Andrea Bonfort 7302

CP&L

Carolina Power & Light Company
Roxboro Electric Generating Plant
1700 Dunnaway Rd
Semora, NC 27343

Carolyn M. Jungclas
Plant Manager

File: 12560-N

July 28, 1997

Mr. Dexter Matthews, Chief
Solid Waste Section
Division of Waste Management
P. O. Box 27687
Raleigh, North Carolina 27611-7687

Re: Carolina Power & Light Company
Roxboro Steam Electric Plant
Person County, North Carolina
Landfill Waste Management Plan

Dear Mr. Matthews:

Per your April 29, 1997 letter, enclosed is the Roxboro Plant's Landfill Ten-Year Waste Management Plan. During past years, the Roxboro Plant Industrial Landfill was the largest industrial landfill and one of the largest landfill of any type in the state. Utilizing newly developed technology, this situation will soon change. Roxboro Plant has undertaken a $1.55 million project that will result in the conversion of 500,000 tons of waste fly ash into two reusable materials: a material suitable as a concrete ingredient; and the other material suitable as a carbon-rich fuel. It is expected that disposal of fly ash at the Roxboro Plant's Landfill will be reduced by 65%-70% within the next ten years.

Please contact Ronnie Wolfe at (910) 597-6246 or Kerry MacPherson at (919) 362-3414 should you have any questions concerning this report.

Yours very truly,

Carolyn M Jungclas

Carolyn M. Jungclas
Plant Manager
Roxboro Steam Electric Plant

KAM/pw
Enclosure

Carolina Power and Light Company

Roxboro Steam Electric Plant

Dry Fly Ash Landfill Waste Management Plan 1997-2007

I. Introduction

During 1996, the North Carolina General Assembly amended the Solid Waste Management Act in House Bill 859 (HB859). This revision required owners of Industrial Waste Landfills, such as the Roxboro Plant's Dry Fly Ash Landfill, to establish a waste generation goal and provide a ten year waste management plan. The General Statutes specified that the plan should include 1) a waste reduction goal established by the generator, 2) options for the management and reduction of wastes evaluated by the generator, and 3) a waste management strategy, including plans for waste reduction and waste disposal for the ten-year period covered by the plan. The General Statutes require that the plan be updated at least every three years. Also, the Solid Waste Section requested that the generator submit a copy of the Plan by the end of July 1997.

The Roxboro Steam Electric Plant is a four-unit, 2477 megawatt, coal-fired electric generating facility located northwest of Roxboro on Hyco Reservoir in Person County. The 315-acre Landfill located on Company property southeast of the generating facility is used for the disposal of coal combustion by-products, primarily fly ash. A 4-acre area within the borders of the Landfill is also permitted for the disposal of demolition waste and asbestos. All property within at least 0.5 mile of the Landfill is owned by the Company.

Landfill History

The Roxboro Dry Fly Ash Landfill is essentially a fly ash monofill. The Landfill is located on top of the East Ash Pond which was abandoned in 1985. The East Ash Pond was constructed in the early 1960s by damming up a small valley. This valley is an extension of an arm of the larger valley that forms Hyco Reservoir. Coal ash was sluiced to the ash pond to settle, gradually filling the pond to a depth of 70 feet at the dam. The geologic conditions beneath the ash pond and in the adjacent vicinity consist of a thin soil cover over a complex series of igneous and metamorphic rock.

The Landfill is isolated from the watershed by a separation dike. Once the Landfill has reached capacity, perimeter ditches will divert all non-ash laden stormwater runoff from the Landfill area. Internal runoff and leachate is contained in the Landfill area. It is diverted to a retention pond and then to the West Ash Pond for treatment before discharged through a NPDES monitoring point. The underdrainage system is constructed of a minimum of three feet of coarse bottom ash (reclaimed from the ash pond) placed on top of the ponded ash. The underdrainage system provides a capillary break that along with the system of main and lateral drains facilitates the removal of water trapped in the ponded ash as new dry ash is placed in the overlying Landfill. Bottom ash is also used to construct vertical chimney drains that drain rainwater runoff falling on the active portion of the Landfill. Chimney drains connect to the underdrainage system, allowing the runoff to flow to the West Ash Pond. The conditioned ash (10% water is added to control dust and facilitate compaction) is placed in 12-inch loose lifts and compacted. The Landfill is developed in stages, both horizontally and vertically.

II. Waste Stream Characterization

The Landfill is essentially a fly ash monofill, with small amounts of coal rejects, concrete and asphalt, and asbestos also disposed.

Fly ash is a powdery nonhazardous substance resulting from the combustion of coal. Generally, ash is composed of silicon, aluminum, iron, and calcium in their oxide forms. Magnesium, potassium, sodium, and titanium are also present to a lesser degree as are even smaller concentrations of trace metals. Fly ash also contains small amounts of unburned carbon. Fly ash that is low in carbon content can be sold as an ingredient in concrete. Fly ash sold for concrete manufacturing, must be kept dry, while fly ash destined for the landfill is conditioned by the addition of water. It is estimated that conditioning adds 10% to the weight of the ash. Where indicated throughout this document, dry fly ash weights have been converted to wet ash weights to allow for comparisons. The following table summarizes the amounts of fly ash sold dry for concrete production and landfilled wet on site from 1990 through 1996.

Table 1. Fly Ash Generation at CP&L's Roxboro Plant

Year	Fly Ash Landfilled (wet tons)	Fly Ash Sold (dry tons)*	Total Fly Ash Generated (wet tons)
1996	513,527	73,590	594,476
1995	485,436	77,334	570,503
1994	416,653	101,536	528,343
1993	518,504	39,536	561,994
1992	619,305	35,680	658,553
1991	562,185	31,000	596,285
1990	496,913	29,501	529,364
Average	516,075	55,454	577,074

* Dry tons converted to wet tons by multiplying by 1.1.

Starting in the year 2000, the Company will begin the transfer of ash generated at the Mayo Plant to the Roxboro Landfill. In the first year, 20% of the ash generated at the Mayo Plant will be transferred to the Landfill. Ash transferred will increase in 20% increments until 100% of the fly ash generated at the Mayo Plant is transferred to the Roxboro Landfill by the year 2004. The amount of fly ash generated at the Mayo Plant is estimated to be 178,700 dry tons/year (196,600 wet tons).

Coal rejects (including spilled coal) are also landfilled. At the Roxboro Plant, coal is transported on conveyor belts from the coal pile to coal crushers. From the crusher, the coal is transported by conveyor belts to the tripper which directs the coal into silos that feed the pulverizers. The pulverizers reduce the coal to powder-sized particles that are injected into the boilers as fuel. During this process some coal falls from the conveyor belts, crusher, and tripper. Material that cannot be broken up in the pulverizer (rocks, pyrites, etc.) are rejected by the pulverizer along with usable coal. Rejects or spilled coal that is primarily coal is returned to the coal pile for reuse, while material that is primarily rocks or soil, is sent to the Landfill. Reviewing a 36-month period (4/93 through 3/96), approximately 60% of material could be returned to the coal pile as usable coal. The remaining material, mostly rock mixed with pyrites could be disposed in the landfill. The following table summarizes the amount of coal rejects placed in the on-site landfill from 1993 through 1996:

Table 2. Coal Reject Disposal

Year	Rejects (tons)
1996	1288
1995	856
1994	786
1993 (9 months)	581

Scrap **concrete and asphalt** are occasionally placed in an area of the Landfill specifically permitted for debris disposal. Volumes are dependent on renovation and outage activities at the plant. During 1996, approximately 752 tons of broken concrete and asphalt were disposed in the Landfill. This amount is elevated due to construction and renovation activities at the plant during the year. An average of 500 tons is estimated during any given year. Where feasible, broken concrete is used on site as a rip rap material to prevent erosion or as structural fill.

Asbestos is disposed in two discrete permitted upland areas on the west side of the Dry Fly Ash Landfill. Although the amount of asbestos placed in the landfill has steadily increased since 1992, the amount of asbestos removed from Company facilities is highly dependent on scheduled outages and abatement activities. An estimated 200 tons annually of asbestos-containing material is projected to be landfilled.

Table 3. Asbestos Waste Disposal

Year	Asbestos (tons)
1996	223
1995	130
1994	59*
1993	56
1992	20

*In 1994, approximately 4,129 tons of cooling tower fill from the Mayo Plant was also disposed in the Landfill. The cooling tower fill was a nonfriable asbestos cement material.

III. Waste Reduction Options

Coal Rejects

The Roxboro Plant generates an estimated 2,300 tons of spilled and reject coal per year. Approximately 60% of this volume (or 1380 tons) can be returned to the coal pile and reburned. Materials too dense to pass through any of the plant's 36 pulverizers are periodically rejected as a waste (approximately 920 tons annually). Rejects are typically small rocks, rock containing pyrites (iron sulfide), and coal. If these rejects were only small rocks, several alternative disposal options could be utilized. The presence of coal and pyrites, however, yield a waste that is best sent to a landfill for disposal. Eliminating the non-coal material before it reaches the pulverizer is not practical because it is such a small percentage incorporated in the coal (920 tons of rejects/5,000,000 tons of coal or <.02%).

Asbestos

Only a relatively small amount of asbestos (average 200 tons) is disposed annually. In the ten-year timeframe, the plant will continue to conduct asbestos abatement projects as necessary. No practical alternative disposal options exist, so landfilling of this waste continues to be the best option.

Concrete and asphalt

A small portion of the landfill is designated for the disposal of demolition debris such as concrete and asphalt from construction projects. Relatively clean concrete with minimal amounts of exposed metal is suitable as structural fill or as a rip rap material. The plant has a considerable length of intake and discharge canals as well as dikes along its ash pond and drainage canals that are lined with rock. As needed, concrete chunks could be used in place of natural stone as a rip rap material to prevent erosion. Relatively clean asphalt can be recycled as an ingredient in new asphalt. High transportation cost, however, only make this practical for projects at or in the immediate vicinity of the plant. Another option is to design renovation projects in a manner that reduces the generation of waste concrete and asphalt. **It is the Plant's goal to investigate the potential to reuse waste concrete and asphalt and to achieve an annual disposal rate of less than 400 tons/year within the next ten-year timeframe.**

Fly Ash

Of the total amount of fly ash produced annually (577,000 tons) during an average year, only a small percentage (approximately 10% or 55,500 tons) is suitable as an ingredient in concrete. Although there are numerous reasons for minimal ash utilization (e.g., limited market demand, comparatively low on-site landfill/ash pond disposal costs, requirement for dry fly ash handling, high fly ash transport costs, etc.), the most constraining factor limiting it's entry into the primary market arena (i.e., concrete admixture) is the amount of residual carbon content remaining in the ash. That is, only low carbon fly ash is suitable for use as a concrete admixture, and the relative yield and availability of low carbon ash is comparatively small. Ironically, with the installation of low nitrogen oxide (NO_x) burners at the Roxboro Plant, the available supply of low carbon fly ash will be reduced further (i.e., use of low NO_x burners leads to a higher unburned carbon content in the fly ash). Due to the inherent technological constraints associated with the burning of coal while simultaneously minimizing the formation of NO_x (i.e., the process is not 100% efficient), a significant amount of "residual" energy remains in the fly ash as unburned carbon. The amount of unburned carbon, normally expressed as percent loss-on-ignition (% LOI), is typically on the order of 15% (ranges are approximately 7-18%).

Other potential uses for fly ash are as a structural fill or a flowable fill material. These are low value options which are dependent on the distance to the construction project due to high cost of transportation and the low cost of natural materials (i.e., soil).

IV. Waste Reduction Strategy

During 1997 and 1998, the Company is installing an innovative fly ash separation technology at the Roxboro Plant to separate existing fly ash into low carbon ash and high carbon ash streams. The former is suitable as a concrete admixture and the latter fraction is sufficiently carbon-enriched to be re-used as a fuel source. Once installed, this equipment will (1) physically separate the fly ash into a "low" LOI (i.e., <3%) ash fraction and a "high" LOI (i.e., >50%) ash fraction, and (2) re-cycle the high LOI ash stream as an energy source. The ash to be re-cycled (i.e., separated and re-burned) as part of the project scope would include the dry fly ash produced at the Roxboro Plant and a portion of the fly ash generated at the Mayo Plant. Combined this represents approximately 500,000 dry tons annually (i.e., ~ 50% of the total volume generated by CP&L).

All equipment and systems necessary to support this project will be sited at the Roxboro Plant. A simplified block diagram of the project is shown in Figure 1; the details of the fly ash separation and fly ash re-burn project phases (hereafter referred to as Phases I and II, respectively) are discussed in detail below:

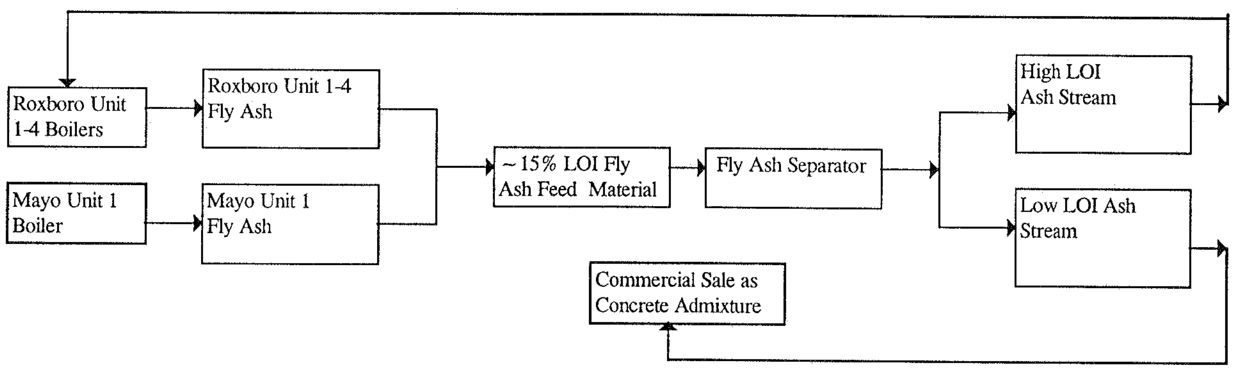

Figure 1. Process Flow Diagram for Recycling of Residual Dry Fly Ash

Phase I - Fly Ash Separation

Phase I of this $1.55 million project involves the design, fabrication, installation, and operation of the equipment required to physically separate the combined Roxboro and Mayo Plants' dry fly ash feed material into high and low LOI streams (Figure 1). Separation Technologies, Inc. (STI) developed this technology based on an electrostatic separation principle wherein negatively charged particles (i.e., those that are also carbon depleted) in the feed material are attracted to a positively charged electrode, and conversely, the positively charged particles (i.e., those that are carbon enriched) are attracted to a negatively charged electrode. When the feed material is fed into a counter rotating conveyor belt located between two closely spaced parallel electrodes in a high magnetic field, this technology yields continuous and high volume separation of the ash (refer to Figure 2 below).

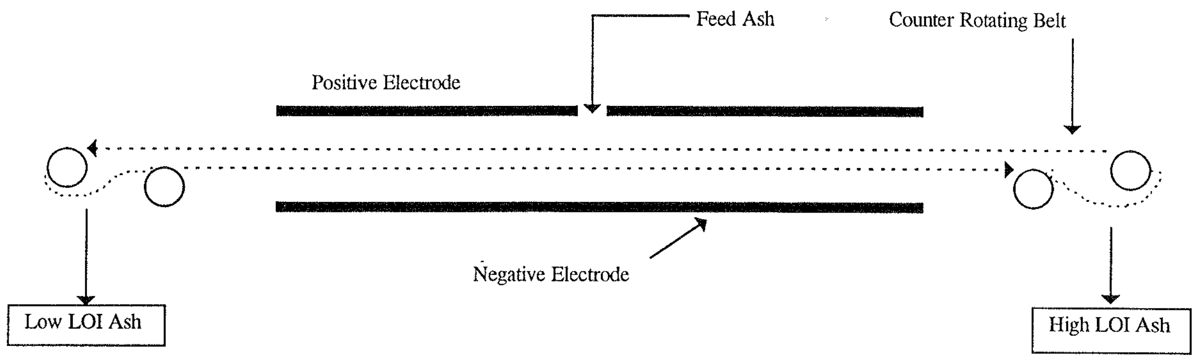

Figure 2. Diagram of Fly Ash Electrostatic Separator

The separation process flow equipment configuration design has been completed and construction is underway. Construction includes appropriately sized ash storage silos (i.e., for the feed fly ash, low LOI fly ash, and high LOI fly ash), fly ash feed system (i.e., rotary feed valves, vibrating screen, fluidized conveyers), electrostatic separator(s), positive-pressure conveying system (i.e., for transfer of the low/high LOI ash to their respective silos), and a dust collection system (i.e., to maintain the fly ash feed and separator systems under slightly negative pressure). A portion of the ash conditioning system will be retained to allow landfilling of ash during maintenance of the separator system or during times when ash generation exceeds capacity of the system. The first separator unit is scheduled operational by September 1997, with the second unit operational by July 1998. Each unit has the capacity to handle 250,000 dry tons/year.

Phase II - Ash Re-Burn

The scope for Phase II of this project includes development of the optimum design configuration, and installation of the necessary equipment, for transport, and re-injection of the high LOI ash into one of the Roxboro Unit boilers. The conceptual design configuration includes pneumatic transfer of the high LOI ash to a storage silo. From the silo the high LOI ash will be placed on coal belts and mixed with coal during coaling up operations. Work is in progress to determine the optimum location and sizing of the equipment. A test burn of this material is scheduled during the latter part of 1997.

Mayo Plant's Fly Ash

Starting in the year 2000, fly ash from the Mayo Plant will be transported to the Roxboro Plant. The first year approximately 20% of the Mayo Plant's generation (39,300 wet tons) will be sent to the Roxboro Plant. Each of the next four years, this will be increased until 100% of the ash is being transported to the Roxboro Plant. This fly ash could be blown into the storage silos and processed by the carbon separation equipment or conditioned for landfill disposal. The amount of ash processed depends on the available capacity of the separation units and outages at the Roxboro Plant. For the purpose of this report, it is assumed that all ash transported to the Roxboro Plant by the Mayo Plant will be placed in the Landfill.

V. Waste Reduction Goal

The Roxboro Plant has established a goal of reducing the amount of material being placed in the on-site landfill by 65% by the year 2005. This reduction represents an annual diversion from the Roxboro Plant's

Dry Fly Ash Landfill of over 500,000 tons. This reduction is based on the successful installation and operation of carbon separation equipment at the Roxboro Plant with the resulting increase in ash sales as summarized below:

Table 4. Waste disposal (in thousands of tons) at the Roxboro Plant's Landfill, 1996-2005.

Waste Material	Annual Average Generated	1996 Actual	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fly Ash (Roxboro)	577.1	594.5	474.1	195.5	68	68	68	68	68	68	68
Fly Ash (Mayo)	196.6	0	0	0	0	39.3	78.6	117.9	157.2	196.6	196.6
Fly Ash Total	773.7	594.5	474.1	195.5	68	107.3	146.6	185.9	225.2	264.6	264.6
Rejects[1]	0.9	1.29	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
CD Wastes [2]	0.5	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Asbestos [3]	0.2	0.22	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total	775.3	596.8	475.7	197.1	69.6	108.9	148.2	187.5	226.8	266.2	266.2
Percent Reduction			38.6%	74.6%	91.0%	86.0%	80.9%	75.8%	70.7%	65.7%	65.7%

[1] Projected 920 tons/year based on 36 months of data.

[2] Projected 500 tons/year based on historical disposal rates.

[3] Projected 200 tons/year based on historical disposal rates.

Assumptions in these calculations include an estimated downtime of 7.5% for the separation equipment and an average fly ash generation of 577.1 tons (wet weight) based upon the past six year's generation. Ash generated in excess of the carbon separation units capacity is landfilled as is 100% of the ash transferred from the Mayo Plant. Scheduled unit outages, demand for the mineral product, and utilization of the carbon rich product will impact these calculations. Reduction in the amount of material disposed in the landfill actually peaks at 91% in 1999 after the carbon separation equipment is fully installed and prior to the start of the transferring of ash from the Mayo Plant. Ash transportation costs from Mayo to Roxboro is expensive and alternative disposal options will be considered in coming years. Low value options, such as structural fills will be investigated, but these involve transportation of ash to the structural fill project. An additional carbon separation unit is also a possibility, but is contingent on market demand for the mineral product.

On the horizon, additional regulatory programs, such as for ozone and fine particulates, have the potential to change the quality of fly ash and jeopardize the gains in waste reduction described in this document. This document will be periodically reviewed and updated to reflect changes in waste generation, recycling options, and regulatory mandates.