Blue Ridge Environmental Defense League

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To: The Georgia Department of Natural Resources: Environmental Protection Division

Re: Comments on Proposed Amendments to Georgia's Rules for Solid Waste Management Chapter 391-3-4

August 10, 2016

On behalf of the members and Directors of Blue Ridge Environmental Defense League and our members and Chapters in Georgia, I offer the following comments on the "Proposed Amendments to Georgia's Rules for Solid Waste Management Chapter 391-3-4"

Liners and Associated Issues

The Environmental Protection Division (EPD) has proposed adopting the US EPA's rules, including their requirements for liner systems. However, this design is not likely to protect groundwater from contamination. \The efficacy of using composite liner systems for containment of coal ash has not been demonstrated. Dr. Dennis Lemly, Research Associate Professor of Biology at Wake Forest University points out that there is no performance data to indicate that this design is suitable for coal ash disposal. In a report submitted to the United States Environmental Protection Agency, Dr. Lemly concluded, "Coal ash produces leachate with an exceptionally high anionic strength due to the presence of sulfate, chloride, and many other constituents. Sulfate concentrations alone can exceed 30,000 mg/L (3). Moreover, ammoniated

coal ash, which is the predominant form produced today, enhances the leaching rate of elements that form anionic compounds in solution, in particular, selenium, arsenic, molybdenum, fluoride, and vanadium (4). Collectively, these factors suggest that failure of HDPE liner material in a coal ash application is very possible for chemical reasons unrelated to direct degradation of the membrane itself."[1] Dr. Lemly submitted comments to the North Carolina Department of Environmental Quality outlining his concern that there is little experience using these types of liner systems for coal ash disposal sites.[2] For example compaction of coal ash causes the liquid in the waste to rise to the surface, possibly creating problems.[3]

In a 2013 presentation to the New York Federation of Solid Waste and Recycling, Abigail Beck, M.S., P.E., commented that it was, "Possible but not probable to install leak-free geomembrane."[4] Indeed, the standard manufacturer's warranties of two potential suppliers of the HDPE liner to an applicant for a coal ash landfill in North Carolina are *five years*, with some products having a warranty up to 20 years.[5]

World renowned landfill expert Dr. G. Fred Lee has long been critical of the "dry tomb" approach for municipal solid waste landfills. His many studies and reports outline the certainty of liner failure, insufficient monitoring wells placed far apart, inadequate post-closure care and financial assurance.[6] In comments prepared for Blue Ridge Environmental Defense League, Dr.

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[1] Lemly, Dennis A, PhD. "Technical and Environmental Issues with Synthetic Liners Proposed for use in Coal Ash Disposal Applications". Comments submitted to the US Environmental Protection Agency. 21 September 2010.
[2] Lemly, Dennis A, PhD. "Technical and Scientific Issues with Coal Ash Structural Fills in North Carolina." Comments to the North Carolina Department of Environment and Natural Resources. 22 April 2015. Comments attached with comment document.
[3] DePree, Piet. Tribble, Lowry. "The Challenge of Coal Ash." Golder Associates. 6 October 2014. Article included with comment documents.
[4] Beck, Abigail, MS, PE. "Leaks In Installed Geomembranes: An Overview of Past, Present and Future". TRI Associates. 6 May 2013. Presentation included with comment documents.
[5] Emails to Therese Vick 23 February 2015 and 2 March 2015.
[6] Lee, G. Fred, PhD. Lee, Anne-Jones, PhD. "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste." G. Fred Lee and Associates. Updated January 2015.

Lee stated, "However, there is no doubt th[at] eventually the liner will fail to prevent pollution of groundwater with waste-derived leachable components. Since landowners in the vicinity of a landfill should be entitled to groundwater free of hazardous and deleterious chemicals forever, wastes with leachable components such as coal combustion ash should not be permitted to be deposited in landfills that do not provide protection of the groundwater resources forever."[7]

Financial Assurance

In consideration of the toxicity of coal ash, it is imperative that sufficient financial assurance be mandated from any landfill that accepts coal ash. EPD must review closure and cleanup costs for new and existing facilities that wish to accept coal ash. Dr. G. Fred Lee has documented the inadequacy of closure costs required under the federal Subtitle D regulations. (See Dr. Lee's report at 6).

Waste Characterization

Coal ash contains toxic constituents and is not a benign waste stream. It contains heavy metals such as arsenic, selenium, mercury, and chromium, often present as hexavalent chromium, and radionuclides. Recently in South Carolina, radioactive waste was found to have been disposed of in a Duke Energy coal ash impoundment.[8]

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http://www.gfredlee.com/Landfills/SubtitleDFlawedTechnPap.pdf. Report included with comment documents. Dr. Lee's resume can be viewed here: http://www.gfredlee.com/exp/GFL_Resume.pdf.

[7] Lee, G. Fred, PhD. Lee, Anne-Jones, PhD. Comments on Proposed Disposal of Coal Combustion Ash Comments included with comment documents.

[8] Fretwell, Sammy. "Nuclear Waste, Arsenic at SC Coal Plant Raise Concern." *The State. 7 March 2015.* Nuclear waste, arsenic at SC coal plant raise concern Article included with comment documents.

TCLP

It is not clear from the proposed amendments what method(s) EPD will require to determine the toxicity of coal ash to be disposed of landfills. Because the TCLP may underestimate the toxicity of coal ash, the US Environmental Protection Agency (EPA) does **not** recommend that the test be used for the characterization of coal ash waste. In its final rule on the disposal of coal combustion residues EPA said that, "For landfills, EPA agrees that TCLP, SPLP and other single pH test methods may not be the most appropriate leachate extraction methods for all waste streams and all disposal scenarios."[9]

PCBs and Other Constituents of Concern

G. Fred Lee, PhD points out that, "As discussed in the above sections of reports on PCB management issues, the TCLP is not a valid test to evaluate whether PCBs in soils, wastes and cement "stabilized" wastes can be leached from the wastes in sufficient concentrations to cause pollution of the environment by PCBs. This same conclusion applies to many other types of hazardous chemicals such as PAHs, heavy metals etc."[10] There are questions concerning the possibility that PCBs were disposed of in coal ash impoundment. In one media report, a former worker stated that "everything" was poured in the impoundments. Of equal concern, the TCLP does not measure radionuclides. Coal ash contains varying amounts of Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM). Naturally occurring isotopes

[9] Environmental Protection Agency 40 CFR Parts 257 and 261 [EPA–HQ–RCRA–2009–0640; FRL–9919–44– OSWER] RIN–2050–AE81 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities Final Rule: http://www.gpo.gov/fdsys/pkg/FR-2015-04-17/pdf/2015-00257.pdf (The rule will not be attached to comment documents).

[10] Lee, G. Fred, PhD. Lee, Anne-Jones, PhD. "TCLP Not Reliable for Evaluation of Potential Public Health and Environmental Hazards of PCBs or Other Chemicals in Wastes: Unreliability of Cement Based Solidification/Stabilization of Wastes." G. Fred Lee and Associates. September 2009. http://www.gfredlee.com/Landfills/TCLP_Solidification.pdf. Report included with comment documents.

of uranium, thorium, potassium, and their decay products including radium can be present in coal ash.

The toxicity of the coal ash to be excavated, transported, and ultimately disposed of requires a thorough waste characterization using the most appropriate testing methods.

Leachate

Municipal wastewater treatment plants are designed to treat biological contaminants, not heavy metals, radionuclides, and possibly PCBs or other toxics. These constituents will be partitioned into the discharged effluent or into the sludge- with inherent risks to the environment and public health. In a 2015 email to a BREDL member Dr. Avner Vengosh, a researcher at Duke University noted: *"*Indeed, a typical WWTP cannot treat and remove the inorganic contaminants that are associated with coal ash. Our recent paper, see attached also shows radioactivity in coal ash.[11] Dr. Dennis Lemly, a Wake Forest University professor, and also a research biologist for the US Forest Service had similar concerns. He was quoted in a September 2015 media report: "Lemly said municipal wastewater treatment plants were designed for organic material, not coal ash leachate, which he described as "highly toxic."[12] At the Brickhaven coal ash landfill in Chatham County, North Carolina, radium has been detected in landfill leachate.

[11] Papers included with comment documents

[12] Devane, Steve. "Research fish biologist concerned with drainage from coal ash storage in Lee County. *Fayetteville Observer*. 7 September 2015. http://www.fayobserver.com/news/local/research-fish-biologist-concerned-with-drainage-from-coal-ash-storage/article_7da62f15-9b9e-5718-8c96-7542b795de2d.html

[13]

"It's a demand they can't meet," he said. "It's not because they don't want to. It's because they're not set up to deal with it."

Coal ash contains bromide, which can combine with chlorine and form trihalomethane; according to EPA trihalomethane poses a cancer risk. There have already been instances of the creation of trihalomethanes in Eden and Madison, downstream from the Belews Creek Steam Station discharge.[14]

How millions of gallons of leachate from millions of tons of coal ash is to be tested, treated and disposed of should be of vital concern to EPD.

Air Quality

The excavation, transportation, and disposal of millions of tons of coal ash will have significant and deleterious effects in the communities surrounding Duke Energy's coal ash impoundments, the communities along the transportation routes, the workers and the targeted communities. Coal

[13] "First Semi-Annual Groundwater, Surface Water and Leachate Monitoring Report." 26 May 2016. Documents can be obtained from the North Carolina Department of Environmental Quality. http://deq.nc.gov/

[14] Gutierrez, Bertrand M. "Discharge from Belews Creek power plant affects water quality." *Winston-Salem Journal.* Winston Salem. 13 April 2014. http://www.journalnow.com/news/local/discharge-from-belews-creek-power-plant-affects-water-quality/article_8e6f8202-a305-580d-a389-d96da37d5629.html

ash dust is difficult to control- it is "hydrophobic", sometimes described as behaving like "dry water", and because of its fine particle size is easily deposited off-site and along transport routes, depositing on land and surface water. It contains crystallized silica, the culprit in the chronic lung disease silicosis. When inhaled, with its small particle size, coal ash is carried deep into the lungs and can irritate the respiratory system and worsen chronic lung disease. Toxins such as arsenic and lead as well as radionuclides are more concentrated the smaller the particle. In a study of the Kingston, Tennessee coal ash spill Duke University researchers found that, "The high concentrations of trace metals (Tables 1 and 2) and radioactivity (Table 3) reported in this study for the bulk TVA coal ash are expected to magnify, as fine fractions of fly ash (which may be re-suspended and deposited in the human respiratory system) are typically 4-10 times enriched in metals relative to the bulk ash and the coarse size fraction (7, 46). The toxic metal content in coal ash, the sizes of fly ash particulates, and the ionizing radiation (IR) exposure (both incorporated and external) may act synergistically or, less frequent, antagonistically, affecting human health directly (predominantly through inhalation of contaminated air) and indirectly through the food chains (consuming contaminated agricultural products) (14)."[15]

Hydrogen sulfide (H2S) can be emitted from coal ash landfills, particularly when mixed with municipal solid waste. H2S is considered a broad-spectrum poison, which means it can affect multiple systems of the body. Residents living near coal ash disposal sites report rotten smells in their communities. [16]In Uniontown Alabama, where the coal ash from the 2008 TVA Kingston,

[15] Ruhl, L. Vengosh, A. Et al. "Survey of the Potential Environmental and Health Impacts in the Immediate Aftermath of the Coal Ash Spill in Kingston, Tennessee" *Environmental Science and Technology.* 15 August 2009. http://dukespace.lib.duke.edu/dspace/handle/10161/6943. Paper included with comment documents.
[16] "Ash in Lungs." Earthjustice. Physicians for Social Responsibility. August 2014. Report included with comment documents.

Tennessee spill was taken, air dispersion modeling was undertaken to determine the possible air emissions which could be coming from the landfill there. The modeling found that, "…the Arrowhead Landfill generated a substantial amount of H2S and TSP air emissions during normal operations."[17] Local government in Chatham County, North Carolina has retained a consultant who has been doing independent air monitoring at the coal ash landfill there. The table below shows the increase of ambient airborne metals near the landfill during truck delivery of the coal ash[18]:

Consituent	10/21/2015 Results		Concentration		12/21/2015 Results		Concentration		% Change
Particulate Weight	135	mg	221.853	µg/m³	328	mg	548.495	µg/m³	147%
Aluminum (Al)	1340	µg	2.202	µg/m³	4580	µg	7.659	µg/m³	248%
Barium (Ba)	40.5	µg	0.067	µg/m³	64	µg	0.107	µg/m³	61%
Calcium (Ca)	1010	µg	1.660	µg/m³	4580	µg	7.659	µg/m³	361%
Chromium (Cr)	<6.7	µg	below RDL		16	µg	0.027	µg/m³	>145%
Cobalt (Co)	<2.7	µg	below RDL		4.6	µg	0.008	µg/m³	>80%
Copper (Cu)	49.2	µg	0.081	µg/m³	74.2	µg	0.124	µg/m³	53%
Iron (Fe)	2630	µg	4.322	µg/m³	9510	µg	15.903	µg/m³	268%
Lead (Pb)	17.2	µg	0.028	µg/m³	32.1	µg	0.054	µg/m³	90%
Magnesium (Mg)	697	µg	1.145	µg/m³	3300	µg	5.518	µg/m³	382%
Manganese (Mn)	114	µg	0.187	µg/m³	311	µg	0.520	µg/m³	178%
Nickel (Ni)	5.3	µg	0.009	µg/m³	13.6	µg	0.023	µg/m³	161%
Phosphorus (P)	77	µg	0.127	µg/m³	239	µg	0.400	µg/m³	216%
Potassium (K)	269	µg	0.442	µg/m³	1360	µg	2.274	µg/m³	414%
Silicon (Si)	173	µg	0.284	µg/m³	692	µg	1.157	µg/m³	307%
Sodium (Na)	176	µg	0.289	µg/m³	959	µg	1.604	µg/m³	454%
Strontium (Sr)	4.5	µg	0.007	µg/m³	16.1	µg	0.027	µg/m³	264%
Sulphur (S)	401	µg	0.659	µg/m³	839	µg	1.403	µg/m³	113%
Titanium (Ti)	73	µg	0.120	µg/m³	295	µg	0.493	µg/m³	311%
Vanadium (V)	<6.7	µg	below RDL		14.6	µg	0.024	µg/m³	>118%
Zinc (Zn)	88.4	µg	0.145	µg/m³	118	µg	0.197	µg/m³	36%

Fugitive coal ash dust will have a significant impact on public health in the communities targeted for coal ash landfills, along the transport corridors, to workers, and around the sites that are being excavated.

[17] Tarr, Jim. "An Evaluation of Particulate Matter, Hydrogen Sulfide and Non-Methane Organic Compounds from the Arrowhead Landfill." 8 August 2012. Copy of report included with comment documents.
[18] "Ambient Air Monitoring Report Chatham County Coal Ash Disposal Site" http://www.chathamnc.org/modules/showdocument.aspx?documentid=28059

Saltstone: The Alternative

Because of the inherent dangers of landfilling and transportation of coal ash across Georgia, the Blue Ridge Environmental Defense League has recommended a safer solution, the technology called “Saltstone” for coal ash waste disposal. The technology, developed for the US Department of Energy for use at the Savannah River Site, would allow the waste to be stored on Duke Energy property and isolate the waste from the air, ground and surface water and the land. For further information see: Coal Ash Disposition: The Alternative for North Carolina.[19]

[19] Copy of report submitted with comment documents.