I. Overview

SECTION 5.(b) of Session Law 2014-122 requires the Department of Environment and Natural Resources to evaluate each coal combustion residuals landfill currently operating in the state and, in particular, to assess the risks to public health, safety, and welfare; the environment; and natural resources, of coal combustion residuals surface impoundments located beneath coal combustion residuals landfills to determine the advisability of continued operation of these landfills. The department shall report to the Environmental Review Commission no later than January 15, 2015 on its findings and recommendations concerning the risk assessment of each of these sites and the advisability of continued operation of coal combustion residuals landfills.

This report addresses the evaluation of each coal combustion residuals landfill. The evaluation of coal combustion residuals surface impoundments will be provided separately.

Comprehensive Site Assessments (CSA) that includes groundwater assessment work plans and receptor surveys will be conducted at all 14 Duke facilities, including the three sites where coal combustion residuals landfills are located. These assessments will begin in early 2015 upon approval of the assessment plans by the Division of Water Resources. It is anticipated these assessments will address all surface impoundments at the sites and should be completed by August 2015. Once the assessments are completed, the information obtained will be used to assist with the development of proposed classifications for the purpose of closure and remediation pursuant to NCGS 130A-309.211. Remediation proposals will require development of Corrective Action Plans (CAPs) for the restoration of groundwater quality. The CAP's will address potential risk to human health, safety, and the environment. The CAP's are anticipated to be completed by late 2015.

History

Session Law 2007-550 provided conditions under which a power plant could build a coal combustion residuals landfill over a coal ash surface impoundment. General Statute 130A-295.4(b) specified that the landfill be constructed with a bottom liner system consisting of three components, in accordance with the general statute. The two upper components consist of two separate flexible membrane liners, with a leak detection system between the two liners. The third liner is a low-permeability layer consisting of two feet of soil with a maximum permeability of 1×10^{-7} centimeters per second or an approved equivalent. This provided a leakage monitoring zone and established the compliance boundary for the landfill directly under the landfill liner system.

II. Existing Coal Combustion Residuals (CCR) Landfills

In all cases, the lined landfill serves as a cap for the underlying coal ash basin. Each of the landfill designs used coal combustion products as structural fill under the landfill, on top of the retired basin. The Division of Waste Management has permitted three coal combustion residuals landfills at Duke power plants that are entirely or partially located, or proposed to be located, on retired surface impoundments or basins which were formerly used for the disposal of coal ash. The three are described in the following:

A. PERMIT NO. 3612, ALLEN STEAM STATION

Located in Gaston County, the CCR landfill is double-lined and located entirely over a retired surface impoundment. As of April 2014, the landfill contained 932,748 tons of coal ash: See Figure 1. Figure 2 displays the retired ash basin prior to construction of the double-lined landfill.

Figure 1 Permit No. 3612, Allen Steam Station (Outlined in Red)



Figure 2 Retired Ash Basin Aerial



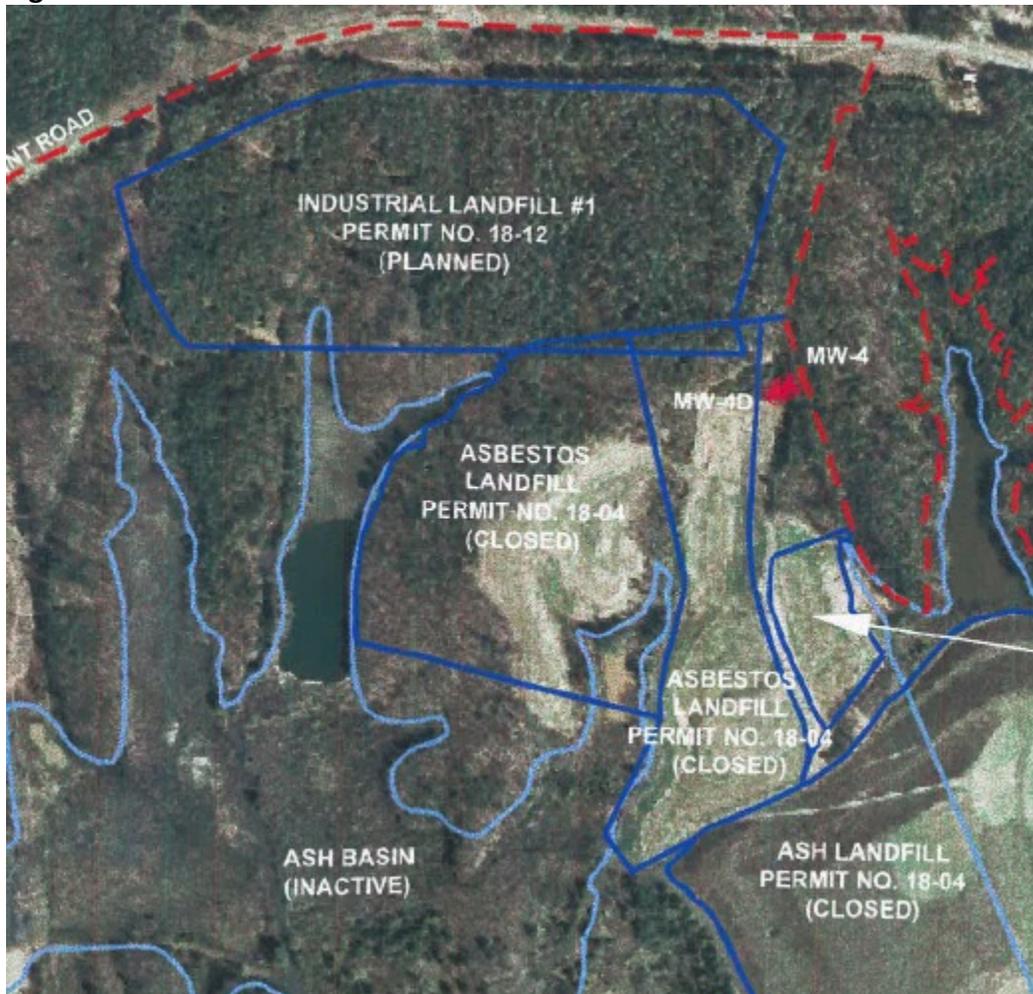
B. PERMIT NO. 1812, MARSHALL STEAM STATION

Located in Catawba County, the CCR landfill is double-lined, and the initial phase has four cells. The first two cells are not located over any portion of a surface impoundment (approximate area outlined in green), and the second two cells have an outside berm and a small area of the cell (approximate area outlined in red) over an upper reach of the basin that had been dry for years. As of April 2014, the landfill contained 462,438 tons of coal ash: See Figure 3. Figure 4 displays the retired ash basin prior to construction of the double-lined landfill.

Figure 3 Permit No. 1812, Marshall Steam Station



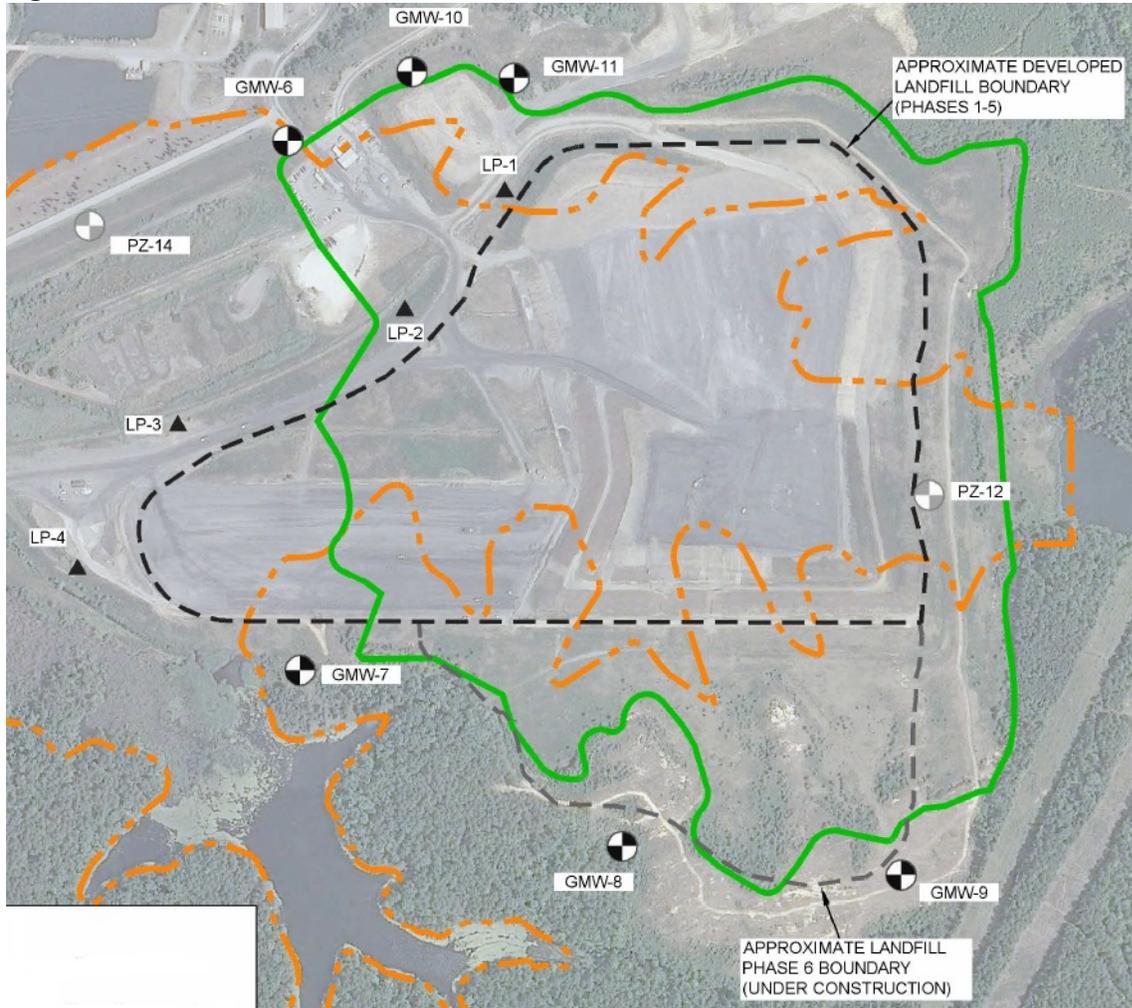
Figure 4 Retired Ash Basin Aerial



C. PERMIT NO. 7302, ROXBORO STEAM STATION

Located in Person County, the CCR landfill (outlined in black) is built over an unlined landfill (outlined in green), originally permitted in 1988, that was constructed on top of the retired ash basin (outlined in orange). The CCR landfill consists of original single-lined phases and newer double-lined phases. The CCR landfill was considered to be the closure cap for the retired basin and unlined landfill. The CCR landfill received a permit to operate in 2003, prior to SL 2007-550 and the double liner requirement. The entire basin is covered, and future development is proposed for areas outside the basin footprint. As of April 2014, the CCR landfill contained over five million tons of coal ash. See figure 5.

Figure 5 Permit No. 7302, Roxboro Steam Electric Plant



The initial, unlined landfill at Roxboro had a groundwater monitoring system which was kept in service after the lined landfill was constructed. Groundwater sampling results show that the groundwater quality in the monitoring wells is stable or reduced in levels of contamination compared to the groundwater quality before the lined landfill capped the ash (which was disposed in the retired basin and the unlined landfill). Figure 6 is an example of groundwater trends at the facility. The down-gradient monitoring wells are GMW-6, GMW-10 and GMW-11, while wells GMW-7 and GMW-8 are side-gradient. The background well is GMW-9. Monitoring well GMW-6 was installed within the footprint of the retired ash basin.

Figure 6 Summary of Groundwater Quality

		Table 1 - Summary of Groundwater Quality																							
		Dec 2002	May 2003	Nov 2003	May 2004	Nov 2004	May 2005	Nov 2005	May 2006	Nov 2006	May 2007	Nov 2007	May 2008	Nov 2008	May 2009	Nov 2009	May 2010	Nov 2010	April 2011	Nov 2011	April 2012	Nov 2012	April 2013	Nov 2013	April 2014
Constituent	2L (ppb)	Well GMW-6 (ppb)																							
boron **	315/700	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	3820	2850	3920	2620	962	762	2460	1160	1270	1420	1450	
chromium	50	10	6	160	ND	28	11	10	5	12	10	ND	5.5	6.5	2.6	5.6	6.2	2.3	3	2.1	ND	1.24	1.02		
iron	300	4240	1750	59100	1950	1310	6950	2240	1600	1870	2440	3230	2220	680	861	429	64.9	62.9	ND	ND	8.84	16.5	8.67		
manganese	50	1660	609	2330	169	372	166	81	51	86	60	82.8	55.6	22.7	25	46.4	4.4	6.6	6.2	4.9	4.48	4.94	3.17		
selenium ***	50/20	96	101	93	105	94	88	96	86	81	76	71.2	68.1	56.6	61	73.2	59.9	60.5	82.8	62.8	77.3	82.4	82.1		
sulfate	250,000	1,108,000	830,000	859,000	586,000	454,000	589,000	554,000	627,000	666,000	587,000	830,000	810,000	690,000	709,000	624,000	473,000	458,000	531,000	580,000	574,000	559,000	421,000		
		Well GMW-7 (ppb)																							
boron	315/700	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	1250	1430	1560	812	26.3	ND	9.3	179	33.4	818	17.2		
chromium	50	ND	ND	ND	49	47.3	824	226	ND	8	79	143	43.4	52.1	58.4	17.4	4.7	ND	1.4	1.8	ND	7.65	0.623		
iron	300	831	171	271	983	693	3720	1360	6620	398	486	2260	466	444	274	593	250	97.7	46	59.2	13.9	156	58.7		
manganese	50	154	20	10	34	30	32	17	2540	ND	ND	14.4	9	10.6	7.9	27.2	7.8	ND	1.7	2.9	ND	5.75	2.39		
selenium	50/20	ND	4	4	4	4	4	ND	370	8	9	ND	ND	ND	7.7	0.73	ND	ND	ND	ND	ND	0.476	0.15		
sulfate	250,000	64000	30600	549000	36600	35200	31900	27700	19100	61200	33800	39000	130000	100000	93500	61000	22900	19000	19000	96200	19800	123000	15900		
		Well GMW-8 (ppb)																							
boron	315/700	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	2750	2360	2660	2590	1870	1970	1980	1750	1680	2460	2680		
chromium	50	ND	ND	ND	ND	ND	ND	ND	ND	11	ND	ND	ND	2	ND	23.8	8.6	7.7	8.8	4.4	ND	4.28	3.07		
iron	300	187	110	68	324	203	847	50	676	540	1210	ND	ND	ND	ND	168	71.3	166	203	126	21	230	195		
manganese	50	449	122	156	290	263	128	129	82	58	57	48.4	36.6	28.8	36	80.6	30.5	33.9	25.8	36.7	29.8	45.6	41.4		
selenium	50/20	ND	12	15	23	17	13	ND	10	12	16	ND	ND	ND	2.7	ND	ND	ND	ND	ND	ND	0.382	0.241		
sulfate	250,000	231,000	329,000	586,000	625,000	529,000	430,000	359,000	400,000	375,000	420,000	390,000	410,000	390,000	472,000	499,000	348,000	387,000	279,000	316,000	343,000	461,000	562,000		
		Well GMW-9 (ppb)																							
boron	315/700	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	5.3	43.4	35.8	48.9	12.4	8.2	ND	15.5	ND	ND	3.76		
chromium	50	ND	ND	34	ND	ND	ND	ND	ND	8	10	ND	ND	ND	1.4	11.4	ND	0.96	0.66	ND	ND	ND	0.5		
iron	300	4890	311	2440	171	136	197	78	58	60	117	94	41	42	144	102	31	55.7	52.7	42.1	20.8	30.5	39.7		
manganese	50	266	27	144	11	ND	11	7	11	ND	ND	1.9	1.9	1.8	7.6	3.9	0.55	1.4	1.3	0.74	ND	0.729	1.18		
selenium	50/20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	0.84	ND	ND	ND	ND	0.177	0.192		
sulfate	250,000	18,000	25,000	ND	7,370	8,900	6,590	15,500	19,600	8000	167000	17000	15000	14000	144000	13700	15900	13600	13100	13800	15700	15500	21000		
		Well GMW-10 (ppb)																							
boron	315/700	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	412**	345**	253	301	59.9	93.2	14.5	24.7	33.6	57.1	10.1		
chromium	50	11	ND	6	ND	ND	ND	10	ND	8	16	ND	0.8	ND	ND	10	14.6	20.5	1.1	3.6	5.33	1.3	0.758		
iron	300	6680	513	2780	926	1030	1050	2850	793	284	799	531	477	317	177	198	432	547	60.7	173	164	326	102		
manganese	50	264	98	148	79	71	71	127	57	36	54	42.1	41.9	31.4	26.3	6.9	10.8	9.5	1.5	5.6	6.38	6	2.49		
selenium	50/20	2	4	3	3	2	ND	ND	ND	2	ND	ND	ND	ND	1.2	0.84	ND	ND	ND	ND	ND	0.77	0.237		
sulfate	250,000	1,720,000	256,000	132,000	147,000	95,200	86,200	76,400	46,000	75000	44500	53000	61000	48000	35300	48000	16800	15100	11500	16900	21300	25700	21300		
		Well GMW-11 (ppb)																							
boron	315/700	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	2340	1330	388	943	625	996	615	1240	514	1690	919		
chromium	50	ND	ND	ND	ND	10	ND	8	5	7	9	ND	12.8	2.2	2.6	11.5	1.6	1.5	2.2	1.9	ND	0.623	0.5		
iron	300	624	1540	1370	2310	7600	3730	2450	1340	349	848	641	8520	2310	1200	205	1420	393	248	454	150	234	31		
manganese	50	190	44	55	29	50	40	35	48	39	59	16.3	139	20.1	29.7	5.3	46.7	13.9	4.4	9	3.91	4.98	0.961		
selenium	50/20	231	264	196	155	21	67	60	43	14	33	30.5	13.9	14.3	20.7	25.8	5.1	21.1	13.6	20.1	19.9	34.2	20.4		
sulfate	250,000	806,000	686,000	76,100	544,000	98,400	197,000	146,000	187,000	196000	146000	210000	170000	150000	995,000	755000	103000	120000	114000	566,000	133000	184000	181000		

NOTES
 highlighted cells indicate concentrations above 2L
 NT - not tested
 ND - non detect
 ** - 2L Standard changed Jan 1, 2010 (B changed from 315 ppb to 700 ppb)
 *** - 2L Standard changed Jan 1, 2010 (Se changed from 50 ppb to 20 ppb)

III. Design and Inspection of CCR Landfills

Development of each of the landfills included extensive geotechnical borings to assess the conditions of the impoundment beneath the landfill, initial determination of water levels in the retired basins and confirmation of ash properties that were used in future engineering plans. Tests were run on settlement properties for each of the proposed landfill areas, and the design of the earthen berms was reviewed by the Division of Energy, Mining and Land Resources' Dam Safety Program. Coupled with operational procedures, which were incorporated into the permit, the landfills on the retired surface impoundments were determined to be structurally

protective of public health and the environment if built and operated in accordance with the approved plans.

The Division of Waste Management's solid waste section has inspected the landfills on a routine schedule similar to other industrial landfills in the state. All three of the landfills have been inspected in 2014 by environmental senior specialists and are in compliance with solid waste rules and their permits. A copy of the inspection audit is attached in the Appendix.

A February 20, 2014 inspection for the Marshall Steam Station (Permit No. 1812) noted that the leachate collection system had not had its annual inspection in 2013, as specified in the operational plan of the facility. The violation was resolved with prompt cleaning of the leachate collection system, as verified during a March, 7 2014 inspection.

Leachate management was of concern at the Allen Steam Station (Permit No. 3612) from October 2013 through January 2014. Violations were noted related to the handling of leachate, which reached stormwater structures during unusually heavy storm events. Violations were resolved with improvements to the landfill's leachate collection system, installation and repair of the stormwater infrastructure, modifications to the operation of the active cell, and movement of operations from cell #1 to cell #2, which had the most recent upgrades incorporated. These upgrades included the use of chimney drains for effective leachate management. Chimney drains were incorporated into the active cell #2. Adjustments to leachate handling in cell #1 will be incorporated in the future when operations resume there. The most recent inspection, on May 14, 2014, indicated that the system was operating properly. The improvements resolved the leachate issues to the satisfaction of the solid waste section and are protective of public health and the environment. It should also be noted that operations at the Allen plant have changed. It is no longer used as a base load plant, but rather as a peaking plant, which substantially reduces the generation rate of CCRs.

The Duke/Progress Roxboro Plant was most recently inspected on April 22, 2014, with a prior pre-construction meeting held at the site with solid waste section staff on September 10, 2013. No violations were observed.

IV. Conclusion

The design and operational information the Division of Waste Management has reviewed indicates that the three coal combustion residuals landfills constructed on top of retired surface impoundments are operating in compliance with regulatory requirements. They were constructed and are currently operating in a manner protective of public health, safety and welfare; the environment; and natural resources. The current groundwater data available at the Roxboro facility indicates that the lined landfill has provided a protective barrier and is actually helping to reduce migration of contaminants into the groundwater beneath the basin. The December 19, 2014 federal Environmental Protection Agency (EPA) rules established additional coal ash residual landfill design criteria, with one component being a five-foot separation distance between the bottom of the ash and the seasonal high water table. DENR is

continuing to evaluate current rules and statutes to determine if additional requirements for coal ash management are warranted. In addition, the data from the CSAs conducted at the three sites will be used to evaluate groundwater conditions at the respective sites and identify potential risks to public health and the environment. This data will also be used to make determinations about the appropriate corrective actions, classifications and closures of the ash basins. Permit requirements for future coal ash residual landfills constructed on top of retired ash basins in North Carolina would need to be conducted in light of recommendations implemented from those studies.