2015 Coal Combustion Products Study as required by the Coal Ash Management Act

Session Law 2014-122, Subsection 4(d)(1)

May 13, 2015

Submitted by:
North Carolina Department of Environment and Natural Resources and the Environmental Management Commission

I. Overview

Session Law 2014-122 (SL 2014-122) Subsection 4.(d)(1) requires a review of the beneficial use of coal combustion products (CCP) and the regulations as follows: "The Department of Environment and Natural Resources and the Environmental Management Commission shall jointly review Subpart 3 of Part 2I of Article 9 of the General Statutes, as enacted by Section 3(a) of this act, and 15A NCAC 13B .1701, et seq. In conducting this review, the Department and Commission shall do all of the following:

(1) Review the uses of coal combustion products as structural fill and the regulation of this use under Subpart 3 of Part 2I of Article 9 of the General Statutes, as enacted by Section 3(a) of this act, to determine if the requirements are sufficient to protect public health, safety, and welfare; the environment; and natural resources.

(2) Review the uses of coal combustion products for other beneficial uses and the regulation of these uses under Section .1700 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code (Requirements for Beneficial Use of Coal Combustion By-Products) and Section .1200 of Subchapter T of Chapter 2 of Title 15A of the North Carolina Administrative Code (Coal Combustion Products Management), and other applicable rules, to determine if the rules are sufficient to protect public health, safety, and welfare; the environment; and natural resources.

(3) Evaluate additional opportunities for the use of coal combustion products as structural fill and for other beneficial uses that would reduce the volume of coal combustion residuals that are being disposed of in coal combustion residuals landfills, industrial landfills, or municipal solid waste landfills while still being protective of public health, safety, and welfare; the environment; and natural resources.

(4) Monitor any actions of the United States Environmental Protection Agency regarding the use of coal combustion products as structural fill or for other beneficial uses.

(5) Jointly report to the Environmental Review Commission no later than January 15, 2015, on their findings and recommendations regarding the use of coal combustion products as structural fill and for other beneficial uses."

This report provides a comparison of regulations 15A NCAC 13B .1700 (13B) and 15A NCAC 02T .1200 (02T) with requirements established by SL 2014-122 and the new federal rule issued by the Environmental Protection Agency (EPA rule) on December 19, 2014. This report looks at use of CCP in structural fills and other beneficial uses currently in North Carolina. Further work is being done as required by SL 2014-122 on the evaluation of additional opportunities for the use of CCPs for other beneficial uses that would reduce the volume of coal combustion residuals that are being disposed of in landfills, while still being protective of public health, safety and welfare; the environment; and natural resources.

II. Comparison of Regulations 15A NCAC 13B .1700 and 15A NCAC 02T .1200, SL 2014-122, and EPA Rule on Coal Combustion Residuals Generated by Electric Utilities

A. Permit Requirements

Regulations 15A NCAC 13B .1700 and 15A NCAC 02T .1200, and SL 2014-122 enumerate the allowable uses of CCPs. 15A NCAC 13B .1700 defines "Coal combustion by-products" as “residuals, including fly ash, bottom ash, boiler slag and flue gas desulfurization residue produced by coal fired electrical or steam generation units”. 15A NCAC 02T .1200 is applicable to the treatment, storage, transportation, use, and disposal of CCPs that are defined as wastewater treatment residuals only. Types of reuse covered under the rules in 13B, include structural fills with a projected beneficial end use, an ingredient in an industrial process to make a product, or as an effective substitute for a commercial product or natural resource. Types of reuse covered under the 02T regulations include road overlay, pipe bedding and structural fills over one foot in depth require permits.

Since January 4, 1994, persons proposing to use dry CCPs as structural fill material have been required to notify the Division of Waste Management (DWM) in accordance with the rules in 13B 60 days before initiating construction. Structural fills with a volume greater than 10,000 cubic yards are also required by the rule to submit construction plans. Final cover must be applied within 60 calendar days of completion of the placement of CCP. Properties, on which greater than 1,000 cubic yards of CCPs have been utilized, must have a statement recorded on the deed within 90 days which includes the volume and locations of the CCPs. Session Law 2014-122 provides the most comprehensive of the three sets of requirements, with liners, leachate collection and groundwater monitoring at the large structural fills (projects of 8,000 tons of CCPs or more per acre or 80,000 tons per project) and a formal permit.

The new EPA rule issued December 19, 2014 defines the criteria for beneficial use and allows the states to develop and monitor requirements for structural fill and other reuse operations. Per the EPA rule “Beneficial use of CCR means the CCR meet all of the following conditions:
(1) The CCR must provide a functional benefit;

(2) The CCR must substitute for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices, such as extraction;

(3) The use of the CCR must meet relevant product specifications, regulatory standards or design standards when available, and when such standards are not available, the CCR is not used in excess quantities; and

(4) When unencapsulated use of CCR involving placement on the land of 12,400 tons or more in non-roadway applications, the user must demonstrate and keep records, and provide such documentation upon request, that environmental releases to groundwater, surface water, soil and air are comparable to or lower than those from analogous products made without CCR, or that environmental releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use.”

Note: The EPA’s term “coal combustion residuals” (CCR) when referring to beneficial use is synonymous with CCP as defined in SL 2014-122.

A chart is provided below to characterize the differences among the requirements:

Allowable Use	Deemed Permitted per 02T	Must acquire a permit per 02T	No permit required per 13B	SL 2014-122	US EPA CCR Rule 2014
Combustion fuel	x				
Material for manufacturing (Concrete, asphalt, bricks, etc.)	x		x		
Disposal at a landfill	x		x		x
Use at a landfill	x		w/DWM approval		
Material for traction control during snow and ice events	x		w/DOT approval		
Substitute for blasting grit, roofing granules, and filter cloth precoat	x		x		
Flowable fill for backfill of trenches	w/DHHS approval				
Stabilization of residuals	x		x		
Soil additive / amendment, or other agricultural purpose	x		W/NCDA approval		
Overlay for roads, residential driveways, farm roads, and high-traffic farm areas		x	w/DOT approval		
Bedding for pipes, railroad beds, and underground storage tanks		x	x		
For the extraction or recovery of materials and compounds contained within CCP.			x		
Base or Subbase under a structure or footprint of a paved road, parking lot, sidewalk, or similar structure (≤1' thick)	x		Notify DENR		
Base or Subbase under a structure or footprint of a paved road, parking lot, sidewalk, or similar structure (>1' thick)		x	Notify DENR		
Base or Subbase under a structure or footprint of a paved road, parking lot, sidewalk, or similar structure (<8,000 ton / year or <total of 80,000 tons / project) deemed permitted				deemed permitted	
Base or Subbase under a structure or footprint of a paved road, parking lot, sidewalk, or similar structure (>8,000 ton / year or total of 80,000 tons / project) permit requirements				need permit	

B. New Expedited Permit Timeframes Required by Session Law 2014-122

The Session Law creates a new permitting program under GS 130A-309.215(a) for projects involving 8,000 tons of CCP per acre or more or 80,000 tons or more of CCP in the total project. Permit applicants are required to submit information 60 days before initiation of a structural fill project. With the exception of local government approval or franchise, and an environmental impact analysis, the requirements for a properly contained structural fill are similar to those of a landfill. Like a landfill, there is significant pre-application work necessary for an applicant to prepare a permit application. The expedited permit review timeframes established in GS 130A-309.203 are described below:

Staff	Applicant	Time
	Completion of design and submittal of the permit application	Typically 6-12 months
Receipt of comprehensive Structural Fill application, review and issuance of the draft permit		4-5 months
Public comment period		1-2 months
Final permit issuance		1-2 months
	Construction and certification that construction meets permit conditions.	Typically 6-12 months

C. Monitoring

Monitoring Requirements include the use of a Toxicity Characteristics Leaching Procedure (TCLP) to be performed on the ash. The 13B regulations require only that the test be performed, but not specify that results be sent to the Division of Waste Management. The 02T regulations require that if TCLP concentrations and the total metal level values exceed the following thresholds, the CCPs may not be reused.

	Leachate Concentration Limits mg/l	Ceiling Concentration Limits mg/kg	Monthly Average Concentration Limits mg/kg
Arsenic	5	75	41
Barium	100		
Cadmium	1	85	39
Calcium			
Chromium	5		
Copper		4300	1500
Lead	5	840	300
Magnesium	5		
Manganese			
Mercury	0.2	57	17
Molybdenum		75	75
Nickel		420	420

pH			
Phosphorus			
Potassium			
Selenium	1	100	100
Silver	5		
Sodium			
Zinc		7500	2800

As stated prior, the EPA rules require documentation for unencapsulated use of CCRs involving placement on the land of 12,400 tons or more in non-roadway applications demonstrating that environmental releases to the groundwater, surface water, soil and air are comparable to or lower than those from analogous products made without CCRs; or that such environmental releases will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use.

D. Annual Reporting

The 13B regulations and SL 2014-122 require that generators of coal combustion by-products report:

1. Volume of coal combustion by-products produced;
2. Volume of coal combustion by-products disposed;
3. Volume of coal combustion by-products used in structural fill facilities; and
4. Volume of coal combustion by-products used for other uses

The 13B regulations do not require the end user of the CCPs to report information to the Department of Environment and Natural Resources or to the generator, nor do the regulations require maintenance or operation plans be provided by user of the CCPs.

The 02T regulations have requirements for the generator to provide the following information to the end user:

1. Name and address of distributer;
2. Materials Safety Data Sheet; and
3. Guidance on safe transportation and storage to prevent runoff to surface water and to prevent wind erosion.

The end user, in this case the owner or operator of the structural fill project, must provide an operation and maintenance plan which includes maintenance of wastewater treatment systems and equipment, safety measures, sampling and analysis protocol and spill controls. The owner or operator must report to the Division of Water Resources by March 1 of each year the following information:

1. Source, volume and type of CCP for use or used;
2. Date CCPs distributed; and
3. Name of each recipients of CCPs and a description of end use.

E. EPA Final Coal Combustion Residuals Rule – Overview of Beneficial Use Impacts

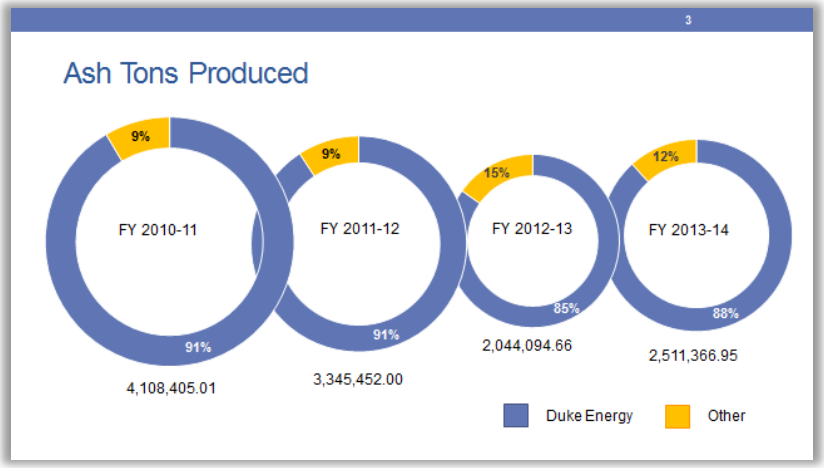
On December 19, 2014, the US EPA released a prepublication copy of the final rule: *Hazardous and Solid Waste Management of Coal Combustion Residuals from Electric Utilities*. The rule consists of an amendment to Title 40 Chapter I Part 257 Subpart D of the Code of Federal Regulations. Part 257 of Subpart D incorporates the criteria for classification of solid waste disposal in landfill and surface impoundment facilities.

While the new federal rules do not consider beneficial reuse of coal combustion residuals (CCRs) as disposal, and therefore do not regulate structural fills, it does establish some requirements for large scale beneficial use projects involving unencapsulated use placement on the land of 12,400 tons or more in non-roadway applications. Projects involving the placement of CCRs in sand or gravel pits and quarries, CCR piles and any practice that does not meet the definition of a beneficial use, are considered to be a landfill subject to the new federal rules.

III. Structural Fills and Beneficial Use of CCP in North Carolina

Ash is produced across North Carolina by large utilities as well as small power generators. At present Duke Energy has six power plants which are generating energy with coal which produce ash. There are also eight other power generators who produce ash. Several power generators have ceased burning coal or producing ash in recent years.

Coal combustion residuals (CCR) as defined in SL 2014-122 is a byproduct of coal power generation which is disposed of into impoundments or landfills, when beneficially used it is a coal combustion product (CCP). The byproducts consist of fly ash, bottom ash, boiler slag and flue gas desulfurization residue (FGD). Fly ash and bottom ash are often used as construction materials in products such as cement, block or as structural fill. The FGD byproduct, sometimes referred to as synthetic gypsum, is often used to manufacture dry wall. FGD is not used as structural fill and is seldom disposed. Duke's power plants generate the majority of the CCPs and CCRs, as shown in the following chart.



Annual reporting of the quantities of CCR and CCP generated, disposed of, and used as structural fill or other uses is required by regulation 13B. The two tables below show the amounts of ash and the amounts of FGD generated at each facility and the quantities disposed in landfills or used in structural fill or other uses.

Coal Combustion Ash 2013-2014				
Facility	**Ash Tons Produced**	**Ash Tons Disposed in Landfills**	**Ash Used in Structural fill**	**Ash Tons Other Uses**
Marine Corps Air Station, Cherry Point	3,663.50	3,663.50	0.00	0.00
Duke Energy Allen Steam Station	178,540.00	239,160.00	0.00	0.00
Duke Energy Belews Creek SS	543,902.00	198,052.00	0.00	293,820.00
Duke Energy Buck SS	0.00	0.00	0.00	0.00
Duke Energy Cliffside SS	235,747.00	192,691.00	0.00	1,509.00
Duke Energy Dan River SS	0.00	0.00	0.00	0.00
Duke Energy Marshall SS	452,206.00	381,082.00	132.00	15,192.00
Duke Energy Riverbend	0.00	0.00	0.00	0.00
Edgecombe Genco,LLC	22,858.84	0.00	11,793.55	11,065.29
University of North Carolina at Chapel Hill	23,875.06	0.00	0.00	23,875.06
Progress Energy Carolinas - Asheville	0.00	0.00	0.00	0.00
Progress Energy Carolinas - Mayo Steam Electric Plant	144,674.00	108,739.00	0.00	35,935.00
DAK Americas	0.00	0.00	0.00	0.00
Progress Energy - Roxboro Steam Electric Plant	662,522.00	542,806.00	26,024.00	93,692.00
Westmoreland Partners, Roanoke Valley Energy Plant	118,220.04	118,220.04	0.00	0.00
Capital Power Corporation - Southport Facility	52,074.00	52,074.00	0.00	0.00
Capital Power Corporation - Roxboro Facility	15,685.00	15,685.00	0.00	0.00
Blue Ridge Paper Products - Canton Mill Waynesville	56,945.00	56,945.00	0.00	0.00
Ingredion	454.51	156.61	0.00	297.90
Totals	**2,511,366.95**	**1,909,274.15**	**37,949.55**	**475,386.25**

Coal Combustion FGD 2013-2014			
Facility	**FGD Tons Produced**	**FGD Tons Disposed**	**FGD Tons Other Uses**
Marine Corps Air Station, Cherry Point	0.00	0.00	
Duke Energy Allen Steam Station	88,254.00	4,347.00	83,060.00
Duke Energy Belews Creek SS	389,226.00	262,990.00	146,361.00
Duke Energy Buck SS	0.00	0.00	0.00
Duke Energy Cliffside SS	219,354.00	135,219.00	92,412.00
Duke Energy Dan River SS	0.00	0.00	0.00
Duke Energy Marshall SS	369,968.00	28,418.00	327,373.00
Duke Energy Riverbend	0.00	0.00	0.00
Edgecombe Genco, LLC	0.00	0.00	
University of North Carolina at Chapel Hill	0.00	0.00	
Progress Energy Carolinas - Asheville	84,495.00	1,081.00	83,414.00
Progress Energy Carolinas - Mayo Steam Electric Plant	138,499.00	383.00	138,116.00
DAK Americas	0.00	0.00	

Progress Energy - Roxboro Steam Electric Plant	427,472.00	0.00	427,472.00
Westmoreland Partners, Roanoke Valley Energy Plant	0.00	0.00	
Capital Power Corporation - Southport Facility	0.00	0.00	
Capital Power Corporation - Roxboro Facility	0.00	0.00	
Blue Ridge Paper Products - Canton Mill Waynesville	0.00	0.00	
Ingredion	0.00	0.00	
Totals	**1,717,268.00**	**432,438.00**	**1,298,208.00**

CCP Structural Fill under construction in Halifax County

A total of 61 regulated structural fills have been constructed in North Carolina: 42 in the coastal plains; 36 in the piedmont; and 2 in the mountains. Proposed end uses for these structural fills include roads, airport runways and hangers, industrial parks, warehouses, a museum, retail buildings, parking lots, an automobile dealership and lined landfills. Although a description of the nature and purpose of the project is a requirement of the notification under the 13B regulations, some properties on which structural fills have been completed were not developed with the proposed end use. Properties on which infrastructure development did not occur have had a greater incidence of compliance issues resulting from lack of comprehensive post-closure care. Most of the structural fills on which infrastructure development did occur, have buildings and/or other paved areas limiting erosion and storm water infiltration, and have well maintained vegetative areas.

A. 15A NCAC 13B .1700 Structural Fills

A preliminary inventory of the structural fills is shown below. This inventory categorizes the structural fills as those which notified according to the 13B regulations and fills those which were constructed prior to the regulations. A total of 79 fills are known which fall into these two categories:

1. 15A NCAC 13B Structural Fills – 61 total
   - 40 over 10,000 cubic yards
   - 21 under 10,000 cubic yards

2. Pre-13B regulations Structural Fills (pre January 4, 1994) – 18 total
   - 6 over 10,000 cubic yards
   - 12 under 10,000 cubic yards

Structural Fill used for construction of airport hangar at Lake Norman Airport.

EB Grain Warehouses constructed on CCP Structural Fill on Hwy 301 north of Rocky Mount.

B. 15A NCAC 2T .1200 STRUCTURAL FILLS

Coal Combustion Products (CCP) Distribution Permits are issued by the Division of Water Resources (DWR) for the treatment, storage, transportation, and beneficial use of a subsection of CCPs. The DWR permitting program is limited to CCPs that are recovered from permitted wastewater treatment systems. The table below shows the permitted distribution facilities, their associated ash distribution and wastewater disposal permit numbers, locations, and amount of CCP distributed from each facility from 2011 - 2013.

Active CCP Distribution Permits

Permit #	Permittee	Plants Permitted (Wastewater Permit #)	County	CCP Distributed (Dry Tons)		
				2011	2012	2013
WQ0000020	Duke Energy Progress, Inc	Asheville Steam Electric Power Plant NC0000396	Buncombe	735,206	648,689	665,589
		Cape Fear Steam Electric Power Plant NC0003433	Chatham	82	0	0
		Sutton Steam Electric Power Plant NC0001422	New Hanover	89	0	89
		Mayo Steam Electric Power Plant NC0038377	Person	0	0	0
		Roxboro Steam Electric Power Plant NC0003425	Person	5,980	15,673	49,919
		Weatherspoon Steam Electric Power Plant NC0005363	Robeson	0	0	0
		Lee Steam Electric Power Plant NC0003417	Wayne	0	0	0
WQ0000452	Duke Energy Carolinas, LLC.	Marshall Steam Station NC0004987	Catawba	113,628	64,525	25,287
		Allen Steam Station NC0004979	Gaston	16,443	3,725	84,416
		Riverbend Steam Station NC0004961	Gaston	0	0	0
		Dan River Steam Station NC0003468	Rockingham	0	0	0

The primary uses of CCP distributed according to permits issued by the DWR are for construction products and for structural fills. A large structural fill project, the Asheville Regional Airport Structural Fill, is a lined fill, with a leachate collection system and groundwater monitoring is as follows:

Asheville, NC (Buncombe County)

- Permit WQ0000020
- Area 1 – 18 acres, constructed 2007-2009
- Area 2 – proposed 32 acres, not constructed yet
- Area 3 – 31 acres, constructed 2013-spring 2015
- Area 4 – 45 acres, constructed 2010-2013
- Total acres – 126 acres
- End use – Primarily paved runways

C. SESSION LAW 2014-122 STRUCTURAL FILLS

Applications for two permits allowing structural fills greater than 80,000 tons per project were received on November 21, 2014. These sites are former clay mines for which reuse as a structural fill will restore the original grade of the site proposed. Additional future use is not currently stated. A site visit was conducted on December 5, 2014 by Department staff. The Completeness Review, performed in accordance with § 130A-309.203, was issued on December 19, 2014. Draft permits were issued on March 23, 2015, followed by a public comment period in effect until May 16, 2015. The Department shall issue a final permit decision on an application for a permit within 60 days after the comment period on the draft permit decision closes.

More details regarding the two proposed structural fills follows:

1) Brickhaven Mine Tract A Structural Permit
   - Moncure, NC (Chatham County)
   - Mine Permit No. 19-25
   - 301 acres
   - Proposing to place 12.5 million tons (10 million cubic yards) as structural fill (1.7 million cubic yards / year)
   - 145 acres for the lined fill area
   - Phase 1 – 60.6 acres in 2 cells
   - Phase 2 – 55.2 acres in 2 cells
   - Phase 3 – 29 acres in 1 cell
   - 7.5-8 years to complete

2) Colon Mine Structural Fill
   - Sanford, NC (Lee County)
   - Mine Permit No. 53-05
   - 411 acres
   - Proposing to place 8.87 tons (7.1 million cubic yards) as structural fill (1.6 million cubic yards / year)
   - 118 acres for the lined fill area
   - Phase 1 - 36.9 acres in 2 cells
   - Phase 2 - 81.8 in 3 cells
   - 5-5.5 years to complete

D. LAND APPLICATION OF COAL COMBUSTION PRODUCTS

CCPs can be used as a soil amendment for agricultural uses. Potential benefits of utilizing CCPs as an agricultural soil amendment include buffering of acidity in soils with a low pH, increasing moisture absorption rates, and addition of minerals. As with land application of any material, rates of usage to achieve a beneficial outcome should be determined on a case-by-case basis taking into account existing soil conditions and the specific material to be land applied.

See Appendix II for further discussion of Land Application.

IV. Recommendations and Conclusion

In conclusion, it is the recommendation that CCP regulations as set forth in 15A NCAC 13B be revised to incorporate the protective measures established by SL 2014-122 and any additional requirements determined to be necessary for the protection of public health, safety and welfare; the environment; and natural resources, and the regulations in 15A NCAC 02T be repealed so that structural fill rules are all located in 15A NCAC 13B. The moratorium on structural fills could be extended by one year to allow for the rule revision process.

At a minimum, the following are recommended rule changes to 15A NCAC 13B:

- Current law allows coal ash as structural fill under an impermeable surface (such as building a foundation) and a permeable structural fill such as that used in landscaping. Although the two types of projects present different risks of infiltration to groundwater, the same laws and standards apply to both. Consideration for more stringent standards for structural fills, regardless of size, which are not covered by an impermeable end use should be evaluated during the rulemaking process;

- determine period of time to allow ash working face to be open to precipitation and wind at structural fills and at industrial landfills;

- outline procedure to allow use of coal combustion residuals as an agricultural soil amendment determining the rate of application on a case by case basis, for coal ash as well as FGD, according to the nutrient needs of the crop and the soil and residual characteristics;

- test coal ash for leachability at source should be according to Synthetic Precipitation Leachate Procedure (SPLP) or other testing procedure according to the EPA SW 846;

- require that the fill be used for the stated purpose;

- define a greenfield with construction requirements (continually sloping and compacted to specific standards with 6 inch soil and vegetative cover);

- require training of landfill operators; In the last few years Duke Energy landfill operators have worked with DENR to revise the landfill operator course work in order for there to be content which is specific to the management of a coal ash landfill. It is the recommendation of DENR that there be a certification program developed for Coal Combustion Residual and Product landfill and structural fill operations. A landfill or structural operator, regardless of size of landfill or fill, would be required to complete the training;

- require annual reporting from generators – where does ash go (reuse contractors); and

- require annual reporting from structural fill operators – where is ash from (generator of ash).

The new federal definition of beneficial use of CCR should be addressed in the state requirements by regulation or statute regarding the four criteria of beneficial use and additional draft criteria according to evaluation provided in Appendix I.

Appendix I - Criteria for the Beneficial Use of Unencapsulated Coal Combustion Products

The Department of Environment and Natural Resources may designate ash or other coal combustion by-product materials as being suited for beneficial use. Coal combustion products uses include structural fills, treatment or dyeing of wood mulch or landscape material, land application, and porous concrete mixes or other porous building materials. The process of designating the materials as suited for beneficial use may require assessment of the following criteria:

1. What is the intended use of the residual and how will the proposed recycling and reuse of the material in question protect, conserve and preserve the natural resources of the State?
2. How and to what extent does the reuse of the anthropogenic material in question conserve the limited and finite capacity of the State's solid waste facilities?
3. How will any public health and environmental hazards to soil, ground and surface water, crops, plants or animals associated with the proposed recycling of material be minimized or eliminated? Describe human health and ecological risks associated with the proposed reuse of the material in the proposed manner and location.
4. To what degree will the recycled material be analogous to commonly used raw materials and how will the use of this material result in a viable and beneficial substitution of a discarded material for a commercial product or raw material?
5. To what extent is there a guaranteed end market for the recycled solid waste material to be produced?
6. Identify and discuss the controls (e.g. environmental, engineering, institutional, etc.) that will be used to properly and safely recycle and reuse the material. This discussion should include, but not be limited to, information regarding the following:
    a. The quantity of the material to be received and recycled;
    b. The maximum quantity of material to be stored at the site at any one time;
    c. The source of the material, including the name and address of the generator;
    d. A detailed narrative and schematic diagram of the production, manufacturing, and/or residue process by which the waste material is produced;
    e. The expected consistency and chemical quality of the material;
    f. How the generator has minimized the quantity and toxicity of the material;
    g. Describe appropriate dust, sediment, stormwater (runoff), and erosion control measures.
    h. Adequate and regular inspection of the material upon receipt;
7. Adequate site controls relating to the storage, handling and processing of the material, including the extent to which the recycled material will be handled to minimize loss;
8. Adequate controls for handling and disposing of any residual wastes, including the location of final disposal for any residual waste generated during further processing;
9. Explain why the proposed recycling of the material is not simply an alternate method of disposal. Describe information regarding the actual or estimated value of the the material both before and after it is recycled.
10. What degree of processing has the material undergone and degree of further processing is required, if any? The applicant must demonstrate that any mixing of different types of material improves the usefulness of the recycled material.
11. Where the project in question includes the reuse of any soil impacted by known or suspected contamination, or the use of any material as a component of "manufactured soil product" (i.e.: solid waste that is or has been altered or rendered into a material with soil type properties), the applicant must demonstrate the use of these materials at the location in question:
    a. Is compliant with the NCDA&CS requirements as soil additive or conditioner,
    b. Is compliant with the Compost Quality and Distribution Standards listed in NCAC 13B .1400 Compost Product Requirements and Distribution of the Solid Waste Regulations; and

   c. Will not result in degradation of the environment.
12. End uses as soil nutrient additives or other agricultural purposes shall be under the authority of the NCDA&CS.
13. Provide a characterization plan that includes protocols for sample collection and analyses designed to provide a representative characterization of the material. The characterization plan shall address:
    a. How the samples will be collected (i.e. locations, times, frequency per volume etc.).
    b. The types of samples to be collected (i.e., discrete, grab, composite, etc.).
    c. How substances in the material will be identified.
    d. The applicable physical and chemical analyses to be performed (i.e. size, density, percent solids, liquid content, pH, reactivity, leachability [TCLP, LEAF, SPLP test], and total metals testing and plant nutrient content.
    e. Analysis for biological properties of the waste if deemed appropriate (i.e. pathogens).
    f. The variability of the substances present in the material.
    g. The number of samples required (grab and/or composite) to be collected and analyzed in order to adequately determine the physical, chemical, and biological properties of the material (current recommendation is one sample per 20,000 tons)
    h. Verification that the sampling and analytical methods used have identified all constituents present in the material, and a detailed written report describing the concentration and distribution of all substances which may be contained in the material.
14. Any person involved in the storage, handling, processing or use of material for beneficial reuse shall be required to provide financial assurance that:
    a. The project approved in the plan will be completed; and
    b. Any unused material will be properly removed and disposed of upon completion of the project or if project operations cease for any reason.
15. Additional information, as required, at the discretion of the Department Head.
16. Certify that the applicant, the facility(ies) where the material is processed for reuse and the facility(ies) where the processed material is to be used are not the subject of any actual or potential statutory or regulatory environmental violations (state or federal), or, if actual or potential violations exist, that the processing of the waste or its use are part of a final settlement or remedy approved by NCDENR.

Appendix II - Discussion of Land Application Uses

The beneficial reuse of CCPs in land application has potential benefit for agriculture if the application is performed consistent with good agronomic practices. Land application of Flue Gas Desulfurization residuals may provide the most benefit in land application systems. The use of other combustion products will most often provide little nutritive value in land application systems based on the loading rates required.. Potential benefits of land application of CCPs include:

- Calcium (Ca) source
- Potassium (K) source
- Sulfate (S) source
- Phosphorus (P) source
- Trace metal source
- Improved infiltration
- Reduces phosphate (PO_4) runoff (Ca and Fe precipitation with PO_4)
- Mitigate high sodium levels
- Liming agent
- Trace minerals

Under the 15A NCAC 13B .1700 rules, the land application of CCP's is under the authority of the NC Department of Agriculture and Consumer Services (NCDA&CS). NCDA&CS is a non-regulatory agency regarding CCP's, but they do provide recommendations for the reuse of materials based on soil testing and waste analysis data to determine appropriate loading rates. Because of soil types and conditions in NC, it is recommended that application rates be more conservative than application rates may be in other parts of the country. Crop sensitivity has been noted in NC soils.

Table 1 - Trace constituents (in ppm) found in ash based on monthly samples (Ash Quality as a soil amendment)

M	As	Cd	Cr	Cu	Pb	Hg	Ni	Se	Zn	P	K	Ca
J	71	.7	19	35	20	.2	14	12	37	282	2160	4440
F	76	.12	11	27	10	.1	12	9	24	344	1860	1880
M	52	.4	19	31	11	.1	13	11	63	246	3280	1580
A	47	.17	13	29	10	.1	11	9	20	297	1630	2850
M	71	.48	21	36	16	.3	16	9	36	294	1930	3810
J	94	.44	21	35	13	.2	16	11	35	185	2460	2680

J	52	.43	10	26	9	.2	10	10	16	209	1970	1540
A	35	.3	11	22	9	.1	10	7	17	243	1250	2250
S	58	.73	16	30	12	.2	14	13	21	167	1400	2310
O	66	.82	14	30	13	.3	13	15	17	274	1710	1650
N	76	1.3	20	41	18	.2	17	12	31	237	1990	2830
D	64	.14	13	34	11	.4	12	11	23	288	1690	1530

Examples for agronomic use:

- Ca - Typical 2400 mg/kg x .002 = 5 lb Ca/ton
- K – Typical 2000 mg/kg x 0.002 = 4 lb K/ton
  - To supply 80 lb K/ac a loading of 20 tons/ac is required
- P – typical 250 mg/kg x 0.002 = 0.5 lb P/ton
- Zn – Typical 30 mg/kg x 0.002 = 0.06 lb/ton
  - To supply 5 lb Zn/ac a loading of 80 tons/ac is required

40 CFR PART 503 POLLUTANT LIMITS FOR THE LAND APPLICATION OF SEWAGE SLUDGE

	Ceiling mg/kg	Pollutant Concentrations Monthly Avg Mg/kg	Annual Pollutant Loading Rates Kg/ha	Cumulative Pollutant Loading Rates Kg/ha
As	75	41	2.0	41
Cd	85	39	1.9	39
Cu	4300	1500	75	1500
Pb	840	300	1.5	300

Hg	57	17	0.85	17
Mo	75	75	NA	NA
Ni	420	420	21	420
Se	100	100	5	100
Zn	7500	2800	140	2800

The recommendations provided by NCDA&CS are based on maintaining productivity of croplands and on the long term productivity of agricultural lands. If soil testing demonstrates levels of particular constituents above standards, the department may recommend no application of CCP. Land owners may elect to forego NCDA&CS recommendations, but in no instance can either the annual or cumulative pollutant load be exceeded.

Appendix III - Beneficial Uses of Coal Combustion Residue: Medical Issues

The potential toxic effects of various constituents of CCRs are well known, and need not be elaborated in detail here. In all instances, potential toxic effects become real if the exposure is high enough for long enough. “The dose makes the poison” said Paracelsus. Children are especially vulnerable to lead, mercury and other agents. Briefly put, the metals of major concern to human health are:

- **Arsenic**: known to cause cancer of lung, kidney, bladder, liver and skin if exposure -- mainly by inhalation or/and ingestion -- is high enough for long enough. Arsenic is present in rice and in many soils so exposure to arsenic from CCRs would be superimposed on that from any native arsenic present. Arsenic is also associated with neurologic and cardiovascular disease and diabetes.
- **Manganese:** can cause slowing of movement and other Parkinson-like changes including disordered thinking.
- **Cadmium:** known to cause lung cancer, independent of any co-exposure to arsenic. Cadmium can also cause kidney disease and emphysema.
- **Chromium:** known to cause lung cancer, nasal septum perforation and asthma when inhaled, and ulcerations of the GI tract when ingested.
- **Mercury:** multiple forms of neurological toxicity, especially in the form of methylmercury to which it is converted in water or soil. The fetus and developing child are especially vulnerable, so FDA set the limit of methylmercury in fish at 1 ppm.
- **Lead:** Children are especially susceptible to lead neurotoxicity. Adult men may have impaired sperm production.

In addition, selenium is notably toxic to fish. They can accumulate this element, and some aquatic exposed species have been completely eliminated from ponds in which they were exposed to CCRs.

Appendix IV - Beneficial Use Case Study – Structural Fill, Asheville Airport

The Asheville Airport expansion began in 2005. Beginning in 2006, coal combustion products (CCP) were permitted as a beneficial fill to support the taxiway and associated area. At the time, the ash was dredged from a nearby coal ash pond and the activity was permitted in accordance with rules promulgated as 15 A NCAC 02T .1200. The activity was permitted through NCDENR Division of Water Resources, Aquifer Protection Program. The permit included a number of conditions including:

a. liner material and a leachate collection system in the fill areas;
b. an impermeable cap to minimize water movement into and through the cells;
c. groundwater monitoring wells on the property and a groundwater monitoring program initiated on adjoining properties;
d. surface water quality monitoring stations;
e. a comprehensive assessment of the ash to be utilized in the structural fill; and
f. annual reporting to NCDENR DWR

This structural fill has resulted in the beneficial use of over 2 million tons of ash as beneficial fill to support development of critical airport hard surfaces. Had the beneficial fill activity not been permitted, the needed fill material for the airport expansion would have been mined at an off-site location and transported to the facility. The beneficial fill resulted in numerous benefits including reduction in gaseous emissions associated with mining and transport.

Reference to coal ash often includes the term toxic waste. Toxic waste is defined in 40 CFR 261.24 as a material containing concentrations of specific regulated materials above the concentrations listed in the Rule. The Toxicity Characterization Leach Procedure (TCLP) is used to characterize a material as toxic. To be considered toxic the leachable concentration of metals must exceed the level presented in Table 1, below. For comparison, the table contains reported values for the ash utilized in the Asheville airport beneficial use project.

Table 1: TCLP Concentrations in 40 CFR 261.24

Metal	TCLP Concentration for "Toxic" Criteria (mg/l)	Source Material for Asheville Structural Fill (mg/l)
Arsenic (As)	5	<0.05
Barium (Ba)	100	1.9
Cadmium (Cd)	1	<0.005
Chromium (Cr)	5	<0.025
Lead (Pb)	5	<0.025
Mercury (Hg)	0.2	<0.002
Selenium (Se)	1	<0.1
Silver (Ag)	5	<0.025

Source: 40 CFR 261.24 and 2013 WQ0000020A annual report to NCDENR DWR

In accordance with permitting requirements in the Ash Reuse Permit WQ000020, a TCLP analysis has been conducted annually for each source of CCP utilized for the Asheville Airport structural fills. Reporting submitted for TCLP analysis of the source material indicate that most samples contain detectable but very low

quantities of the metals of concern from the utilized sources of CCP. These constituents include arsenic, cadmium, chromium, lead, manganese and mercury.

Sample results from the groundwater monitoring wells surrounding the Asheville Airport Structural Fill, indicate that the constituents detected are iron, manganese and chromium. For the wells installed surrounding Area 3 in February 2013, elevated levels of iron were reported in four of the ten wells, and six of the ten wells show elevated levels manganese.

None of the ash samples for the beneficial use project ongoing at the Asheville airport exceeded the TCLP concentrations listed in the Federal Register citation. The annual report submitted to NCDENR – DWR in 2013 lists concentrations of TCLP constituents as presented in column 3. The quality of ash in the most recent reporting year as presented in Table 1 indicates the material is not defined as toxic as defined by USEPA. The waste determination and assessment is critical since materials classified as toxic are not considered as suitable for beneficial use.

The beneficial use activity permitted at Asheville airport involved development of engineered fill cells to utilize a large volume of ash. The ash was beneficial in the development of the structures required to accommodate critical aircraft operations at the facility. The cells are lined, equipped with monitoring devices, and the structural fills have been routinely monitored.

A critical concern is prevention of leaching of metals from the fills into surface water or groundwater. Storm water infiltration into the structural fills, which would generate leachate, is minimized because of the structure of the cap – the cap is the impermeable, concrete taxiway overlying the fill. Additionally, because the cells are lined and equipped with a leachate collection system, the risk to groundwater is lessened. Results from the on-site groundwater monitoring are presented in table 2.

Table 2: Leachate Monitoring, 2013 Annual Report for Permit WQ000020A

ASHEVILLE AIRPORT, AREA 3
GEOTRACK PROJECT NO. 12-2999-N

Compound	NCDENR 2L Standard	Well ID W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9	W-10
Inorganics (Metals):											
Aluminum		0.38	9.7	0.68	BRL	0.12	BRL	0.12	0.47	BRL	2.7
Antimony		BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Arsenic	0.01	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Barium	0.7	0.016	0.078	0.022	BRL	0.021	0.014	BRL	0.026	0.035	0.02
Beryllium		BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Boron	0.7	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Cadmium	0.002	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Calcium		0.14	1.8	0.44	0.17	0.25	2.4	0.1	1.3	1.1	0.45
Chromium	0.01	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Cobalt		BRL	0.011	BRL	BRL	BRL	0.041	BRL	BRL	BRL	BRL
Copper	1	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Iron	0.3	0.24	**3.8**	**0.39**	BRL	0.055	**18**	0.063	0.22	BRL	**0.93**
Lead	0.015	BRL	0.0073	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Magnesium		0.39	1.6	0.38	0.54	0.43	1.8	0.21	0.76	0.84	0.67
Manganese	0.05	**0.12**	**0.54**	**0.17**	0.035	**0.066**	BRL	0.018	**0.061**	0.013	**0.26**
Mercury	0.001	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Molybdenum		BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Nickel	0.1	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Phosphorus-Total		BRL	0.17	BRL	BRL	BRL	BRL	BRL	BRL	BRL	0.68
Potassium		1.6	1.3	1.9	BRL	BRL	BRL	BRL	1	0.82	0.77
Selenium	0.02	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Silicon		4.4	18	4.4	2.2	2.5	1.2	2	4	3.1	5.5
Silver	0.02	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Sodium		0.52	8.1	0.84	0.94	1	2.7	BRL	1.6	1.1	0.66
Strontium		BRL	0.037	BRL	BRL	BRL	BRL	BRL	0.015	0.015	BRL
Thallium		BRL	BRL	BRL	BRL	BRL	BRL	0.074	BRL	BRL	BRL
Tin		BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Titanium		0.01	0.067	0.012	BRL	BRL	BRL	BRL	0.021	BRL	0.044
Vanadium		BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL	BRL
Zinc	1	BRL	0.045	BRL	BRL	BRL	BRL	BRL	BRL	BRL	0.043

The leachate monitoring indicates that no TCLP parameter exceeds water quality standards for groundwater. Exceedances to the NCDENR 2L groundwater standards are associated with manganese and iron; neither of which are primary pollutants. The monitoring data suggest the quality of the leachate is not a threat to public health and the environment.

Prior to transportation of the ash fill to the airport homes were developed within close proximity to the airport. A part of the overall beneficial use effort included assessment of the water quality in residential wells. Residents of the community were given the opportunity to be included in the well survey. Results from the ongoing residential well monitoring on adjacent properties is presented in table 3.

Table 3: Sampling Results from Residential Wells in Hidden Creek Showing NCDENR 2L standards for comparison

Well Coordinate		Sample Date	pH	Chloride	Sulfate	Nitrate	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Mercury	Magnesium	Manganese	Sodium	Zinc
Lat	Long		6.5 - 8.5	250	250	10.00	0.01	0.002	0.01	1	0.30	0.015	0.001		0.05		1.00
			S.U.	mg/l													
35.4499	-82.5444	1/25/10	8.12	2.8	< 2	0.11	< 0.002	< 0.001	< 0.01	< 0.002	< 0.05	< 0.01	< 0.0002	0.5	< 0.01	10.0	0.02
35.4496	-82.544	1/25/10	6.62	4.3	< 2	1.40	< 0.002	< 0.001	< 0.01	0.062	0.08	< 0.01	< 0.0002	2.1	< 0.01	6.7	0.01
35.4491	-82.5444	1/25/10	6.56	2.6	< 2	0.22	< 0.002	< 0.001	< 0.01	0.003	< 0.05	< 0.01	< 0.0002	1.0	< 0.01	5.8	< 0.01
35.4482	-82.5444	1/25/10	6.99	2.6	< 2	0.58	< 0.002	< 0.001	< 0.01	< 0.002	< 0.05	< 0.01	< 0.0002	1.5	< 0.01	7.8	< 0.01
35.4494	-82.5433	2/15/10	5.73	5.3	< 2	1.30	< 0.002	< 0.001	< 0.01	< 0.002	2.40	< 0.01	< 0.0002	1.6	0.04	5.7	< 0.01
35.4484	-82.5434	2/15/10	7.75	8.5	< 2	0.59	< 0.002	< 0.001	< 0.01	0.004	0.07	< 0.01	< 0.0002	2.3	0.02	8.9	< 0.01
35.4468	-82.5533	3/2/10		18	3.1	0.16	< 0.002	< 0.001	< 0.01	0.004	< 0.05	< 0.01	< 0.0002	0.7	< 0.01	5.9	< 0.01
35.4503	-82.5432	3/8/10	6.10	1.7	< 2	1.10	< 0.002	< 0.001	< 0.01	0.005	< 0.05	< 0.01	< 0.0002	2.1	< 0.01	6.8	0.03
35.4488	-82.5414	3/8/10	5.22	14	< 2	0.48	< 0.002	< 0.001	< 0.01	< 0.002	< 0.05	< 0.01	< 0.0002	2.6	0.03	6.7	0.01
35.4482	-82.5415	3/8/10	6.19	3.3	< 2	0.47	< 0.002	< 0.001	< 0.01	0.009	< 0.05	< 0.01	< 0.0002	1.8	< 0.01	7.7	< 0.01

*Yellow denotes exceedance of standard

These data indicate that the higher levels of metals in groundwater are associated with lower pH; specifically noted are wells with a lower pH and iron concentrations above standard limits. Neither pH nor iron are considered primary pollutants. The data do not support any contention that these excursions to groundwater quality are associated with the ongoing fill activity since little well data was collected prior to initiation of the fill effort.

Surface water has also been monitored in the Hidden Creek Watershed and community. The Hidden Creek neighborhood is immediately adjacent to the airport property to the northeast of the existing runway. Surface water quality monitoring results from the watershed are presented in Table 4. Parameters that are indicators

of water quality and are measured at the time of sampling include Biochemical Oxygen Demand, Total Suspended Solids, pH, E. Coli as well as other standard parameters. The water quality monitoring in the Hidden Creek Watershed has been used to assess the concentration of the more typical constituents present in ash. These constituents include the metals listed in the TCLP criteria. Concentrations of metals detected from the TCLP suite are listed below and surface water quality limits associated with these are presented in Table 4, below.

Table 4: Surface Water Monitoring Results, Hidden Creek

Parameter	Samples from 2010
As	0.0023
Ba	0.07
Cd	<0.001
Cr	<0.01
Pb	<0.01
Hg	<0.002
Se	<0.005
Ag	NR
NO2+NO3	1.10

These data indicate that concentrations detected in receiving streams are below 2L standards concentrations.