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November 2, 2020

VIA ELECTRONIC FILING

Ms. Kimberley A. Campbell, Chief Clerk
North Carolina Utilities Commission
Dobbs Building
430 North Salisbury Street
Raleigh, North Carolina 27603

Re: DEP Late-Filed Exhibit Nos. 4, 5, 22, and 23
Docket No. E-2, Sub 1219

Dear Ms. Campbell:

Per the request of the North Carolina Utilities Commission during the Duke Energy Progress, LLC ("DEP") evidentiary hearing, enclosed for filing on behalf of DEP in the above-referenced proceeding are *Late-Filed Exhibit Nos. 4, 5, 22, and 23*, including supporting workpapers.

Please do not hesitate to contact me should you have any questions. Thank you for your assistance with this matter.

Very truly yours,

/s/Mary Lynne Grigg

MLG:kjg

Enclosures

Duke Energy Progress, LLC's
Late-Filed Exhibit No. 4

Docket No. E-2, Sub 1219

Ash Basin Information

Site	Facility Type	Basin Name	Stopped Reciept of CCR	Stopped Receipt of Process Water and/or Stormwater (considering gravity flow as stormwater inflow)	Total Quantity Excavated as of July 31, 2020 (M tons)[1]	2020 Quantities (tons) CCR Inventories as of July 31, 2020	2019 Quantities (tons)	2018 Quantities (tons)	2017 Quantities (tons)	2016 Quantities (tons)	2015 Quantities (tons)	Quantity Estimated at Retirement (M tons)
DEP												
Asheville	Pond	1964 Basin	2020	2020	2.24	1,110,698	1,138,602	1,821,370	2,546,254	3,033,389	2,606,500	3.16
	Pond	1982 Basin	2017	2016	4.75	0	0	0	0	0	627,000	3.70
Cape Fear	Pond	1956 Basin	1963	NA	0	418,800	418,800	418,800	418,800	418,800	418,800	0.42
	Pond	1963 Basin	1978	NA	0	859,200	859,200	859,200	859,200	859,200	859,200	0.86
	Pond	1970 Basin	1978	NA	0	838,800	838,800	838,800	838,800	838,800	838,800	0.84
	Pond	1978 Basin	1985	NA	0	832,800	832,800	832,800	832,800	832,800	832,800	0.83
	Pond	1985 Basin	2012	NA	0	2,815,200	2,815,200	2,815,200	2,815,200	2,815,200	2,815,200	2.82
HF Lee	Pond	1950 Basin	1962	NA	0	268,800	268,800	268,800	268,800	268,800	268,800	0.27
	Pond	1955 Basin	1962	NA	0	529,200	529,200	529,200	529,200	529,200	529,200	0.53
	Pond	1962 Basin	1980	NA	0	910,800	910,800	910,800	910,800	910,800	910,800	0.91
	Pond	1982 Basin	2012	2019	0	4,515,600	4,515,600	4,515,600	4,515,600	4,515,600	4,515,600	4.52
	Pond	Polishing Pond	2012	NA	0	9,100	9,100	9,100	9,100	9,100	9,100	0.01
Mayo	Pond	Ash basin	2019	2019	0	6,600,000	6,600,000	6,600,000	6,600,000	6,600,000	6,600,000	6.60
Robinson	Pond	Ash Basin	2012	2020	0.01	2,891,762	2,904,000	2,904,000	2,904,000	2,904,000	2,904,000	2.90
Roxboro	Pond	East Ash Basin	1986	2019	0	7,073,881	7,073,881	7,073,881	7,073,881	7,073,881	7,073,881	7.07
	Pond	West Ash Basin	2018	2019	0	12,974,500	12,974,500	12,974,500	12,876,970	12,828,895	12,767,697	12.97
Sutton	Pond	1971 Basin	2014	2016	3.52	0	0	118,007	2,304,392	2,922,510	3,815,361	3.82
	Pond	1984 Basin	2013	2016	3.27	0	0	711,612	1,317,155	2,516,033	2,834,400	2.83
Weatherspoon	Pond	Ash Basin	2011	2015	0.77	1,397,429	1,561,853	1,838,857	2,380,268	2,450,000	2,450,000	2.45

Notes:
1. Excavation quantities tracked as part of basin closure. May not inlcude excavation for general O&M cleanouts or historical beneficial use.
2. Unless noted, yearly estimated quantities were as of the end of the year.

Duke Energy Progress, LLC's
Late-Filed Exhibit No. 5

Docket No. E-2, Sub 1219

Late Filed Exhibit #5 – Requesting the 2006 20-Year CCP Management Plan

The 2006 20-year CCP Management Plan, included in this late filed exhibit, was also provided to the Public Staff in data request 133-6.

URS

April 10, 2006

Progress Energy
Strategic Engineering Unit
Attn: Daniel Donochod and Thomas Travers
410 South Wilmington Street
Raleigh, NC 27601

Subject: Progress Energy – 20-Year CCP Management Plan (Final Submittal)

Dear Dan and Tom:

URS Corporation (URS) is pleased to submit the enclosed final submittal of the 20-Year CCP Management Plan (Plan). We have included for your use, five (5) copies of the final Plan – two (2) copies are in full color and three (3) copies are in black and white.

This project has been a challenging, yet extremely rewarding experience for URS. We have enjoyed performing this scope while working together with Progress' CCP Team of professionals. We sincerely hope that this product is useful to Progress Energy as a planning tool and that it facilitates forward thinking for long-term CCP management.

As we have already discussed, Steven Putrich would be happy to come down to your office, at your convenience, to go over the essential elements included in this design submittal or to discuss future opportunities involving the implementation of this Plan.

Please do not hesitate to contact us if you have any questions or concerns regarding the enclosed information or any other matters.

Sincerely,

URS CORPORATION

Steven Putrich, P.E.
Senior Manager, Power Generation

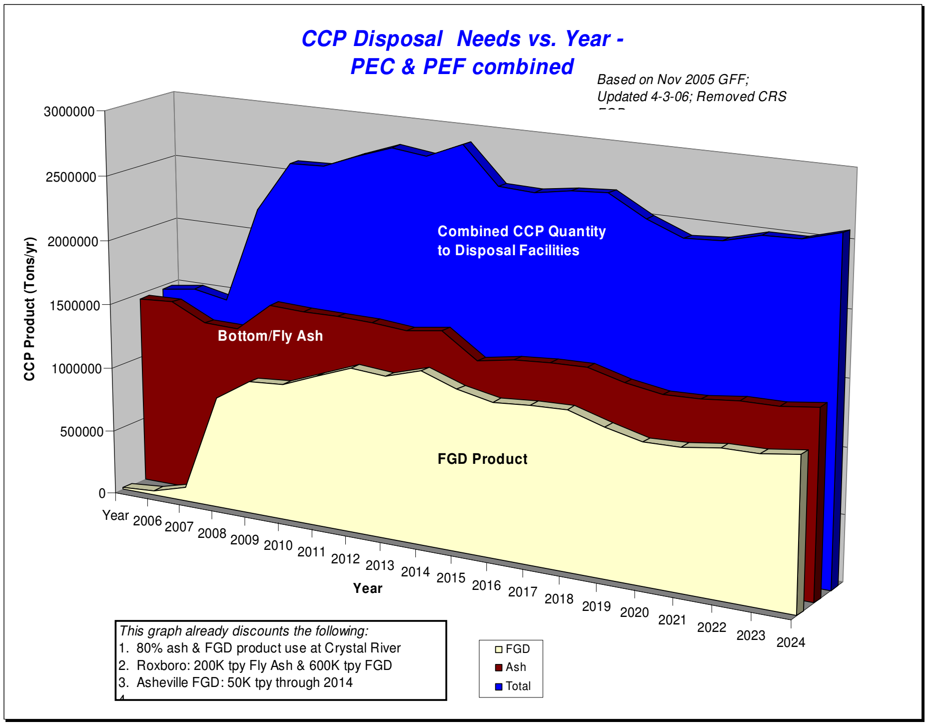
Jay D. Mokotoff, P.E.
Project Manager

cc: Ginny Farrow – Progress
John Toepfer, P.E. – Progress
Steve Jenkins, P.E. – URS
Nick Golden – URS
Sherry Voros – URS
File 13810810

URS Corporation
1375 Euclid Ave., Suite 600
Cleveland, OH 44115-1808
Tel: 216.622.2400
Fax: 216.622.2428

Progress Energy

20-YEAR CCP MANAGEMENT PLAN



April 12, 2006

Progress Energy
410 South Wilmington Street
Raleigh, NC 27601

Prepared in collaboration with:

URS

1375 Euclid Avenue, Suite 600
Cleveland, Ohio 44115
(216) 622-2400
steven_putrich@urscorp.com

Progress Energy

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Plan Overview – Part I

A 20-year strategy was developed for the engineered management and disposal of coal combustion products (CCP) for each of Progress Energy's nine coal-fired power plants. The coal fired power plants considered in this 20-year CCP plan (Plan) are located in North Carolina (Asheville, Cape Fear, Lee, Mayo, Sutton, Roxboro and Weatherspoon); South Carolina (Robinson); and Florida (Crystal River). The CCPs considered in this Plan are bottom ash, fly ash, and flue gas desulfurization (FGD) byproducts of both wet and dry scrubbers. Accumulated CCP disposal quantities for the 20-year period for all PEC & PEF plants includes: 19,471,500 tons of ash (fly/bottom ash combined to be managed in a new disposal facility) and 18,300,000 tons of FGD byproducts. The Plan is divided into two parts. **Part I** provides the general features of the Plan including overall project assumptions, review of existing CCP management practices, future CCP projections, beneficial reuse, drivers for change, a review of long-term CCP management/disposal options, and organizational considerations. **Part II** presents the long-term disposal management plan, and recommendations on a plant-by-plant basis and an overall conclusions section with a summary of the plans developed for each plant.

The main driver for Progress' CCP Team conducting this Plan is that the current facilities at each plant for managing or disposing of CCP (primarily ash ponds) are at or near capacity. In this Plan, existing CCP disposal facilities at all plants are assumed to reach capacity in 2010, with the exception of Roxboro, Mayo and Crystal River. Roxboro's existing monofill is projected to reach capacity at the end of 2013, and Mayo's existing ash pond is projected to reach capacity at the end of 2015. Crystal River's existing monofill is not currently permitted to receive FGD byproduct; therefore a new facility is required once Crystal River's FGD system goes on-line beginning in 2009.

Project Assumptions

Several overall project assumptions were utilized in the development of the Plan. The most important assumptions include:

- Short-term CCP management/disposal options address years 2006-2010 and will be the responsibility of the Regions to address. Several plants will need short-term solutions implemented in order to have enough capacity to reach 2010. The most critical plants are Asheville and Sutton. Long-term CCP management/disposal options address years 2010-2025.
- Disposal quantities are developed based on the November 2005 Generation and Fuel Forecast (GFF). Disposal quantities have been adjusted for only a limited number of plants (Asheville, Roxboro, and Crystal River) where Progress is assured of existing or guaranteed contracts for the sale of CCPs. For the purposes of this Plan, speculative beneficial reuse of CCPs is not considered an appropriate long-term management strategy due to its unpredictable nature and markets.

This Plan concentrates on long-term CCP disposal options, provides an evaluation of each of the viable options, and ultimately provides a single recommended option for the management of

CCPs on a plant-by-plant basis. Care is taken to present a wide-array of disposal options and not to limit the potential solutions to only technologies currently utilized by Progress. Potential options that were either clearly impractical or known to have unacceptably high costs or risks due to lack of product/technology development, or have unproven performance in the industry, were not considered for this study. Disposal options included both wet and dry disposal, based primarily on the following: Progress' proposed FGD technology; overall CCP forecasted production rates, the plants' existing infrastructure, and economics of converting an existing wet handling system to a dry handling system. Progress' existing CCP management program generally consists of wet sluicing of ash into ash ponds, with a few exceptions. The Roxboro, Mayo and Crystal River Plants are the only plants currently utilizing some form of dry handling.

Options Evaluated

The following wet disposal options were evaluated:

- Option W1 – New Lined Pond
- Option W2 – Multiple Cycled Ponds and Monofill Disposal
- Option W3A – Ash Pond Excavation, Monofill Disposal, and Pond Relining
- Option W3B – Ash Pond Excavation, and Restacking Over a Separatory Liner
- Option W4 – Dike Extensions on Existing Pond Over Separatory Liner
- Option W5 – Geotubes Stacked on Existing Pond Over Separatory Liner
- Option W6 – Geotubes Over Separate Lined Structure
- Option W7 – Gypsum Wet Stacking

The following dry disposal options were evaluated:

- Option D1 – Monofill
- Option D2 – Monofill Sited on Existing Pond Over Separatory Liner

Drivers for Change

Several motives are provided as the basis for changes in CCP management methods; these are referred to as the "drivers for change". The drivers for change have greatly impacted both plant operations and the means by which CCP management is carried out and planned for in the future. Those drivers with the greatest level of impact generally include the following categories: regulatory; environmental and public pressures; increasing fuel variability; past CCP management practices; and emission control systems impacts. Specific regulatory impacts discussed in this report are those due to Progress' commitment to the requirements of the Action Plan developed by the Utility Solid Waste Activities Group (USWAG) and the recent finalization by the North Carolina Department of Environment and Natural Resources (NCDENR) of Progress' Ash Reuse Permit. In addition, more stringent regulations for water quality standards, air emission controls, regulated pollutants and ash discharge permits are making a significant impact on the approach to CCP management.

Organization

This report provides an overview of Progress' current CCP management organization and offers recommendations for improvement of the organization in the future. The existing organization for Progress' CCP management is composed of both Regionalized and Centralized structures. A recommended CCP management organizational structure is presented in order to provide clear boundaries for all Progress departments involved. A dedicated team, to be called the CCP Review Team and headed by the Technical Services Section (TSS) is recommended. This team includes coordination among the plants, the Environmental Services Section (ESS), Plant Construction Department (PCD), Regional Engineering (RE) and Regulated Fuels Department (RFD), with periodic support from the finance and legal departments. It is further recommended that all funding, design and implementation activities required for CCP long-term depositories be sought via the PCD, with actual funding through the Capital Planning authorization process.

Industry CCP Survey

For this CCP study, a survey was performed of members of the American Coal Ash Association (ACAA) and other non-member utilities using a series of questions focused on CCP management structure, roles and responsibilities, and operations at utilities with coal-fired plants located throughout the U.S. Survey results and findings, along with feedback from the ACAA director and various utilities, provided a wide range of responses regarding corporate and plant-based management responsibilities and structure. The findings and responses along with general industry knowledge were compiled and summarized in this report. Although there are certain trends and consistencies that appear common, such as outsourcing of CCP marketing and disposal management functions, as well as engineering for large CCP projects, each utility has its own particular brand or style of internal structure with regard to corporate, regional and plant-based staffing. It is likely that environmental regulatory trends will dictate the long-term strategies of the majority of CCP management programs. Few entities have the traditional larger internal structures to support CCP management activities, but instead have divided or shared those functions among fuels, environmental, engineering, and plant operations, with some outsourcing of functions on an as-needed basis. Utilities that have the most optimized and cost-effective CCP management programs operate with well-thought out, strategic and updated CCP management plans that keep current with plant needs, fuel strategies and environmental controls.

Part II of Plan – Plant Specific

Part II of this Plan provides CCP Disposal Management Plans for each of the nine plants. The following items are discussed and evaluated:

- Existing CCP management and future CCP projections for ash and FGD materials;
- Current and future beneficial reuse opportunities;
- Plant-specific assumptions;
- On-site and off-site land use options; and
- Comparative evaluation of each of the viable disposal options specific to each plant.

Not all disposal options were considered for each plant. The options considered were based primarily on existing site constraints, land availability, type and quantity of CCP materials being disposed, Progress' proposed FGD technology, and finally Progress' preference. The comparative evaluation of each viable disposal option for each plant was based on four key screening criteria believed to be the most critical to the success of the long-term CCP Management Plan. The evaluation criteria and their respective weighting include: Technical Considerations (5% weight); Environmental, Permitting and Regulatory Considerations (25% weight); Site Development/Land Availability Considerations (5% weight); and Economic Considerations (65% weight).

Cost Assumptions

As part of the cost evaluation, each of the alternatives were evaluated for the long-term disposal of CCP and costs were categorized into either capital costs, O&M costs, or miscellaneous costs. Several costing assumptions were used to develop the cost estimates; however a few of the most pertinent costing assumptions are the following:

- Costs are presented in 2006 dollars for CCP management through the year 2025. Costs do not include inflation ("time value of money" is not considered) or Allowance for Funds Used During Construction (AFUDC).
- Cost estimates include a 15% markup on capital costs to account for unknown and unlisted items and a 10% markup on capital costs to account for a contingency and for engineering, consulting and permitting. No markup or other contingency has been included for the O&M costs.

In addition to the cost estimation that has been conducted for each of the viable disposal options considered at each plant, a generalized CCP Capital Cash Flow Projection has been developed for each plant. This projection provides a visual layout of the estimated capital costs for the disposal option recommended for each plant.

Overall Plan Recommendations & Costs

In summary, each plant has been evaluated at a conceptual level in accordance with the overall project assumptions as well as several plant-specific assumptions. A summary of the recommended disposal option for each plant and the respective total cost (capital and O&M) and total cost per ton is provided in the following table.

Summary of Recommended Plant Disposal Options			
Plant	**Recommended Disposal Option**	**Estimated Total Cost (includes O&M)**	**Estimated Cost/ton**
Asheville	Option D2 – Monofill Sited over Existing Pond over Separatory Liner	$46,398,000	$8.88/ton
Cape Fear	Option D2 – Monofill Sited over Existing Pond over Separatory Liner	$37,396,000	$10.85/ton
Crystal River	Option D1 – Monofill	$37,809,000	$6.46/ton
Lee	Option W1 – New Pond	$17,045,000	$10.86/ton
Mayo	Option D1 – Monofill	$41,563,000	$6.39/ton
Robinson	Option D1 – Monofill	$26,494,000	$14.67/ton
Roxboro	Option D1 – Monofill	$50,579,000	$5.96/ton
Sutton	Option D1 – Monofill	$44,420,000	$9.32/ton
Weatherspoon	W4 – Dike Extension	$4,204,000	$37.37/ton
Total Fleetwide		**$305,908,000**	

The recommendation of this Plan is that the majority of the plants implement conversion to dry handling systems and manage CCPs via a dry CCP disposal solution in the form of a new monofill (Option D1) or a new monofill constructed over existing ash ponds (Option D2). For each of the plants that are currently managing ash with wet ponds and where dry disposal is the preferred long-term solution, dry conversion will be required. Although the evaluation of the potential for future beneficial reuse of CCP was beyond the scope of this project, dry ash handling systems can open the door to more lucrative reuse/sales in the cement and concrete industries.

The predominance of the selection of dry disposal solutions has in large part been dictated by planned FGD systems, and in some cases, plants that were already operating a dry ash handling system (Roxboro, Crystal River and Mayo - for clarification, Mayo's ash is dry collected and put in silos, then wet sluiced to an on-site pond). For those plants that have already been converted, there was no driver to switch to a long-term wet CCP disposal solution. Progress' plan that each plant's long-term CCP plan provide for one common disposal facility, either wet or dry, was also a primary driver for the recommendation for dry handling for 7 of the 9 plants evaluated.

Preliminary cost estimation indicates that Option D1 has an associated total cost ranging from $5.96/ton to $14.67/ton. The large total unit cost range is due to the size of the plant, the projected tonnage of CCPs, transportation distance, and available land for construction of the monofill. The monofills recommended for Asheville and Cape Fear are to be sited above the existing ash pond (Option D2) and have an associated total unit cost of $8.88/ton and $10.85/ton, respectively. This option has been recommended because it was determined that the existing ponds represented the only available land in close proximity to the plant that met the preliminary siting criteria.

This study recommends that the Lee Plant, which is not currently scheduled for an FGD system retrofit, construct a new lined ash pond (Option W1) to manage CCP for a cost of $10.86/ton. For Weatherspoon, which has been scheduled for plant retirement in 2013, the recommendation is for a dike extension over the existing pond and utilization of a separatory liner (Option W4) for a cost of $37.37/ton. The cost for disposal at Weatherspoon is considerably higher because of the relatively low quantity of CCP production, the overarching requirement to install a liner under CCP disposed of after 2010, along with the costs being amortized over a relatively short time period (3 years) until the plant's retirement.

Part I: CCP Management Plan – General Features

A 20 Year long-term disposal management plan for Coal Combustion Products (CCP) has been prepared for the nine PEC/PEF coal combustion plants located in North Carolina, South Carolina and Florida. The plants included in this CCP Management Plan (Plan) are listed below:

- North Carolina
  - Lee Plant – Goldsboro, Eastern Region
  - Cape Fear Plant – Moncure, Eastern Region
  - Sutton Plant – Wilmington, Eastern Region
  - Weatherspoon Plant – Lumberton, Eastern Region
  - Asheville Plant – Skyland, Western Region
  - Mayo Plant – Roxboro, Western Region
  - Roxboro Plant – Roxboro, Western Region
- South Carolina
  - Robinson Plant – Hartsville, Eastern Region
- Florida
  - Crystal River Plant – Crystal River, Southern Region

This plan is focused on the development of a 20-year strategy for engineered disposal solutions for CCP including: bottom ash, fly ash and Flue Gas Desulfurization (FGD) byproducts. FGD byproducts consist primarily of calcium sulfate dihydrate (gypsum) from wet FGD systems or calcium sulfate/sulfite from dry FGD systems, and finally, FGD Waste Water Treatment (WWT) Sludge.

PART I SECTION 1: OVERALL PROJECT ASSUMPTIONS

The following assumptions were utilized in the development of the 20-year CCP Management Plan:

- The Plan will concentrate on long-term CCP management/disposal options (2010-2025). This study does not address beneficial reuse with the exception of the known existing contracts. These include:

  The Plan will consider only firm beneficial reuse contracts:

  - Crystal River – 80% ash utilization and 80% gypsum utilization
  - Roxboro/Mayo – gypsum 600K tons per year (tpy)
  - Roxboro – 200K tpy fly ash utilization
  - Asheville – gypsum 50K tpy (through 2014)

- This Plan does not consider ash re-use/structural fill projects.
- **The November 2005 GFF serves as the basis for future CCP projections**.
- Short-term CCP management/disposal options address years 2006-2010 (it is the responsibility of the Regions to address short term plans). Long-term CCP management/disposal options address years 2010-2025, starting January 2010 through the end of 2025 (for a total of 16 years). Several plants will need short term solutions implemented to provide on-site disposal management through 2010. The most critical ones are Sutton and Asheville.
- Licensing/permitting/design activities will need to commence in 2006 to be ready to receive CCP for disposal in 2010.
- Based on coal projections, it is assumed that of the coal to be received, approximately 25% will be opportunity coal (higher ash coal containing approx. 20% ash) and 75% will be contract coal (normal ash coal containing approx. 12% ash). This equates to a weighted average of 14% total ash.
- This Plan addresses how mill rejects (i.e. pyrite) are currently being managed at each plant, but will not include future pyrite management strategies.
- New monofills and new ponds cannot be sited within the 100-year floodplain.
- CCP must be disposed of within new lined facilities. However, short term solutions (i.e. restack) to be implemented prior to 2010 and outside of this plan may or may not include a liner.
- The quantity of CCP disposal required is calculated by the projected quantities of CCP produced (from the GFF) minus the quantity of contracted beneficial reuse. The plan will be updated annually based on the most current, published GFF data.

- For evaluation of the long-term disposal options, four evaluation criteria are used, the following weightings were used for those four evaluation criteria:
  - 65% Economic considerations
  - 25% Environmental, permitting and regulatory considerations
  - 5% Technical considerations
  - 5% Site development, land availability considerations
- January 1, 2006 was used as the internal deadline for environmental controls decisions on a plant by plant basis. The Plant Construction Department (PCD) provided the direction. Update made on 3/31/06 when official decision was made to not put scrubbers on CR 1 & 2 units. See **Section 3** for Table including SO_2 removal technology by plant.
- Site-specific exclusionary criteria have also been applied in the evaluations when appropriate to address state or location–specific mandates that limit the disposal options considered. Therefore, wet ponding of ash has been ruled out for the Crystal River site due to difficulties with permitting new ponds in that state.
- Cost Estimation Assumptions are provided in **Section 5**.
- NOTE: A list of plant-specific assumptions has been developed by the Progress/URS team and is listed in **Part II** of this Plan.

SECTION 2: Existing CCP Management

Progress' existing CCP management program generally consists of wet sluicing of ash into ash ponds, with a few exceptions. The Roxboro, Mayo and Crystal River Plants are the only plants currently utilizing some form of dry handling methods. **Table 1.1** shows current ash production, handling and disposal methods. As of the writing of this document, only the Asheville plant is currently producing FGD byproduct (gypsum from a wet FGD system). However, Progress' air compliance strategy includes several technologies for SO_2 removal.

2.1 SHORT-TERM MANAGEMENT

Short-term CCP management strategies will be developed and implemented by Progress' Regional Engineering as required to meet disposal needs through 2010. This will allow for the necessary time to plan, design, permit, fund, and construct new long-term management disposal options. Short-term management strategies include alternatives such as ash restacking, dike extension, and internal diking, many of which are planned and being implemented on a regional level. Therefore, this CCP Disposal Management Plan concentrates on long-term solutions from 2010 through 2025.

Extending the life of existing CCP disposal facilities to 2010 will be more difficult for some plants than others. In the West Region, Asheville plant is the most critical. However an ash restacking/internal diking project is underway which is expected to provide from 18 to 24 months of additional ash capacity. The East Region has several plants with ash ponds near capacity, with Sutton and Cape Fear probably the most critical. Potential short term solutions for Sutton include an internal diking or vertical dike extension project. In either case, the Regional Engineers are taking the lead on providing ash storage capacity to 2010. The CCP team will assist the Regions as needed in identifying and implementing short term solutions.

SECTION 3: Future CCP Projections

The projected coal burn and gypsum generation values (Progress Energy Projected Coal Burn Table, November 2005 GFF) were used as the basis for developing the future projections presented in this Plan. A summary of accumulated ash (bottom ash and fly ash) disposal and accumulated FGD byproduct disposal beginning in the year 2010 through the end of 2025 is given in **Table 1.1**. Accumulated disposal amounts are also shown graphically in **Figure 1.1**. The CCP Generation Tables for each plant, projected from 2006 through the end of 2025, are provided in **Appendix A**. For all plants, it has been assumed that 75% of the total projected coal burned will be typical contract coal (12% ash), and 25% of the coal burn will be opportunity high ash coal (20% ash). This results in an average ash content of 14%. The projection data will be reviewed annually and updated appropriately as part of the annual Plan update.

Table 1.1 Projected CCP Accumulation 2010 -2025.

Summary of Required CCP Disposal from 2010 through 2025[1]				
Plant	**Current Ash Handling System**	**Accumulated Ash Disposal (tons)**	**Proposed SO_2 Removal Technology**	**Accumulated FGD Disposal (tons)**
Asheville	Wet	2,352,900	Wet (Gypsum)	2,872,300
Cape Fear	Wet	1,670,100	Dry FGD[2]	1,777,000
Crystal River	Dry	3,062,900	Wet (Gypsum)[3]	2,791,900
Lee	Wet	1,569,400	N/A	0
Mayo	Wet (bottom & fly ash) Dry (fly ash)	2,037,100	Wet (Gypsum)	4,465,600
Robinson	Wet	841,000	Dry FGD	964,500
Roxboro	Wet (bottom) Dry (fly ash)	5,104,300	Wet (Gypsum)	3,386,100
Sutton	Wet	2,721,300	Dry FGD[4]	2,042,600
Weatherspoon	Wet	112,500	N/A	0
Total	N/A	**19,471,500**	N/A	**18,300,000**

[1] All nine plants are assumed to reach capacity in 2010 with the exception of Crystal River, Roxboro, and Mayo. The Roxboro Plant monofill will reach capacity in 2015 and the Mayo Ash Pond will reach capacity in 2016 based on ash loading only (POG Ash Management 2004 Business Plan).

[2] Cape Fear is currently evaluating Furnace Sorbent Injection (FSI). Should FSI be selected for SO2 removal, CCP generated will be less than dry FGD quantity used in this study.

[3] CR 4 & 5 only.

[4] Sutton 3 only.

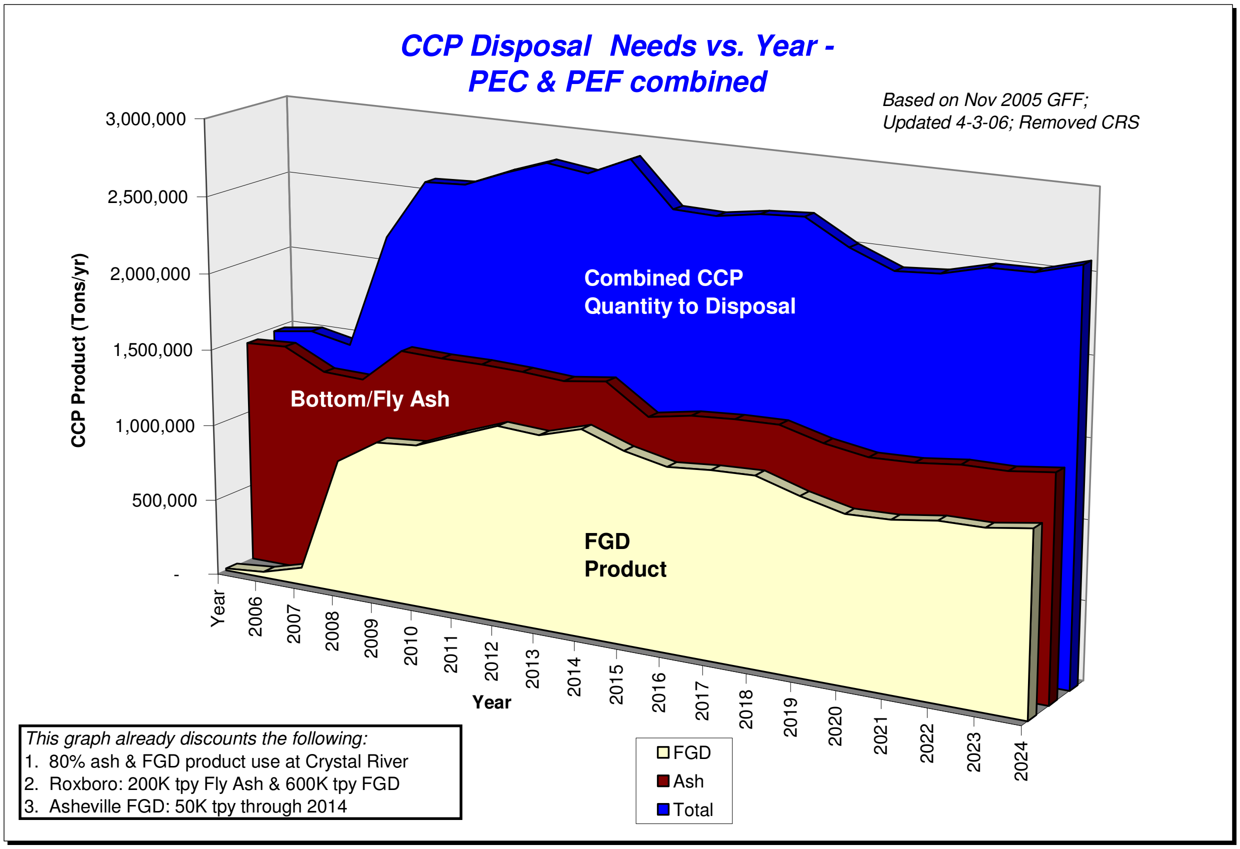


Figure 1.1 Projected CCP Disposal Amounts 2005 -2025.

SECTION 4: DRIVERS FOR CHANGE

4.1 REGULATORY

4.1.1 Utility Solid Waste Activity Group (USWAG) Action Plan

In May 2000, the Environmental Protection Agency (EPA) determined that coal combustion products (CCP) were not hazardous wastes. However, EPA had concerns with how the industry was disposing of CCP. Specifically, the EPA had concerns with the low percentage of ash ponds with groundwater monitoring and the placement of CCP into sand and gravel pits without appropriate engineering controls. The EPA also wanted the industry to consider dry ash handling prior to constructing a new monofill or ash pond. The EPA stated their intent to develop regulations that would require environmental protection constraints similar to those of the Federal 40 CFR Subtitle D (solid waste) regulations to govern the disposal of CCP in monofills and ash ponds. The EPA planned to have draft regulations in late 2006 with implementation in late 2007; however, this schedule will likely require additional extension.

The Utility Solid Waste Activity Group (USWAG) developed an Action Plan to address EPA's concerns identified above. The Action Plan will be a voluntary approach to be implemented by the utility industry. The industry's plan is that if all utilities address EPA's concerns, EPA would not need to develop Subtitle D regulations for CCP. These regulations would presumably force utilities away from ash ponds as a disposal option for CCP. Without Subtitle D regulations, utilities would have time to convert from ash ponds to dry ash handling systems and monofills for CCP disposal.

The Action Plan would further that require utilities install groundwater monitoring wells around monofills and ash ponds that do not have currently have sufficient monitoring wells; begin a comprehensive groundwater monitoring program to measure conformance with groundwater standards; ensure that no CCP are placed into sand and gravel pits that do not have appropriate engineering controls; and consider using dry ash handling to manage CCP prior to constructing a new ash pond or monofill. The Action Plan is currently in draft format and is not expected to be finalized by USWAG until 2007.

Progress Energy management has made the commitment to move forward in the interim and sign up with and conform with the requirements of the Action Plan when it becomes final. Progress Energy will begin monitoring groundwater wells that are inactive (Weatherspoon Plant) or monitored only once a year (Robinson and Sutton Plants) as opposed to two times a year in 2006. Three plants that have ash ponds without groundwater monitoring will have wells installed in 2007 (e.g. Cape Fear, Lee and Mayo Plants) while the remainder of the ash ponds will have wells installed in 2008 (e.g. Asheville and Roxboro Plants). The timing is critical since many of the ash ponds are reaching capacity. The monitoring results will help Progress Energy better evaluate whether a new ash pond could be an option for future CCP disposal. Progress Energy would not want to site a new ash pond at a location that already has groundwater issues associated with the active ash pond.

4.1.2 CCP Usage - Regulations

Progress Energy's Ash Reuse Permit (through NCDENR), which listed approved uses for ponded CCP, expired in 2002. Progress Energy requested renewal in 2002 and received a final permit in April 2005. Progress Energy had some considerable concerns with the requirements of the final permit.

The final permit prohibited the beneficial use of ponded ash that exceeds specified concentrations of metals (e.g., arsenic, mercury, selenium) even if Progress Energy could engineer (via contouring/caps/ash amendment) or demonstrate (via modeling/ground-water monitoring) that there is no impact to groundwater. This would severely impact the ability to use ash from the ash ponds as structural fill (the primary objective for large quantities of ash) and limit ash use in potential structural fill projects (e.g., DOT road construction).

With the State's (North Carolina) approval, Progress Energy adjudicated the permit. This allowed Progress Energy to continue operating under the conditions of the old permit and gave Progress Energy time to negotiate a new permit with the State. Negotiations since April 2005 have been productive. The State now understands the differences between CCP and other residual materials, such as sewage sludge.

A final ash reuse permit was received on February 17, 2006. Environmental Services Section (ESS) recommended acceptance of the permit.

On the positive side, the new permit: (1) preserves the option for ash as structural fill; (2) expands the list of approved uses; and (3) maintains the option to utilize review/compliance boundaries (a benefit of wastewater treatment facilities).

On the negative side, for plants that beneficially reuse ponded ash, there will be more sampling requirements which will result in more money spent on monitoring and analytical tests. The number of samples to analyze is based upon the quantity of ash reused during the calendar year. However, these costs would be more than offset by the benefits derived from the beneficial use of large quantities of ash.

4.1.3 Regulated Pollutants/Water Quality Standards

EPA is reviewing effluent guidelines for the steam electric industry. The guidelines were last modified in 1982. On August 29, 2005, EPA published its draft 2006 Effluent Guidelines Plan. EPA did not name any industry category as the target for actual revision. Instead, EPA said it intends to continue work on detailed analyses of the following three industries: steam electric; pulp, paper and paperboard; and tobacco products. In February 2006, the Utility Water Activities Group (UWAG) submitted supplemental information, in response to EPA requests, regarding the use of biocides, the cost and feasibility of dry fly ash handling, discharges to surface and groundwater from ash ponds and wastewater characterization for combined cycle facilities. If EPA targets the steam electric industry category for effluent guidelines, as one would believe from the information request, National Pollutant Discharge Elimination System (NPDES) discharge permit limits from ash ponds could be made more stringent, requiring a conversion to dry fly ash handling.

In Florida, the drinking water standard for arsenic was recently lowered from 0.05 parts per million (ppm) to 0.01 ppm. The existing Crystal River monofill has neither a liner nor a leachate collection system. However, a new monofill at this facility would require a liner and leachate collection to receive a permit from the Florida Department of Environmental Protection – Solid Waste Management. Liner systems with leachate collection are required for monofills to comply with all groundwater standards, including arsenic. Florida is even contemplating the requirement for liners beneath temporary storage areas that are used to facilitate reuse of CCP and possibly beneath coal piles.

In August 2004, the North Carolina Division of Water Quality (DWQ) initiated a three-phase rulemaking aimed at revising its 141 groundwater quality standards. The first phase affected 33 groundwater standards and considers lower limits for certain metals, halogenated hydrocarbons and cyanide. The groundwater standard for arsenic and selenium will be recommended to be lowered during the second and third phase of this process.

In South Carolina, there is no regulatory activity at this time. The State incorporates by reference the Federal Primary Drinking Water Standards.

4.1.4 Ash Ponds/Discharge Limits

Ash ponds have been used for the disposal of CCP from utility boilers for many years, primarily because the system is inexpensive. However, ash ponds require a large area of land. The CCP are hydraulically sluiced (wet handling) from the boilers to a pond. The pond itself allows the CCP to settle out of the sluice water and then the sluice water is discharged. Therefore, the use of ash ponds for CCP disposal requires a NPDES permit to discharge sluice water from a pond to a surface water body such as a river or lake. As ash ponds fill, it is more difficult to meet the total suspended solids (TSS) limit and limits for metals such as arsenic, chromium and selenium. Also, as these permits are renewed, the permit limits typically are lowered and become more restrictive.

In recent years, some utilities have converted from wet handling of CCP to dry handling, with the disposal of CCP in monofills. Either the Plant was restricted in land or there were difficulties in meeting its NPDES permit limits. An example of the latter is the Roxboro Plant in the early 1990’s. Selenium from the ash pond discharge at Roxboro accumulated in Hyco Lake and resulted in a fish consumption advisory placed on Hyco Lake. Progress Energy had to work with the State of North Carolina to address the fish consumption advisory and the resolution resulted in the conversion to dry fly ash handling at that time. Once dry fly ash handing was installed, the selenium levels in Hyco Lake began to fall and eventually the fish consumption advisory on Hyco Lake was rescinded. More recently (2006), Duke Energy’s Allen Plant experienced difficulties in meeting its ash pond NPDES permit limits and was forced to shut down for six months. These difficulties forced the Allen Plant to begin conversion to dry ash handling and eventually eliminate the disposal of CCP in ash ponds.

A new lined ash pond at an existing coal-fired facility is an option, but one that must be scrutinized per the USWAG Action Plan discussed earlier in this Section. However, an ash pond for the disposal of CCP from a *new* coal fired facility is not an option. The requirements under the New Source Performance Standards at 40 CFR 423.15(g) state that there shall be no discharge of wastewater pollutants from fly ash transport water. A zero discharge ash pond is an option for a new coal-fired facility, but it is not economically feasible for an existing plant.

4.2 GREEN/ENVIROMENTAL PUBLIC PRESSURE

The Clean Air Task Force (CATF) was unsuccessful in convincing EPA to determine that CCP are hazardous wastes as EPA determined in 2000 that CCP are not hazardous wastes. However, the CATF has been successful in moving EPA to develop Subtitle D (solid waste) regulations to govern CCP disposal, as discussed in **Section 4.1.1**. The CATF along with the Hoosier Environmental Council (HEC) and other environmental groups developed a list of "damage cases". These damage cases involve CCP disposal sites at which environmental damage had either been proved or alleged in a manner that suggests that some CCP disposal sites may pose a risk to human health or the environment. The environmental groups also noted that many of these CCP disposal sites lacked groundwater monitoring.

Armed with this information, EPA determined that Subtitle D (solid waste) regulations were needed to govern CCP disposal sites, including monofills and ash ponds. Although the USWAG Action Plan has been able to slow EPA's development of Subtitle D regulations for the disposal of CCP, the environmental groups continue to push EPA in this direction.

4.3 INCREASING FUEL VARIABILITY

The coal supply to the plants is becoming increasingly diverse. Since Progress Energy's coal expenditures top $2B/year, market forces will continue to drive coal procurement decisions. With the expansion of Kinder Morgan's Charleston facility and Southport's announced expansion, imported coal is opening up to non-coastal plants.

Increased diversity of coal supply also increases difficulty of ash pond management. Different fuel sources will cause variations in the volume of ash produced per ton of coal burned, the mineral content of the ash, and the trace mineral constituents in the ash. Imported coals have different levels of potassium and calcium than domestic Central Appalachian coals. This creates swings in pH levels and potential Total Suspended Solids (TSS) issues if ponds are not managed carefully. Most of the current ash ponds do not have acid/basic injection systems installed to counteract pH swings. These systems are not particularly expensive but would create some ongoing O&M expenses. On the other hand, dry ash handling systems and dry ash disposal facilities would significantly reduce pH and TSS concerns associated with pond management.

4.4 PAST ASH MANAGEMENT PRACTICES – (Risk Enhancement)

Unlined ponds have been utilized as the primary method of fly ash disposal at Progress Energy's coal fired generating plants for the past sixty years. Ash ponds have provided an economical and dependable fly ash disposal system throughout this period. The evolution of environmental regulations for point source discharges to surface waters and non-point discharges to groundwater have had significant impact on ash pond disposal facilities. Leachate from unlined ponds has the potential to adversely impact groundwater while the pond effluent discharges can adversely impact surface water quality. Continuing reductions in permissible contaminant levels in groundwater and surface water quality have been a primary driver toward the installation of dry disposal systems. Progress Energy has been forced to move away from ash pond disposal because of high contaminant levels of pollutants in receiving waters traced to fly ash constituents and regulatory controls on potential groundwater contaminants. When these problems have been encountered, the generating plant's fly ash management system was converted to a dry ash handling system and a monofill constructed for fly ash management. Two plants have converted to dry ash handling systems to date: Crystal River and Roxboro. The Mayo plant was constructed with dry fly ash handling capability and a wet ash pond disposal facility. All other coal-fired plants continue to utilize ponds for fly ash management.

The volume of ash going into ash ponds has steadily increased with increasing environmental air quality controls. Prior to the installation of low-NOx burners, fly ash quality at several facilities was high enough to allow it to be marketed for use in ready mix concrete thereby reducing the amount discharged into the ash pond disposal system. Since the limits on NOx emissions have been implemented, the total quantity of ash that can be marketed has decreased due to the high unburned carbon content (LOI) of the fly ash. A decrease in marketable ash has resulted in a corresponding increase in the amounts sent to disposal, thereby reducing the expected life of the receiving ash ponds.

Coal quality has also adversely impacted ash pond capacity and expected life of the facilities. Higher ash coal has been utilized on occasion because of its economic advantage. These coals produce more ash, typically 4-5% more ash per ton of coal burned, further reducing the useful life of the receiving ash ponds.

As ash ponds near their volumetric capacity, the volume of free water available for settling and clarification is reduced resulting in an increase in total suspended solids (TSS) in the pond effluent. Progress has either closed out old ponds or built new ponds at this point or removed ash from the active area of the pond and stacked it in a remote area of the pond above the normal operating water level. Restacking of ash can be performed several times within a given pond without having to remove ash from the permitted pond facility. At some point the total storage capacity of the pond is reached. The last ash ponds built at Progress Energy facilities were built in the early 1980's. These ponds are now at or near their operating capacity. This Plan is designed to address the type of ash management disposal systems that will be used to replace these unlined ash pond disposal systems.

4.5 EMISSIONS CONTROLS IMPACTS

Emissions controls can have substantial impacts on CCP product quality and quantity. If the combustion process is modified to reduce the formation of air pollutants, the effect these changes will have on the fly ash must be well understood, tested, and documented. The addition of chemicals to the combustion or flue gas handling process will impact the chemical composition of the ash produced. The changes to the CCP could prevent the sale or processing of the ash for beneficial reuse, or limit its discharge into a pond.

NOx reduction technology: Selective Catalytic Reduction (SCR) systems are designed for a certain percentage of ammonia slip. The quantity of ammonia deposited on the ash, while very small, will change its processing characteristics for some beneficiation processes reducing the production rate. Ammonia can also impact the ash ponds by raising the total alkalinity.

Low NOx burners (LNB's) are effective at reducing NOx levels by reducing available O_2 levels at the burners. Historically, LNB's also have the undesirable impact of lowering combustion efficiency which raises loss-on-ignition (LOI) levels. This can be a serious concern at facilities where ash is sold, due to strict ASTM limits on fly ash used in making fly ash concrete (6% max LOI). High LOI is also a concern at plants that use ash ponds because the higher LOI means more "ash" volume to the pond, and also increases the risk of ESP fires.

SO_2 removal technologies: Progress Energy is evaluating three SO_2 removal technologies across the fleet: wet FGD's, dry FGD's and Furnace Sorbent Injection (FSI). The impact of each of these three technologies is shown below. Adding reagents for SO_2 removal (i.e. furnace sorbent injection) to the boiler will add additional complexity to the ash management issues.

Table 1.2 Summary of SO_2 Technologies.

SO_2 Removal Technology Impact			
Plant	**Wet FGD**	**Dry FGD**	**FSI**
Product Quantity	1x	0.85x	0.91x
Product Constituents	Gypsum $CaSO_4{\bullet}2H_2O$	Fly Ash, $CaSO_3$, $CaSO_4$, $Ca(OH)_2$, $CaCl_2$ & Inerts	
Slurry pH	5 - 6	11 - 12	
Applicable Unit Size	Large	Medium	Small/Medium
Marketability	Good	Poor	Poor
Separated from ash?	Yes	No (mixed with ash)	No (mixed with ash)

Wet FGD systems: The byproduct of wet FGD systems is gypsum, a highly desirable product for wallboard and cement production. Wallboard plants are being constructed adjacent to larger coal-fired plants throughout the country (including future wallboard plants at Roxboro and Crystal River). Wet FGD's are also able to capture mercury to the extent that wet FGD units should be able to meet the 2005 Clean Air Mercury Rule (CAMR)_standards without additional technology. The mercury captured by the wet FGD is captured within the gypsum-based end product.

Dry FGD systems use lime instead of limestone to capture SO_2. The product tends to be much less marketable than gypsum since the product is a mix of six constituents. The dry material from dry FGD systems is captured in a baghouse or ESP and consists of a mixture of calcium sulfites and sulfates. This powdered material is referred to as dry FGD product, dry FGD ash, dry FGD material, or lime spray dryer ash. This product has thixotropic properties, which means it cannot be readily dewatered. The normal option for dry FGD product is disposal (*only 10% of 2004 production was utilized with the majority in mining applications*[1]).

[1] ACAA 2004 Coal Combustion Product Production and Use Survey; www.acaa-usa.org

SECTION 5: Long-Term CCP Management/Disposal Options

The following Section presents an overview of long-term potential handling/disposal options considered for the nine plants in this study. Care is taken to present a wide-array of options and not limit the potential solutions to only those more-well known disposal technologies. Potential options that were either clearly impractical or known to have unacceptably high costs or risks due to lack of product/technology development, or unproven performance in the industry were not considered for this study.

5.1 BOTTOM ASH, FLY ASH, GYPSUM, AND DRY FGD

Two general handling methods exist for managing CCP including gypsum and ash: wet or dry. Conveyance and disposal management options generally used for gypsum and ash are similar. For reader ease, and to emphasize where handling/disposal techniques would differ (e.g., gypsum versus ash), gypsum-specific comments are indicated in ***bold italics***. It is noteworthy to mention that where a Dry FGD system is planned (Cape Fear, Robinson and Sutton), FGD byproducts from that process are typically kept dry and managed that way due to the difficulties associated with dewatering the product once it is wetted for sluicing/conveyance.

As previously discussed in **Section 1**, in both wet and dry methods, CCP to be managed as part of a long-term management/disposal program will only be placed in lined areas. A separatory liner will be constructed over historical ash in cases where an existing unlined pond may potentially be used as a base for the new management/disposal option. For management options that require the development of a new footprint, a bottom liner system is planned. The term “liners” generally implies the use of a synthetic flexible membrane liner (FML), but may also include the use of a geosynthetic clay liner (GCL), compacted clay, or some combination of these liner elements (“composite system”) for the liner system.

Wet CCP management systems include predominantly sluicing materials in a pipe to a dewatering/sedimentation structure. Dry handling of ash and dry FGD includes trucking and conveyor systems. Dry handling also includes storage silos or hoppers, conditioning equipment, and a loadout. Ash and gypsum can be managed separately or commingled in both wet and dry handling methods. Progress Energy has determined that only one type of handling/disposal option will be selected for each plant.

Handling methods are listed and described in the Sections which follow. Wet handling methods are designated with “W”. Dry handling methods are designated with “D”. Both are numbered in the order of discussion in the CCP Management Plan and not necessarily in order of preference.

- Wet Handling
  - W1 - New lined pond
  - W2 - Multiple cycled lined ponds and monofill disposal
  - W3A – Ash pond excavation, monofill disposal and pond relining

  - W3B – Ash pond excavation and restacking over separatory liner
  - W4 - Dike extensions on existing ash pond over separatory liner
  - W5 - Geotubes stacked on existing ash pond over separatory liner
  - W6 - Geotubes stacked over separate lined structure
- Dry Handling
  - D1- New monofill (on existing PE Property where applicable)
  - D2 - Monofill sited on existing ash pond over separatory liner

Each of these options is described in the following Sections. In addition, the dry conversion process (i.e., converting a plant that currently handles CCP wet to a dry handling system) is also described in **Section 5.1.3**.

5.1.1 Wet Handling Options (Bottom Ash, Fly Ash, and Gypsum)

The following wet handling options pertain to bottom ash, fly ash, and gypsum. Discussions specific to gypsum are indicated in ***bold italics.***

5.1.1.1 Option W1 - New Lined Pond

A new lined pond will be constructed under this scenario, which incorporates a modern liner system, likely a composite liner system, composed of a FML overlying a recompacted clay liner or GCL. ***In the case of gypsum, use of a GCL may not be feasible due to the chemical reaction of the GCL, containing sodium bentonite, with the calcium contained in the gypsum thereby increasing the permeability of the GCL. Geosynthetic manufactures and product research groups have documented this issue. This problem can be mitigated. However, additional expenditures on liner materials may be required to enable the usage of a GCL without covering it with compacted soil or an additional FML layer.***

A schematic of a typical lined pond is shown in **Figure 1.2**. When constructed, ash (bottom ash and/or fly ash) and gypsum can be sluiced to the new structure to settle. Depending on the conditions of the National Pollutant Discharge Elimination System (NPDES) permit, sluice water may be discharged (possibly after additional treatment) to a adjacent surface water of the state or some or all of the sluice water may be required to be recirculated back to the plant.

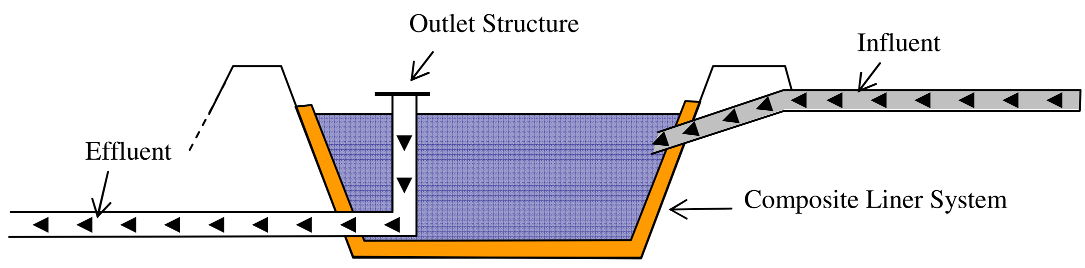


Figure 1.2 Option W1 – New Lined Pond

- Major advantages of the construction of a new lined pond include:
  - Allows for sluicing of the material, a low cost conveyance method
  - Little modification of the existing plant operation will be required
  - Typically the lowest cost option due to low material handling cost
  - Does not require the capital expenditure associated with converting to dry handling
  - Removes some potential regulatory issues associated with the use of unlined ash ponds
  - Beneficial reuse can delay future restacking and/or dredging operations
  - ***Does not require in-plant dewatering system for gypsum (a savings in capital cost)***
- Major disadvantages of the construction of a new lined pond include:
  - Will require a larger footprint and site capacity over a dry system due to the lower dry density of sluiced ash verses dry compacted ash (56 lbs/cf vs. 80 lbs/cf, respectively)
  - Ponds require a relatively flat tract of land or require earthwork to make it relatively flat (is less adaptable to terrain than a monofill)
  - Requires a large amount of land – in some cases, two or more times the land area required for a monofill that would dispose of a similar volume of CCP
  - High initial capital investment –entire pond must be constructed before the facility can be utilized unless pond build-out is phased either through future planned dike raising or phased pond cell construction (i.e., not building the entire pond footprint upfront)
  - Future NPDES permits for ash ponds may require partial recirculation, additional treatment, and/or may require the system to be operated as a "zero discharge" system

- Limits beneficial reuse opportunities to use as structural fill or as feedstock to cement kilns.

- ***In the case of a gypsum pond, NPDES permits will likely require treatment prior to discharge due to the high chloride and sulfate content of the water and/or; NPDES permits will likely require partial recirculation of effluent water (or sluice water) or may require the system to be operated as a "zero discharge" system (additional capital and O&M costs).***

- ***Beneficial reuse of ponded gypsum may be more difficult due to possible high and/or variable chloride content of sluiced gypsum and difficulty in handling the material. High chloride content may preclude the use of gypsum in dry-wall and cement manufacturing.***

Sizing for Option W1 was based on the following assumptions:

- Both interior and exterior dike side slopes are 2:1 (horizontal: vertical);
- Dry unit weight of 56 pcf is used for all CCP material;
- Dike height varies between 25 ft and 40 ft based on plant-specific conditions and to minimize construction cost, where possible;
- 3 ft of freeboard between outlet and top of dike;
- Maximum storage capacity was set at 75% of the pond volume; and
- A dimensional ratio of 3:1 (length: width) was chosen to preclude short circuiting of the pond.

5.1.1.2 Option W2 - Multiple Cycled Lined Ponds and Monofill Disposal

This option involves the construction a series of relatively small lined ponds and a new lined monofill facility. The location of the monofill facility will be evaluated on a plant-specific basis. Under this scenario, the first pond is filled to near capacity, and then sluicing of CCP is directed to the second pond, and ultimately sluicing is directed to a third pond. The ponds must be sized such that adequate settling can occur, to comply with required levels of total suspended solids (TSS) and metals, prior to discharge of the effluent. As with other wet options with discharge to a receiving stream, additional treatment may be required to decrease constituent levels, such as soluble metals. Once the first pond is adequately dewatered, the ash and/or gypsum is then excavated from the pond, and transferred to the adjacent monofill. The first pond can then be reused for sluicing and collection. The cycle is then repeated with the second pond, and so on. This method may require the construction of three or more ponds to allow time for the materials in the pond to dewater adequately. A schematic of this option is shown in **Figure 1.3**.

This option is typically used at very large plants (greater than 1,000 MW) to take advantage of the benefits of landfill disposal without the difficulties or costs associated with dry conversion of the ash handling system. For these larger plants, the cycling ponds are of sufficient size and managed during filling to preclude short circuiting flow paths over their individual cycle life (typically approximately 2-5+ years of storage capacity).

For a smaller plant, the calculated minimum pond size, based on idealized settling calculations, tends to be significantly smaller than a truly practical pond size (from a construction and operations standpoint). Therefore, larger pond sizes will be required than those sizes calculated solely based on the storage volume required to handle the settled ash material, which will lead to an increased capital expense of the project. Capital expenditures for this option are comparable to those of a dry conversion system for a smaller plant. Therefore, this option may not be significantly more advantageous than conversion to a dry handling system followed by implementing one of the dry disposal options, and is not considered to be cost effective at a smaller plant.

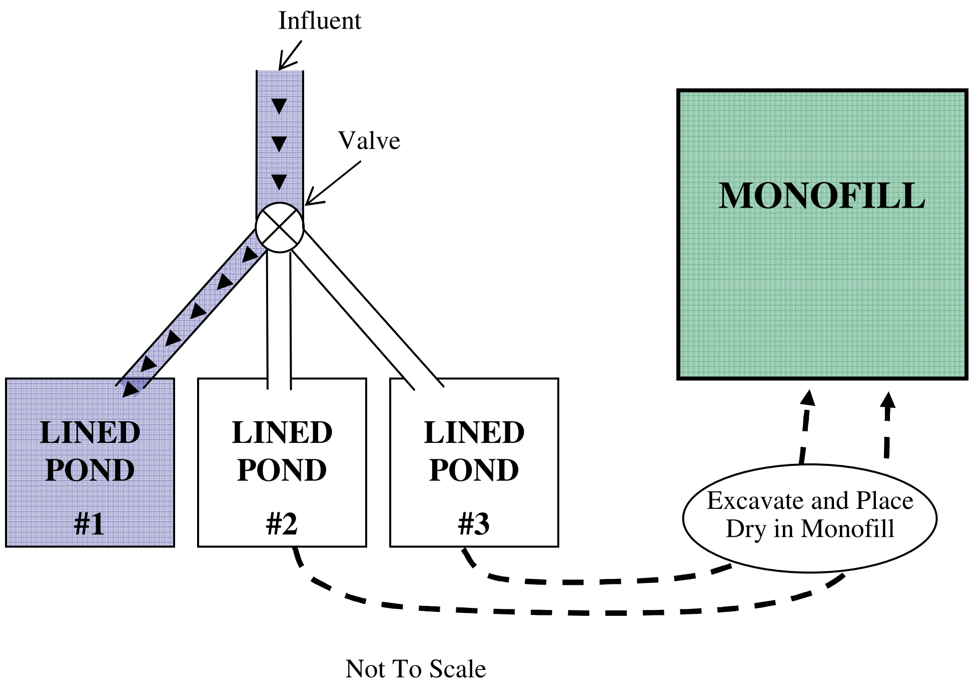


Figure 1.3 Option W2 – Multiple Cycled Ponds and Monofill Disposal

- Major advantages of multiple cycled lined ponds and monofill disposal are similar to those cited for the Option W1 (one larger lined pond). Other advantages include:
  - Allows for the advantages regarding land utilization associated with a monofill without requiring conversion to a dry handling system.
  - May reduce land requirements with smaller cycled ponds and a landfill compared with the construction of a large dedicated one-stop lined pond.

- Reduced up-front capital expenditures compared with the new lined pond scenario due to the construction of the monofill in phases or sub-cells over time.

- Beneficial reuse could significantly lower the construction cost because it may delay or eliminate the need to construct a monofill phase.

- Major disadvantages of multiple cycled lined ponds and monofill are similar to those cited for the Option W1, other disadvantages include:
  - Operations and maintenance (O&M) costs are higher due to the need to excavate and cycle ponds and dispose of CCP in the associated landfill
  - Requires a larger portion of land compared with a dry system and monofill
  - Prescriptive monofill permitting process-although North Carolina regulations allow for alternative liner systems and demonstrations to show that the facility will not negatively impact the environment for non-municipal solid waste (MSW) monofill facilities. Sluiced ash will leach lower levels as opposed to dry ash and may allow for a reduction in liner system requirements and/or cap system requirements; however, this typically requires extensive hydrogeologic modeling prior to acceptance by regulatory agencies.

Sizing for Option W2 is based on the following assumptions:

- Each cycled pond is designed for a minimum of 3 years of capacity;
- Both interior and exterior dikes of the cycled ponds have sideslopes of 2:1 (horizontal: vertical);
- Dry unit weight of 56 pcf is used for all CCP material;
- Dike height varies between 20 ft and 30 ft based on plant-specific conditions and to minimize construction cost, where possible;
- Freeboard of 3 ft is to remain between the outlet and the top of dike;
- Maximum storage capacity was set at 75% of the pond volume;
- The minimum pond area is 15 acres; and
- A dimensional ratio of 3:1 (length: width) was chosen to preclude short circuiting of the pond.

For sizing of the landfill portion of this option, see Option D1.

5.1.1.3 Option W3A - Ash Pond Excavation, Monofill Disposal, and Pond Relining

This option initially involves construction of a new lined monofill (on PE owned property) and the construction of a temporary separatory dike in the existing unlined pond, to allow for continued sluicing of the ash and/or gypsum. The ash is then dewatered, and subsequently excavated from a portion of the unlined pond. Most or all of the ash is then transferred into the new lined monofill while a portion (or potentially the entire existing pond) is relined. At that time, continued sluicing of ash and/or gypsum into the relined facility can be initiated as was previously conducted. A schematic of this option is shown in **Figure 1.4**.

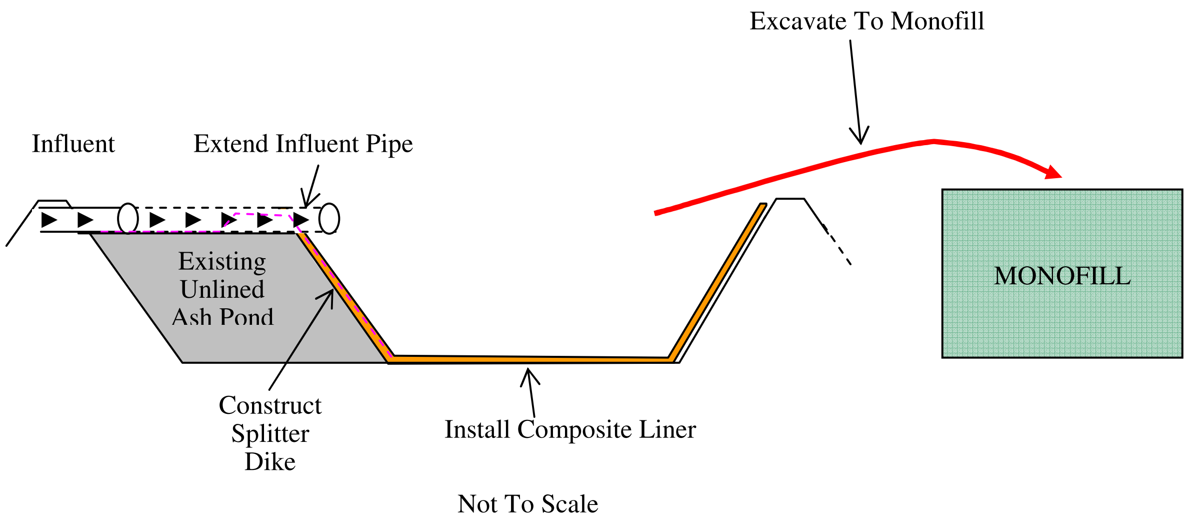


Figure 1.4 Option W3A – Ash Pond Excavation, Monofill Disposal, and Pond Relining

- Major advantages of ash pond excavation, monofill disposal, and pond relining include:
  - Allows for continued sluicing of the material, a low cost conveyance method
  - Allows for the advantages in regards to land utilization associated with a monofill without requiring conversion to a dry ash handling system
  - Requires little to no operational change after construction compared with existing practices (monofill is constructed, filled, and closed relatively quickly with continued sluicing to a lined ash pond thereafter)
  - May require little or no modification to the existing NPDES permit, if only ash is sluiced into the pond and the footprint/boundaries of the pond are unchanged
  - Beneficial reuse can delay future restacking and/or dredging operations
  - Removes some potential regulatory issues associated with unlined ponds
- Major disadvantages of excavating the existing pond, monofill disposal and pond relining include:
  - High initial capital investment – monofill must be constructed in its entirety to accommodate the volume of ash to be removed/cleaned from the existing pond(s) before the facility can be utilized and the pond must be relined, if necessary, up front.

- Construction activities may warrant modifications to the existing NPDES permit and may require increased treatment

- If only one pond exists, it may be difficult to dewater the material prior to transfer to the monofill or may require stacking and drying prior to transfer to the monofill (and double handling associated with this)

- Limits beneficial reuse opportunities to uses of wetted ash, such as structural fill or as feedstock to cement kilns

- ***Similar concerns with gypsum for NPDES and potential pond recirculation issues as in the other ponded options W1 and W2***

- ***Similar concerns for beneficial reuse of sluiced gypsum as cited for ponded Options W1 and W2***

Sizing for Option W3A was based on the following assumptions:

- The total CCP tonnage projected for ultimate disposal is the quantity removed from the existing pond and transported and placed in the landfill; and
- The entire area of the pond was relined.

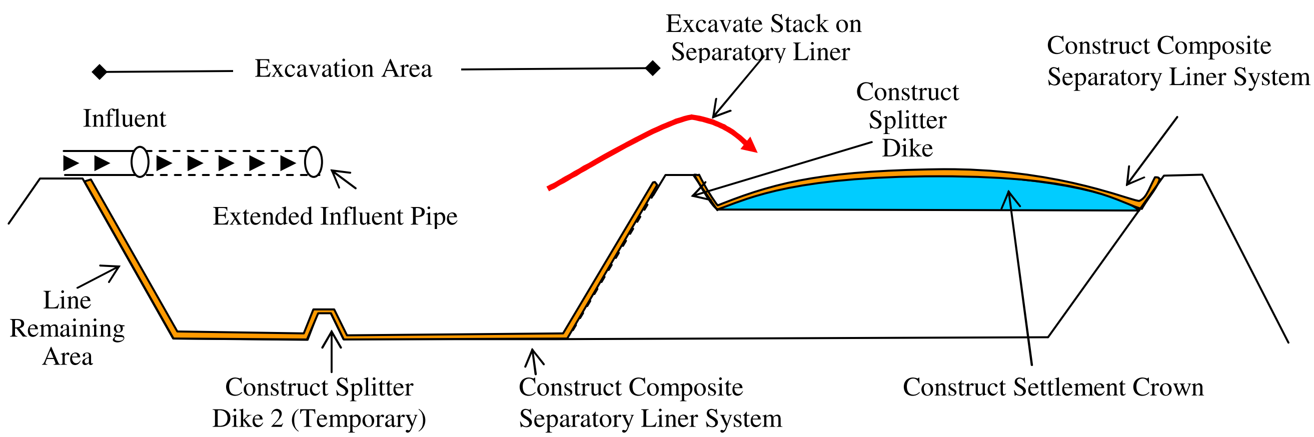
For sizing of the landfill portion of this option, see Option D1

5.1.1.4 Option W3B - Ash Pond Excavation and Restacking Over a Separatory Liner

This alternative initially involves construction of a temporary separatory dike in the existing unlined pond in order to allow the material in the restacking area to dewater. Once this area is sufficiently dewatered (which may take several months), construction of the separatory liner over the restacking area can commence as needed, including the construction of a settlement crown. Ash is then excavated from the active portion of the pond and placed on the newly lined restacking area.

Upon completion of the restacking operation, the active portion of the pond must be drained to allow for relining of the pond. Again, as with the restacking operation, a portion of the site must remain active to dewater the sluiced ash. A dike must be constructed to allow for continued sluicing on one portion of the excavated pond while construction of a separatory liner on the other portion of the excavated pond is carried out. Once a portion is relined, the newly lined portion would begin to receive the sluiced CCP and the second portion of the pond would be relined.

Construction of this alternative would be relatively complex and management of the sluiced CCP will be challenging to maintain the required TSS limits. In addition to the management during construction, the restacked ash will have to be controlled in a manner appropriate to limit fugitive dust, which may require the placement of adequate cover material. A schematic of this option is shown in **Figure 1.5**.



Not To Scale

Figure 1.5 Option W3B – Ash Pond Excavation, and Restacking Over a Separatory Liner

- Major advantages of ash pond excavation and restacking over a separatory liner are similar to those cited for Options W1, W2 and W3A, but in addition include:
  - Allows for efficient land utilization, as no new area is required for the footprint
- Major disadvantages of ash pond excavation and restacking over a separatory liner are similar to those cited for Options W1, W2 and W3A, but in addition include:
  - Stacking super-saturated fly ash may lead to significant stability issues due to the seismic impacts on the underlying ponded ash from both a slope stability and liquefaction perspective (which may lead to a bearing-capacity type failure). Central and western North Carolina and South Carolina are seismic risks due to their proximity to a fault located near the North Carolina/Tennessee border. Another seismic hazard risk is associated with a fault near Charleston, South Carolina. See **Figure C-1 in Appendix C**. Proactive steps can be taken to reduce the risk, but stacking ash on ponded ash may lead to seismic instability.
  - Requires addition of a Settlement Crown
    - The existing pond as may consolidate as much as 20% of the original thickness under load of a new structure.
    - To prevent strain on the geosynthetics during consolidation, a settlement crown will be required under all options where settlements of underlying ponded ash are predicted. This involves constructing a structural fill above the highest areas of potential consolidation, such that as the separatory liner settles, the liner is at no time under tension.
    - This adds to the expense by requiring a significant amount of earthwork.

– Potential Separatory Liner Construction Logistics –

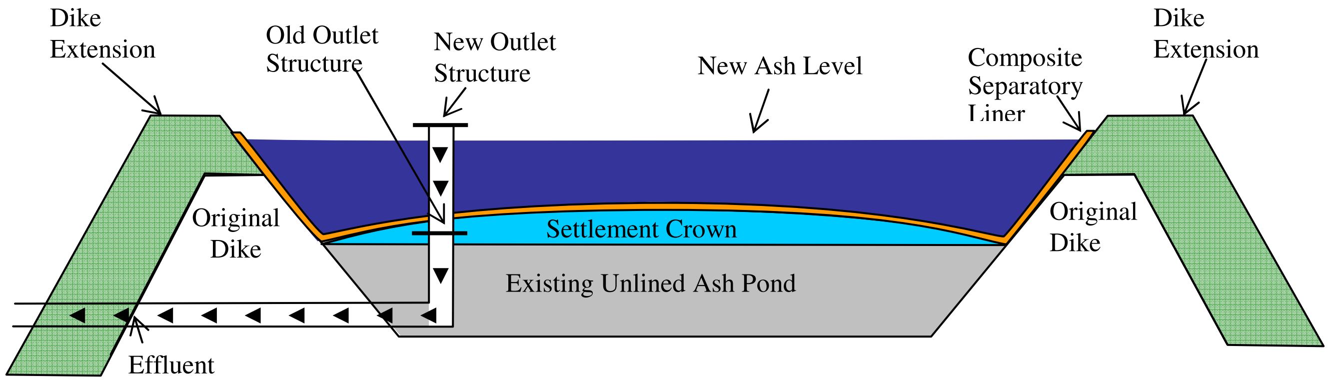
- During construction of the separatory liner, the area of placement must be dry. For a site with only a single active pond, this requires that the ash be sluiced to a separate structure or area for dewatering during construction in the existing pond or portion of the existing pond.
- This may be most easily accomplished by the construction of a separatory dike to separate an active dewatering portion of the existing pond from the construction area may require additional dewatering enhancement s (e.g., use of geotubes – see Option W5 for additional information on geotubes).
- While this can certainly be overcome, coordination of construction activities and O&M in the dewatering system will possibly create logistic and financial difficulties.

Sizing for Option W3B was based on the following assumptions:

- A percentage (typically 25%) of the total area of the existing pond is reserved for restacking over a separatory liner and is designed to be similar in area to the typical landfill size for this option;
- The remaining portion of the existing pond is excavated to create space for the future CCP and relined (typically 75%); and
- The total CCP tonnage projected for ultimate disposal is the quantity removed from the pond and restacked over the separatory liner in a separate portion of the existing pond.

5.1.1.5 Option W4 - Dike Extensions on Existing Pond Over Separatory Liner

Extensions of existing pond dikes over a separatory liner system are a method to gain airspace for ash and/or gypsum disposal. This alternative initially involves construction of a temporary separatory dike in the existing unlined pond, creating two compartments. This allows for continued sluicing of the ash and/or gypsum into one compartment while construction commences in the other compartment. A portion of the existing ash pond is then dewatered (this could take several months) and a separatory liner and vertical dike extensions are constructed in this dewatered compartment. Once the separatory liner and dike extension is completed in this compartment, CCP can be sluiced into this area. At that time, this operation is repeated in the remaining compartment. A schematic of this option is shown in **Figure 1.6**.



Not To Scale

Figure 1.6 Option W4 – Dike Extensions on Existing Pond Over Separatory Liner

- Major advantages of dike extensions on existing ponds over a separatory liner are similar to those cited for Options W1, W2 and W3, but in addition include:
  - Allows for efficient land utilization, as only a small additional area is required for the footprint
- Major disadvantages of dike extensions on existing ponds over a separatory liner are similar to those cited for Options W1, W2 and W3, but in addition include:
  - Lateral footprint extensions needed to extend vertically or vertical extension to include internal dike foundation stability improvements (wick drains, drainage layers, grouting, etc.)
  - Assuming the existing ponds were designed for a similar volume of CCP (approx. 20-30 years of ash), a dike extension to prolong the life of the pond would require the dikes to be constructed at approximately twice the height as initially constructed, which may be practically infeasible or geotechnically unstable. Seismic issues associated with building on top of the ponded ash (as discussed in Option W3B) would also be a potential design concern.
  - Historical ash below the separatory liner may still present regulatory/environmental issues
  - Potential technical considerations to account for settlement of areas below separatory liner and liquids management above separatory liner
  - High initial capital investment – dike extension must be constructed in its entirety
  - Requires a Settlement Crown (similar to Option 3B)
  - Separatory Liner Construction Logistics (similar to Option 3B)

  Drainage layer construction - If a drainage layer with positive slope is required for the options (for example, the monofill sited above an existing pond), additional earthwork will be required to create a positive slope towards the collection system. This fill would be in addition to the fill required to construct the settlement crown.

Sizing for Option W4 was based on the following assumptions:

- Sizing assumptions are similar to Option W1 regarding sideslopes, capacities, etc.; and
- Dike height varies and is iterated until the area of the pond is equal to the existing pond area or the portion of the existing pond area intended to be utilized with the dike extensions.

5.1.1.6 Option W5 - Geotubes Stacked on Existing Pond Over Separatory Liner

This option involves sluicing ash and/or gypsum into woven fabric dewatering tubes (Geotubes) located on the existing ash ponds over a new separatory liner. Under this scenario, Geotubes are used as a means to achieve solids removal in order to meet the TSS limit of the NPDES permit requirements. Additional treatment may be required if any other significant discharge restrictions are imposed such as heavy metals. Discharge of sluice water will be as previously conducted with the existing pond through existing outfall structures. A schematic of this option is shown in **Figure 1.7**.

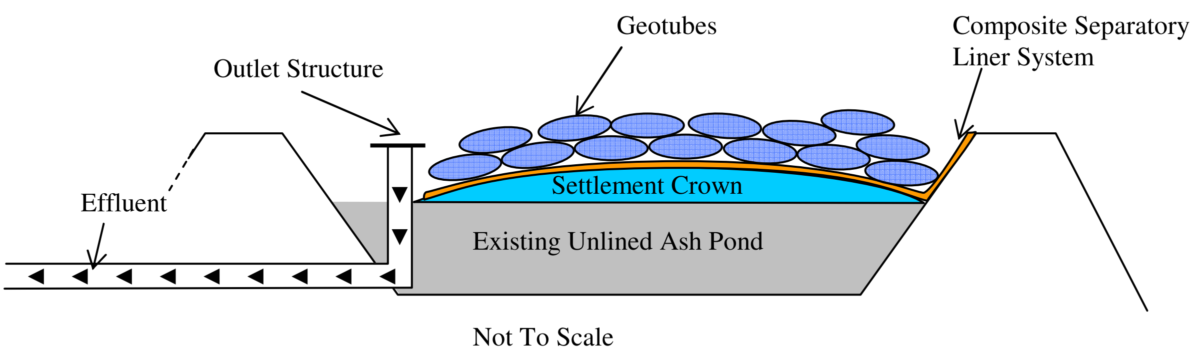


Figure 1.7 Option W5 – Geotubes Stacked on Existing Pond Over Separatory Liner

- Major advantages of Geotubes stacked on an existing pond over a separatory liner are similar to those cited for the previous wet options, but in addition include:
  - Allows for a smaller area to work (and therefore a smaller lined area) due to the efficiency of the geotubes
- Major disadvantages of Geotubes stacked on an existing pond over separatory liner include:
  - Potential seismic issue similar to W3B
  - Beneficial reuse does not significantly reduce capital expenditures since the capital investment for dewatering prior to beneficial reuse will require the use of Geotubes with the ash being removed from the filled Geotube for beneficial reuse
  - Historical ash below the separatory liner may still present regulatory/environmental issues

- Limits beneficial reuse opportunities to wetted ash reuse options
- Filling, managing and staging Geotubes is labor intensive (higher O&M costs)
- Requires a Settlement Crown (similar to option W3B)
- Separatory Liner Construction Logistics (similar to option 3B)
- Drainage layer construction (similar to option 4)

Sizing for Option W5 was based on the following assumptions:

- Geotubes are stacked at the equivalent of 4:1 (horizontal: vertical) sideslopes;
- Geotubes will be stacked to a maximum height of approximately 20 feet (approximately 4 geotubes high after settlement occurs); and
- Final dry unit weight in the geotube is 75 pcf.

5.1.1.7 Option W6 - Geotubes Over Separate Lined Structure

This option involves sluicing ash and/or gypsum into woven fabric dewatering tubes (Geotubes) located on a new, shallow lined pond-like structure that is located in a separate location from an existing pond. Geotubes are stacked inside the separate lined structure leaving an approximately 10-foot wide space from the edge to collect the Geotube effluent along with storm water runoff from the site for conveyance back to the plant and/or discharge under a new NPDES permit. A schematic of this option is shown in **Figure 1.8**.

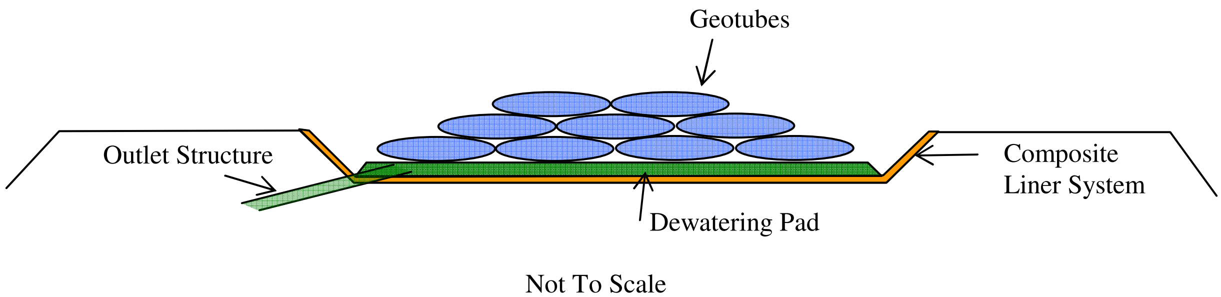


Figure 1.8 Option W6 – Geotubes Over Separate Lined Structure

- Major advantages of Geotube use on a separate lined structure are similar to those cited for the previous wet options and W5, but in addition include:
  - Reduces potential regulatory issues associated with unlined areas
- Major disadvantages of Geotube use on a separate lined structure are similar to those cited for the previous wet options and W5, but in addition include:
  - Potential instability of stacked Geotubes, although the majority of the liquefaction issues mentioned previously should not be a major concern

Sizing for Option W6 is the same as those provided for Option W5.

5.1.1.8 Option W7 – Gypsum Wet Stacking

This option only applies to gypsum disposal. Wet gypsum, at approximately 15 to 30% solids, will be conveyed to the disposal site via a pipeline and discharged into a wet stack pond.

In general, the wet stack pond is subdivided into two separate compartments – active and inactive. This design allows for one pond compartment to be dewatered while the second is used for the disposal of gypsum. Within the active pond, the slurry flows through the perimeter rim ditch, allowing for primary settlement of the gypsum to occur. Occasional discharge points are constructed in the rim ditch to allow the slurry to enter the lined, active pond and the discharge location is varied periodically to control the settling of the gypsum. Over time, the height of the stack increases as gypsum continues to settle and eventually the perimeter dikes are raised to increase the life of the facility. Dikes are raised within the inactive pond by gathering and compacting the settled gypsum to an appropriate height. This process continues to alternate for the two ponds until the life of the facility is reached at which point the final cap system will be installed.

Surface water runoff is collected in a runoff ditch and water within the pond is managed through an under drain and perimeter ditch system. Both ditches discharge into a surge pond where the combined waters are pumped back to the plant, thereby closing the system. A schematic of this option is shown in **Figures 1.9 and 1.10**.

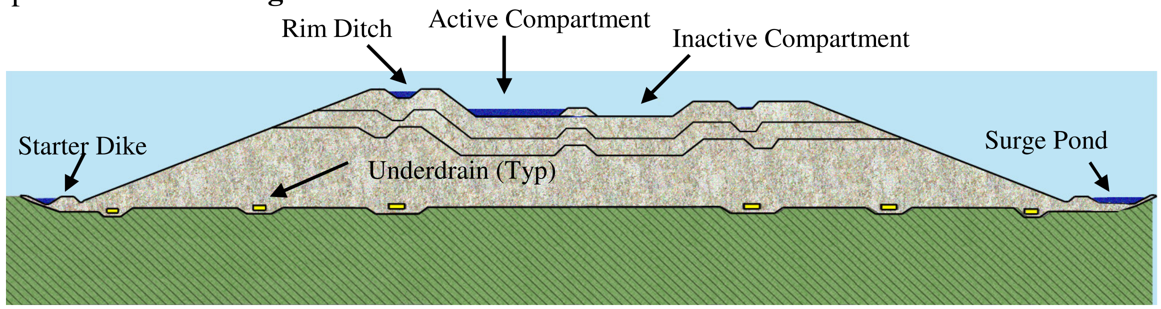


Figure 1.9 Option W7 –Wet Stacking

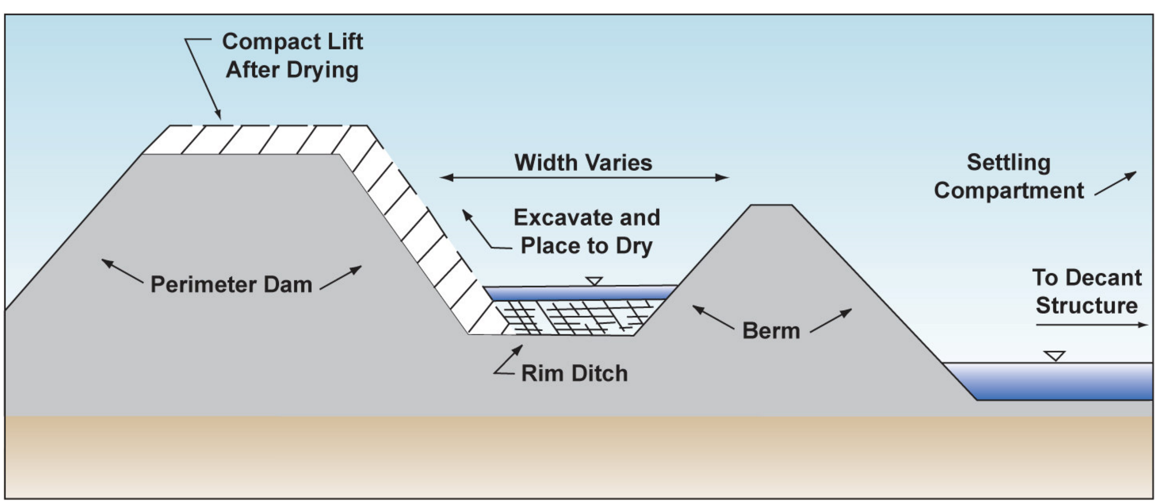


Figure 1.10 Option W7 – Rim Ditch Detail

- Major advantages of gypsum wet stacking include:
  - Allows for gypsum to be sluiced to the disposal area
  - Significantly reduced handling compared with dry monofilling
  - Avoids need for perimeter dikes constructed on imported soils as compared to traditional pond construction
  - Allows for the gypsum to be stacked above grade thereby reducing the required footprint compared with a pond
  - No gypsum dewatering system required – easily reclaim high solids content gypsum as seen with existing wet stacks currently operated by other utilities including the Tennessee Valley Authority (TVA)
- Major disadvantages of gypsum wet stacking include:
  - Increased operation and maintenance compared with a conventional pond
  - Slightly larger footprint required compared with a monofill due to the requirements of a lined surge pond and the increased top area required as the wet stack reaches its design height.
  - Will likely require either recirculation to the plant or discharge under a new NPDES permit
  - New NPDES permits will likely require treatment prior to discharge due to the high chloride and sulfate content of the sluice and recycled water
  - New NPDES permits will likely require partial recirculation or may require the system to be operated as a zero discharge system

Sizing for Option W7 is the same as those provided for Option D1.

5.1.2 Dry Handling Options (Bottom Ash, Fly Ash, Dewatered Gypsum and Dry FGD)

5.1.2.1 Option D1 - Monofill

This option involves conveying material dry, by either conveyor or truck, to a new or existing lined monofill site and placing and compacting the material in controlled lifts in a monofill, typically lined with a composite liner system composed of a flexible membrane liner (FML) and[2] recompacted clay liner or GCL. All storm water which comes in contact with the CCP would be considered leachate and treatment would be required prior to its discharge. The facility is

[2] This could be an "*or*" for Florida. NC regulations require dual liners, whereas Florida may allow a GCL.

constructed in sub cells to allow capital expenditures to be spread out over the life of the facility. Once the facility has reached its storage capacity, it must be closed using a closure cap system and monitored for a period of 10-30 years. The plant's ash systems would need to be converted from wet to dry for this disposal option. For permitting purposes, landfills accepting gypsum and/or dry FGD byproduct are treated the same as monofills accepting ash. A schematic of this option is shown in **Figure 1.11**.

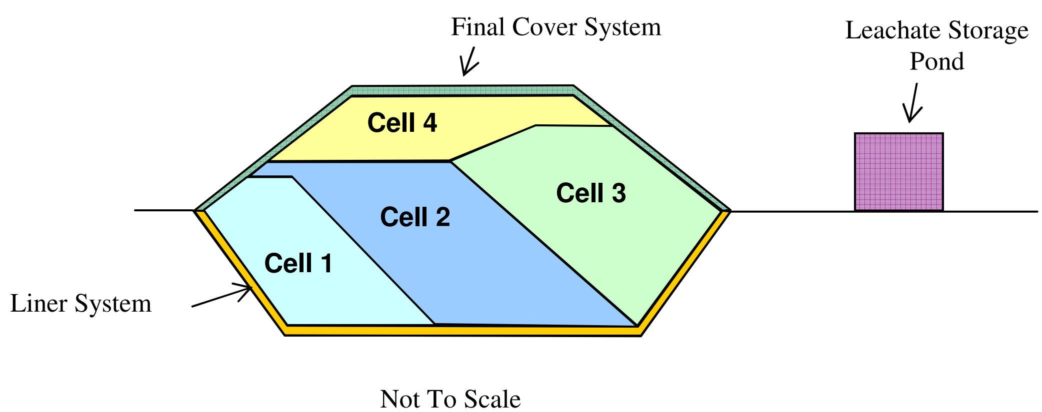


Figure 1.11 Option D1 – Monofill

- Major advantages of a monofill include:
  - Requires less area for disposal due to the density of the CCP placed dry vs. wet.
  - Provides enhanced monofill disposal management, cover only what is placed etc.
  - Increased marketing potential for beneficial use, because material can be more easily reclaimed
  - Efficient use of land
  - Allows for construction in phases, spreading the capital investment over the lifetime of the facility
  - Reduces potential regulatory issues associated with unlined areas
  - All water coming in contact with CCP is treated prior to discharge.
  - Use significantly less water than wet options, thus enhancing water conservation efforts.
- Major disadvantages of a monofill include:
  - Prescriptive monofill permitting process, although North Carolina regulations allow for alternative liner systems and demonstrations to show that the facility will not negatively

impact the environment for non-MSW monofill facilities. Reduced liner system requirements and/or cap system requirements may be allowed in North Carolina at certain sites based on groundwater impact modeling depending on ash leachability of constituents such as Arsenic, Selenium, Sulfate, Boron, etc.

- Negative public perception of a monofill
- Material handling costs are typically high especially where trucking is required
- Conveyor systems are typically expensive unless the cost can be amortized over a large quantity of material and over a long period of time
- Requires dry conversion (except Roxboro, Mayo and Crystal River) or dewatering

Sizing for Option D1 was based on the following assumptions:

- All waste is stored above ground (assumes a flat bottom, which is conservative);
- Sideslopes are 3:1 (horizontal: vertical) with stormwater terraces, yielding an effective side slope of approximately 4:1 (horizontal: vertical);
- A rectangular landfill footprint is assumed using a dimensional ratio of 2:1 (length: width);
- Dry unit weight of all material placed in the landfill is 75 pcf;
- The minimum area of the top of the landfill is 5 acres, which for practical reasons is the minimum area that allows for adequate working space;
- The minimum dimension of the top surface of the landfill is 200 ft to allow machinery to safely operate; and
- Site specific specifications for maximum height were taken into account, where applicable.

5.1.2.2 Option D2 - Monofill Sited on Existing Pond Over Separatory Liner

This option involves conveying CCP in dry form, by either conveyor or truck, to the landfill site located above an existing dewatered ash pond. For construction of the ash landfill, CCP are placed and compacted in controlled lifts in a facility typically lined with a composite liner system (composed of a FML and recompacted clay liner or GCL). All storm water which comes in contact with the CCP will be considered leachate and would require treatment prior to its discharge. The facility is constructed in sub cells to allow capital expenditures to be spread out over the life of the facility. Once the facility has reached its storage capacity, it must be closed using a closure cap system composed of a cap and monitored for a period of 10-30 years. For permitting purposes, landfills accepting dewatered gypsum and/or dry FGD are treated the same as landfills accepting ash. A schematic of this option is shown in **Figure 1.12**.

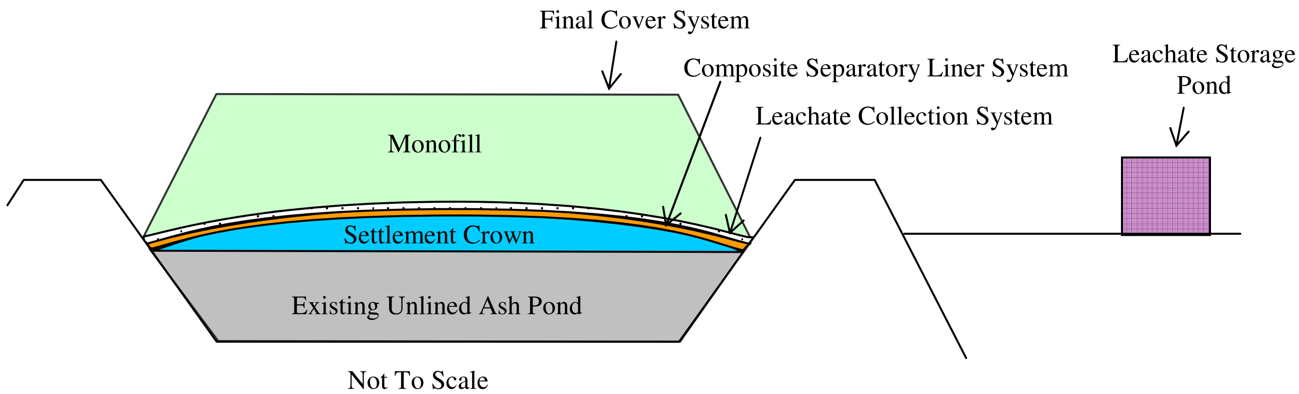


Figure 1.12 Option D2 – Monofill Sited on Existing Pond Over Separatory Liner

- Major advantages of a monofill sited on top of an existing pond over a separatory liner are:
  - Requires less area for disposal due to the density of the CCP placed dry vs. wet.
  - Provides enhanced monofill disposal management, cover only what is placed etc.
  - Increased marketing potential for beneficial use, because material can be more easily reclaimed
  - Efficient use of land
  - Allows for construction in phases, spreading the capital investment over the lifetime of the facility
  - Reduces potential regulatory issues associated with unlined areas
  - All water coming in contact with CCP is treated prior to discharge.
  - Use significantly less water than wet options, thus enhancing water conservation efforts.
- Major disadvantages of a monofill sited on top of an existing pond over a separatory liner are similar to those cited for the monofill, but in addition include:
  - Requires a Settlement Crown (similar to option W3B)
  - Separatory Liner Construction Logistics (similar to option W3B)
  - Potential seismic issues (similar to optionW3B)
  - Significant earthwork required to allow leachate collection system to drain due to the ash in the pond settling in a flat plane. However, beneficial reuse of dry ash below the liner to create adequate grade may be possible.

- Historical ash below the separatory liner may still present regulatory issues
- Potential groundwater impacts due to excess loading on unlined ponds

Sizing for Option D2 is the same as those provided for Option D1.

5.1.3 Dry Conversion

Conversion to a dry handling system (pneumatic or other dry handling system) for fly ash is typically done for one of several reasons, such as:

- There is market potential identified for the dry fly ash, such as for use in the concrete industry as a partial cement replacement, and the potential economic gain from the sale of dry CCP outweighs the projected cost of implementing dry conversion. If post-conversion ash sales are the goal, in-spec product must be consistently produced by the plant.
- Real estate constraints preclude the use of ash settling ponds or other dewatering structures for use in conjunction with a monofill facility (which typically requires half the footprint area compared with a conventional settling pond)
- The facility is experiencing difficulty with the ash ponds meeting effluent requirements (i.e. difficulty in maintaining TSS or increased level of leachable metals in the effluent such as selenium, arsenic, etc.).

In addition to the fly ash dry handling system, where appropriate, dewatering bins (hydrobins) are generally installed to allow the bottom ash to be dewatered for dry conveyance to the disposal site. Bottom ash can also be loaded directly into trucks from the dewatering bins if a market is created for this CCP. As an alternate to bottom ash dewatering, there is a potential for sluicing bottom ash to a dedicated bottom ash pond. (This is currently done and Roxboro and Mayo.)

5.2 COST EVALUATION

A conceptual level cost estimate was developed as part of this Plan on a plant-by-plant basis and is included in **Appendix D**. Each of the disposal alternatives were evaluated for the long-term disposal of CCP and costs were categorized into either capital costs, operations and maintenance (O&M) costs, or miscellaneous costs. Contingencies were incorporated as specified in the assumptions below. The assumptions used to develop the cost estimates for the CCP disposal options are as follows:

- Costs are presented in 2006 dollars for CCP management through the year 2025. Costs do not include inflation (no "time value of money" included) or Allowance for Funds Used During Construction (AFUDC).
- Cost estimates include a 15% markup on capital costs to account for unknown and unlisted items and a 10% markup on capital costs to account for a contingency and for engineering, consulting and permitting. No markup or other contingency has been included for O&M costs.

- Assume 100% of borrow soils can be obtained on-site and will not be imported (with exception of Asheville, where approx. 50% will be onsite and 50% will be offsite; and Sutton which will require 100% offsite borrow).
- Assume that the volume of initial earthwork (cut-to-fill) that is required is based on a uniform depth of excavation multiplied by the area to be used for CCP disposal.
- Assume onsite transportation of dry CCP is conducted with an off-road vehicle from plant to monofill location. Based on the unit price of existing contracts within Progress' East Region, assume a cost of $2 per ton for loading, hauling and dumping.
- A capital cost of $5 per ton for options requiring excavation, hauling and placement of ash from an existing pond.
- Assume offsite transportation of dry CCP is conducted with a tractor trailer hauling to non-contiguous properties. Offsite transportation costs are based on round-trip travel distances and are as follows: 10-mile is $3.40/ton, 15-mile is $3.90/ton, 20-mile is $4.60/ton, and 40-mile is $5.60/ton. Supporting calculations for these costs are provided in **Appendix D**.
- The dry conversion costs provided to Progress by Jacobs Engineering (Dated March 9, 2006) were used for plants potentially converting to dry ash handling system.
- For monofills, assume a 20-year post-closure maintenance and monitoring period (2025-2045), to include monitoring and reporting requirements (groundwater, surface water, leachate, cover maintenance, utilities, reporting, etc.)

In addition to the cost estimation that has been conducted for each of the viable disposal options considered at each plant, a generalized CCP Capital Cash Flow Projection has been developed for each plant. The CCP Capital Cash Flow Projection, provided in **Appendix F** provides a visual layout of the estimated capital costs provided by URS for the single disposal option recommended for each plant. The schedule is provided on an annual basis and is projected through the end of the Study period (year 2025). The total annual estimated expenditures are shown for each plant and are also totalized by Progress Energy to make planning decisions based on the estimated annual economics for each plant and for all of the nine coal-fired plants together. The assumptions that served as the basis for conducting the cost estimates for each CCP disposal option are the same assumptions used for the development of the CCP Capital Cash Flow Projection.

5.3 OTHER BY-PRODUCTS

5.3.1 Pyrites

This Plan addresses how mill rejects (i.e. pyrite) are currently being managed at each plant, but does not include future pyrite management strategies. The Progress Energy generating fleet is currently managing pyrite mill rejects in a number of ways with one of the most common management methods being to add the pyrite mill rejects back into the coal pile. Although the pyrite mill rejects were found to contain approximately 57% carbon by weight, the high sulfur content of pyrite limits the amount of rejects which can be burned as fuel. As a result most facilities have been accumulating excess mill rejects. To deal with this excess material, a number of facilities have been placing pyrite mill rejects in ash ponds or disposing of the excess material in off-site landfills. In 2005, Progress' Environmental Services Section (ESS) performed a study of mill reject management alternatives for each of the plants. The study consistently found off-site disposal in lined landfill facilities to be the most viable option for current and future management of the mill rejects. Further evaluation of selling mill rejects for beneficial use was also recommended. **Appendix B** contains a site-specific summary of the ESS study for each plant.

SECTION 6: ORGANIZATIONAL CONSIDERATIONS

6.1 CURRENT ORGANIZATIONAL ISSUES

The existing organization for Progress Energy's CCP management is composed of both Regional and Centralized structures. The Centralized support had been provided by one individual over the past 5 years. The Engineering Regions have had the responsibility for their respective plant support activities associated with providing sufficient short-term CCP management. The centralized focus support had generally been as requested by plant management for their specific plant, but without an integrated, company-wide focus. Recently, the Regulated Fuels Department (RFD) became involved in reuse opportunities via the creation of a By-Products and Reagents Unit. The roles and responsibilities of the new unit are still being defined at the time of this writing.

With significant overlap between technical and commercial issues on CCP, it remains unclear who has ultimate responsibility for the CCP disposal facilities. This is an issue that Progress Energy will need to resolve in the near future to facilitate effective management of the CCP disposal program. See **Section 6.7** for additional information on how other utilities structure their CCP management programs.

6.2 RESPONSIBILITY: CENTRAL, REGION, FGD

CCP responsibility has varied between the regional, central and plant organizations. In most cases, the response to valid CCP-related concerns that are a normal part of plant operations has been reactive. Decisions to address growing concerns have historically been delayed until the plant reaches a crisis mode. A strategic centralized approach would provide for a much more efficient and proactive approach to CCP management.

The fact that Progress Energy's CCP production will double with the addition of FGD systems (refer to CCP Generation Tables in **Appendix A**) is all the more reason to move forward with clear roles and responsibilities.

6.3 CLEAR BOUNDARIES

Progress Energy's CCP organization must have clarified boundaries for all departments involved.

Technical Services Section (TSS) should be the Lead organization responsible for assuring that a company-wide, long-term CCP management plan is developed and implemented. This involves coordination and communications with Plant Construction Department (PCD), Regulated Fuels' By-Products and Reagents Unit, Environmental Services Section (ESS), Regional Engineering (RE) and the plants, with periodic support from the finance and legal departments.

It is suggested that a small, permanent designated team made up of TSS, RFD, PCD, RE and ESS named the "CCP Review Team" serve as a clearinghouse for all Progress Energy related activities that impact CCP management. This team will review and recommend next step processes, moving forward with any centralized or region initiatives. TSS will chair the CCP project review team.

RFD's By-Products and Reagents Unit (BPRU) will have the responsibility to identify and seek commercial opportunities for CCP beneficial reuse. TSS will provide technical support to BPRU for these commercial opportunities.

Plant Construction Department (PCD) will conduct and/or oversee the study, design and implementation phases of any new on-site or off-site CCP disposal facility. They will also provide project management services. PCD will provide at least 1 member to the permanent CCP Review team.

Other departments that have roles in CCP management include: ESS, Fossil Generation, Accounting, Legal, and, on occasion, Public Affairs. See **Appendix H** for a complete list of CCP Roles & Responsibilities.

6.4 DEDICATED TEAM

As discussed in **Section 6.3**, TSS should lead a permanent, centralized team called the "CCP Review Team" to coordinate all aspects of activities which impact CCP management. This team should consist of members from Technical Services, Plant Construction, Environmental Services, Regulated Fuels and the Regions. Periodic input from legal and financial departments will be needed on a case-by-case basis. The CCP Review team should meet at regularly scheduled intervals. Meetings should include activities such as reviewing:

- Current CCP status at each facility
- Proposed commercial opportunities
- Past lessons learned
- Significant changes since last meeting.
- Technological developments
- Regulatory Changes/Updates
- Permitting issues
- Capital and O&M expenditures
- Long-term planning.

6.5 RESPONSIBILITY TO IMPLEMENT

All funding, design and implementation activities required for CCP long term depositories will be handled by the POG Plant Construction Department.

6.6 AUTHORITY AND FUNDING

Due to the magnitude of expenses for CCP monofill development and the frequency of events, the costs for site development and closeout should be sought via PCD and funded from the Corporate Capital Group with associated senior management approvals.

The operations and maintenance costs associated with CCP management should be funded out of the FGD regional budgets as these are routine and normal O&M expenses. However, the new CCP facilities will require a significant increase in O&M funding attributable to CCP management as compared to past years.

6.7 BEST PRACTICES IN THE INDUSTRY

For the purpose of taking an outsider's look at how other utilities execute the management of CCPs, a survey was conducted with support from the American Coal Ash Association (ACAA). In addition, URS inquired with various power generation companies to supplement the findings from the ACAA survey.

The ACAA survey was a series of questions focused on CCP management structure, roles and responsibilities, and operations at utilities with coal-fired plants located throughout the US. In addition, several questions were asked regarding wet management and ponding of ash, and the utilities' perceptions regarding the movement to dry ash handling. The wet/dry handling questions were of particular interest for Progress as many of Progress's coal-fired power plants currently wet sluice CCPs to ash ponds.

A total of 30 utilities were solicited by ACAA, with 12 utilities responding. In addition, the ACCA director also responded to the survey to give an overview of his understanding of the best CCP management practices in the utility industry. A copy of the summary of survey responses is provided in **Appendix G** of this report.

Survey results and findings, along with feedback from the ACAA director and various utilities, provided a wide range of responses regarding corporate and plant-based management responsibilities and structure. The findings and responses along with general industry knowledge were compiled and summarized into the following generalized statements regarding best practices or and general trends in CCP management in the utility industry:

- For many utilities, it appears that plant operations or the CCP corporate manager identifies the need for new CCP management facilities (i.e., storage and disposal requirements), based on current and projected usage. For many utility companies, the CCP management group (or individual manager) resides within the fuels or environmental departments, and in some cases within corporate engineering. The organizational structure for the CCP management group depends on geography, size and number of the plants. The utilities' engineering entity (corporate, regional or in some cases plant engineers) typically works with the third party engineering/consulting companies contracted to perform design, permitting and construction support for the CCP projects. These firms are typically specialized in

CCP management services. Depending on the source of funding for CCP projects, representatives of that group may also participate in project decisions/management.

- With many utilities now adding FGD systems to comply with SO_2 air quality standards, total annual CCP generation rates are increasing generally 50% to 100%. With this dramatic increase in CCP volumes, many utilities are being forced to retool the management of and strategic planning for their CCP management programs. For some utilities this shift has mandated reorganization and a shifting/reassigning of CCP management responsibilities within fuels, engineering/technical services, environmental, fossil generation and large projects. Increased production will require new on-site disposal facilities (for off-spec/unsold gypsum) and management of gypsum contracts. These contracts add additional pressures and responsibilities for utilities (i.e., production quotas and gypsum quality specifications) whose CCP management programs in the past have been limited to disposal management of ash with occasional beneficial reuse projects or limited fly ash sales for the ready-mix concrete market.

  There is a trend for utilities to move toward utilizing outside entities to manage overall CCP activities, especially marketing of CCPs. Historically, larger utility companies established in-house marketing and to a lesser degree research activities to support CCP utilization. With the recent trend in mergers and down-sizing over the past 5 plus years, more utilities are relying on outside entities to handle their CCP activities including marketing, transportation, disposal, etc. Where this is the case, the utilities tend to spread the contracts to several firms to allow for diversification and not tie up all the contracts with one company. If the utilities' CCP disposal site is on land owned by the power company, plant personnel are typically responsible for CCP handling and placement. If it is off site, usually an outside party (trucker, landfill operator, etc), may do the work. Utilities that are limited in staff resources are moving toward having contractors manage these operations.

- CCP management contracts are generally administered from a corporate office via personnel from fuels, procurement, or engineering departments. Operation and day-to-day management/operation of CCP ponds or landfills is addressed at the plant level. In some cases, maintenance of ponds or landfills is done by contractors or corporate services groups not under the control of the individual plants, such that a corporate entity arranges for maintenance of ponds at several power plants as part of a package contract.

  Larger contracts for new facilities, pond upgrades, and significant capital dollar projects are generally managed and administered by a regional/corporate engineering or large projects group within the utility. Implementation of CCP management projects generally involves participation by a corporate environmental group to provide review and technical support on permits and management of environmental liabilities. If new disposal areas are needed, corporate support from governmental relations, communications and property accounting may become part of the process.

If the expanded site has any potential for public involvement or opinion (especially if potentially adverse), corporate public relations and legal entities will become involved. As stated earlier, utilities generally contract for engineering, design and permitting services in support of these larger CCP projects.

- More plants are considering switching to dry handling, as the EPA and state agencies are strongly discouraging impoundments and wet handling systems due to potential groundwater impacts. Dry systems eliminate many of the issues that cause environmental groups and regulatory agencies to be concerned. While is is not a universal solution, dry handling is often attractive where land is at a premium. The wear and tear on piping systems, the amount of water needed to convey ash long distances and the potential for ruptures and spills make plant operators today look more favorably on dry handling. Typically in the industry, 4 to 5 plants out of 10 coal-fired power plants use wet handling, but new units under construction have elected to use dry handling.

Although there are certain trends and consistencies that appear common, such as outsourcing of CCP marketing and disposal management functions, each utility has its own particular brand or style of internal structure with regard to corporate, regional and plant-based staffing. It is likely that environmental regulatory trends will dictate the long-term strategies of the majority of CCP management programs. Few entities have the traditional larger internal structures to support CCP management activities, but instead have divided or shared those functions among fuels, environmental, engineering, and plant operations, with some outsourcing of functions on a as-needed basis. Utilities that have the most optimized and cost-effective CCP management programs operate with well-thought out, strategic and updated CCP management plans that keep current with plant needs, fuel strategies and environmental controls.

SECTION 7: BENEFICIAL REUSE

For the purposes of this CCP Management Plan, speculative beneficial reuse is not considered an appropriate long-term management strategy due to its unpredictable nature and markets. Speculation about future reuse and sales of CCP is driven by market supply and demand, CCP quality and quantities, and geography as it affects the cost to transport the CCP to the appropriate reuse market. Several plants included in the CCP Management Plan presently have contracted or guaranteed reuse agreements for some or all of their CCP. In the case of those plants, "guaranteed" reuse quantities were deducted from the projected CCP production amounts to determine the net required long-term disposal requirements. Plants with known, existing contracts for current or planned future reuse/sales are summarized in **Table 1.3**. Where FGD gypsum is noted for reuse in that table, these quantities are earmarked for sale as feedstock for wallboard or cement manufacturing. Ash reuse associated with the guarantees in **Table 1.3** is primarily for sales to the ready mix concrete market and aggregate manufacturing industries.

The chosen long-term CCP disposal method that Progress selects for each of the nine plants will in large part dictate future beneficial reuse options. For example, wet-handled fly ash (which is the current method of handling at the majority of the plants), precludes the ash from being beneficially reused in ready mixed concrete as a partial replacement for cement. However, larger-quantity beneficial reuse opportunities are still available for the wetted ash as structural fill (either on or off-site), high-ash flowable fill, aggregate and block manufacturing, and cement kiln feedstock to produce cement clinker. Bottom ash if segregated from the fly ash can be sold for use in lightweight block, and as lightweight structural fill, drainage media, or other uses. The potential for reuse in these manufactured products depends on the gradation, friability and quality of the bottom ash.

In contrast, where fly ash is dry handled and meets ASTM C618 requirements, it has the potential for use as a replacement for cement, in making ready mixed concrete – typically a 20% cement replacement. Ash used in this manner generally has the highest revenue potential per unit ton of any of the dry ash or wet ash reuse scenarios in the CCP markets, and is therefore the market of choice for Progress. Dry ash management with its' welcome potential for ready mix sales may conversely be unacceptable for use in structural fills, without the addition of amending agents, due to the increased levels of inorganic constituents in dry collected fly ash (i.e. heavy metals, selenium, arsenic, boron, etc.). This is the case in particular in the state of North Carolina with NCDENR's interpretation of groundwater "point of compliance" and the application of the Section 1700 regulations (see **Section 4** of this report for more details).

Table 1.3 Beneficial Reuse Plant Summary.

Summary of Known Beneficial Reuse Contracts		
Plant	**CCP**	**Contracted Amount (tons/year)**
Asheville	FGD gypsum	50,000 (maximum)
Roxboro/Mayo	FGD gypsum	600,000
Roxboro	Ash	200,000
Crystal River	Ash	80% of generation
Crystal River	FGD gypsum	80% of generation

7.1 NEW & EMERGING TECHNOLOGIES

7.1.1 High LOI Ash Beneficiation

There have been numerous research projects to develop commercial processes designed to remove or reduce the carbon content of high loss-on-ignition (LOI) fly ashes. Restricted by ASTM C-618 specifications to a maximum 6% LOI for use in concrete applications (and with many markets driven to provide LOI's below 4%), the objectives of this work have been to produce an ash product that can be utilized at high substitution rates as an effective replacement for Portland cement in concrete. Generally, lower LOI results in higher potential cement substitution rates in concrete. Cement substitution rates of 15%-20% are typical and even rates as high as 25%-30% have produced successful results. Research and investigative work has focused on carbon passivation or carbon removal, combustion or separation, and wet or dry processing. Dry processing is further classified by means of air classification, electrostatic, or sieve separation.

Pilot and commercial scale plants have been built to process high LOI fly ash based on the following process technologies: Flotation, Carbon Burn Out, Triboelectric Carbon Separation, Ash Reburn, and Sieve Separation.

Currently, only three of these process technologies are processing quantities of fly ash at greater than 100,000 tons per year: WE Energies' Ash Reburn, Progress Materials' Carbon Burn Out, and Separation Technologies' Carbon Separation. The latter two technologies have been in commercial operation for approximately ten years with good economic and byproduct marketing success.

Technology based solutions for ash beneficiation must be evaluated on a case by case basis at each generating facility. The average LOI level of ash produced at a plant and the method of ash handling will be the most important factors in the selection of the beneficiation technology.

7.1.2 High Volume Ash Usage

7.1.2.1 Cement Kiln Feed

A large market for high LOI fly ash is for cement kiln raw feed. Cement producers can utilize high LOI ash because the high temperatures in the kilns (up to 1500^{0}F) burn off the carbon contained in the ash. The presence of carbon is actually beneficial as a fuel source where the BTU value of the carbon becomes supplemental fuel. Fly ash is also a source of silica, iron and alumina in the manufacture of cement. When used in a kiln, fly ash is replacing sand, mill scale, and clay that is generally available near the cement kiln site. Cement kilns have the capacity to consume 450,000 to 2,000,000 tons of fly ash per year. Currently, the nearest kiln operations to the Carolinas territories are Lehigh in Union Bridge, MD and Lafarge, Holcim, and Giant in Harleyville, SC. Fly ash and bottom ash from the Crystal River plant have been successfully utilized in large quantities in cement kilns as raw feed.

7.1.2.2 Structural Fill

Structural fill CCP reuse opportunities will play a limited role in the overall ash management plan due to the inconsistent pattern of project opportunities. However a properly structured and funded CCP management plan must be in place before the opportunities arise in order to be responsive to requests for fill material. Project opportunities will not always coincide with the generating plants' timing and need to remove material from the disposal facility. In addition, CCP costs in large DOT highway structural fill projects generally run $2 to $4 more per ton than normal natural soil costs (for a 500,000 to 1,000,000 cubic yard project). This translates into an additional expenditure of $1M to $4M per project. By developing a proactive decision process, Progress Energy will be in a better position to evaluate and make informed decisions on providing CCP for a particular DOT and other structural fill opportunities. These project opportunities generally provide for a 30 to 45 day decision window by Progress Energy.

Fly ash is a good alternative to locally available soils for engineered fills for highway embankments, roadways, and commercial real estate projects. The use of fly ash and bottom ash in these applications will, under normal conditions, be centered within a 15 mile radius of the plant site. This limitation is strictly based on the cost of transporting ash from the plant to the job site. Transportation can usually be contracted at this distance, 15 miles, for less than $5 per ton of material. This cost includes removing the material from the disposal or storage facility and placement at the job site. The alternative material for earthmoving contractors is natural soil near the job site which can usually be obtained for $1 to $2 per ton depending on the quantity. There will be jobs where natural soils are not available or the cost exceeds the norm. In these cases, CCP can be priced competitively and offer a good alternative.

Each structural fill project opportunity must be evaluated individually considering the cost, the short-term needs of the disposal facilities at the generating facility and timing requirements of the project. The conditions of Progress' NCDENR ponded ash reuse permit (previously discussed in **Section 4**) are key to the implementation of CCP structural fills.

7.1.2.3 Private Land Development

Commercial real estate development is another structural fill opportunity for fly ash and bottom ash beneficial use. The same economic transportation radius of about 15 miles applies to these projects. Projects can be identified by maintaining close contact with the regional Progress Energy offices since one of the first contacts a project developer makes is with the local utility suppliers to verify service availability. Once an initial contact is made, this can be converted into an opportunity to present the facts and data on the use of CCP structural fill materials. These opportunities will be fewer in number and in general smaller volumes than highway projects. Developers are also more likely to be more restrictive in their use of CCP's unless the economics are offset in their favor by transportation subsidies.

Other utilities have achieved some additional success by getting more involved with the site development industry and by creating a special outreach program to market to the major site development companies which can also be further considered by Progress Energy.

7.1.2.4 Aggregate

The production of aggregate using fly ash and bottom ash offers the most promising potential for increasing utilization of CCP. Aggregates are used in nearly all residential, commercial, and industrial construction and in most public works projects such as roads, highways and bridges, rail road beds, dams, airports, water and sewage treatment projects. The construction aggregate market utilizes approximately 1.6 billion tons per year. To be successful in this market, Progress Energy and the utility industry at large needs to develop the ability to convert unmarketable high carbon fly ash into a specification grade aggregate product. In addition, washing and/or screening of higher quality bottom ash to meet aggregate specifications will also increase aggregate marketing potentials.

Obstacles to successful product development are technical, as well as regulatory and legislative in nature. The most critical technical issue has been the inability to produce ash-based products which have the required engineering properties to meet highway and construction industry standards. There have been hundreds of attempts by research and development companies, universities and industry sponsored programs to overcome these obstacles. However, there are very few commercial processes producing a marketable product from fly ash in the U.S. today.

One of the successful commercial fly ash projects is operated by Progress Materials at the Crystal River plant producing Aardelite from high carbon ash and lime. The plant has produced millions of tons of medium weight aggregate since production was started in 1987. Unfortunately, Progress Material's operations at Crystal River cannot be duplicated in the Carolinas since only lightweight aggregate (42 lbs/cubic foot) is desired in the Carolinas as compared to medium weight aggregate (52 lbs/cubic foot) product from the Crystal River operation.

7.1.2.5 Mine Reclamation

Using CCP to fill coal mines is a practice that has been popular in states such as Ohio and Pennsylvania. On March 1, 2006, the National Academy of Sciences (NAS) released a report commissioned by the EPA and Congress that found that residue left by power plants can be safely disposed of in old mines, although certain measures need to be taken to ensure groundwater safety. The report recommended development of enforceable federal standards to give the states authority to use ash but allows them to adopt requirements for local conditions.[3]

Certain hurdles would have to be overcome for Progress Energy to be able to use ash in mine reclamations projects. Pneumatic discharge rail cars are typically used for ash shipments, so backhauls using existing coal cars are not feasible without additional measures (car covers). PEC must contact mine owners to determine their interest in reclamation. Rail spurs may need to be constructed to inactive mines. An easier way for mine reclamation may be truck backhauls, but currently Asheville is the only plant that receives trucked coal. This beneficial reuse option deserves further exploration with our delivery providers and coal suppliers.

The environmental issues associated with this type of disposal will require extensive review and study. The long-term risks to PEC are not clearly understood at this time. In addition, states where the ash would be disposed could slow the approval process if mine site disposal is perceived as an activity that shifts a utility industry problem to their domain.

[3] Greenwire, March 1, 2006

Part II: CCP Management Plan – Site-Specific Features

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PART II, SECTION 1: INTRODUCTION

Part II of this 20-year CCP Disposal Management Plan provides descriptions of the site and plant-specific features that have been taken into consideration to evaluate the viable disposal options for each of the nine plants. In **Part I** of this Plan, each of the CCP disposal options were discussed, their utilization was defined and the overall design basis was provided. Although general features of each option were provided in **Part I**, the plant-specific application of the option was not provided or comparatively ranked against the other disposal options.

On a plant-by-plant basis, the following items are discussed and evaluated:

- Existing CCP management and future CCP projections for ash and FGD materials,
- Current and future beneficial reuse opportunities
- Plant specific assumptions,
- On-site and off-site land use options, and
- Comparative evaluation of each of the viable options specific to each plant.

Not all disposal options are considered for each plant. The options considered are based primarily on existing site constraints, land availability, type and quantity of CCP materials being disposed, Progress' proposed SO_2 removal technology, and finally Progress' preference. In addition, the viability of each disposal option specific to each plant was determined based on the preliminary screening criteria. In the case of wet stacking (Option W7) which is introduced in **Section 5** of **Part I**, Progress CCP team has decided that, although wet stacking may be a viable option for other utility companies, it is not a disposal technology that is to be further considered for long term implementation as part of this Plan.

1.1 EVALUATION CRITERIA

The future CCP disposal options for the nine plants were evaluated and scored based on four key screening criteria believed to be the most critical to the success of the long-term CCP Management Plan. The evaluation criteria are as follows:

Technical Considerations (5% weight) - Considers the following: engineering feasibility; protection of human safety; geotechnical/stability issues; facility performance (such as the ability to meet effluent requirements), constructability; etc.

Environmental, Permitting and Regulatory Considerations (25% weight) –Considers the following: threatened and endangered species impacts; significant wetland impacts; archeological constraints; permitting of the disposal facility including wetland assessment and mitigation; impacts to floodplains; proposed and future environmental regulations; disposal facility permitting; etc.

Site Development/ Land Availability Considerations (5% weight) –Considers land utilization and land availability - both onsite and/or offsite. "Onsite" land is defined as land owned by Progress Energy that is contiguous to or in close proximity to the plant area. "Offsite" land is defined as land owned by others but that is also contiguous to or in close proximity to land owned by Progress Energy. The following were the criteria utilized for evaluation of onsite or offsite land use:

No significant structures/apparent current land utilization for the areas other than agricultural/hunting that would prevent this use for CCP management;

Area is not located in the 100-year flood plain; and

No obvious geologic setting constraints (such as a large hill, steep grades, etc.) that would preclude the facility from being constructed in the area.

Economic Considerations (65% weight) – Considers the relative capital costs and operations and maintenance (O&M) costs. See **Table D-1**, in **Appendix D**, Cost Estimate for Long-Term CCP Management/Disposal Options, which shows the conceptual cost estimates for the long-term management disposal options. Assumptions used for the development of the cost estimates are discussed in **Section 5** of **Part I** of this Plan.

The scoring system is a subjective scoring system of 1 (most favorable) through 5 (least favorable). Each of the evaluation criteria was weighted as noted above. The cumulative score is an average of the score of the four screening criteria. Refer to **Table E**, Summary of Evaluation for all Plants located in **Appendix E**.

SECTION 2: ASHEVILLE PLANT

2.1 EXISTING CCP MANAGEMENT

Ash from the Asheville Plant is currently managed in an ash pond located south of the plant; refer to **Figure C-2** in **Appendix C**. Regional engineering is currently performing short term management practices, including the construction of an interior dike extension in the pond to allow for continued sluicing of fly ash and bottom ash to the pond. Progress' first scrubber went on line at Asheville Unit 1 in November 2005 and FGD gypsum produced at the site is currently being sold for beneficial reuse.

2.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Asheville Plant.

2.1.2 FGD

The Asheville Plant produces gypsum with the scrubber system on Unit 1 which began operation in November 2005. Approximately 64,000 tons of gypsum is projected to be produced in 2006 with the FGD generation increasing to more than 160,000 tpy by 2008 (according to the Nov 2005 GFF).

2.1.3 Current Beneficial Reuse Opportunities

There are currently no known significant ash beneficial reuse opportunities being utilized at the Asheville Plant. All of the gypsum being produced is currently being sold for beneficial reuse.

2.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the possible CCP disposal options for the Asheville Plant:

50,000 tons/year of gypsum will be beneficially reused through Dec 2014.

On-site CCP disposal is the preferred option and, in fact, off-site disposal would likely cause significant public pressure and opposition associated with transportation off-site, public visibility, expanding potential impacts of Asheville plant outside of the already developed plant site.

A new off-site monofill would require purchase of 200 acres at $40,000/acre and offsite transportation at a one way distance of 20 miles (40 miles roundtrip).

A line item cost of $750,000 is included in the Asheville cost evaluation to provide emergency ash sluicing for the scenario where a new ash disposal solution includes building a monofill over the on-site operating ash pond.

The only viable onsite disposal area at the plant is the operating ash pond footprint and the areas immediately surrounding the existing pond. Footprint in the areas immediately surrounding the operating ash pond include former filled ash ponds (old ash storage areas). An existing transmission line will need to be relocated to utilize the old ash storage area at a lump sum cost of $500,000.

Permitting and construction of a new on-site monofill including the relocation of existing transmission line will be achievable despite expected opposition from adjacent landowners (including Congressman Taylor.)

Plant will need short-term remedies to accommodate ongoing wet disposal in the existing ash pond through 2010. The current restacking project provides storage through the end of 2007.

2.3 FUTURE CCP PROJECTIONS

2.3.1 Ash

The Plant Generation Table provided in **Appendix A**, shows the projected future production for the Asheville Plant, based on the assumptions stated in **Section 1** of **Part I** in this report. The Asheville Plant is expected to generate an average of 147,000 tons/year of ash, resulting in 2,352,900 tons of accumulated ash by end of the year 2025 (a 16-yr period). Due to real estate constraints that would preclude construction of a new on-site ash pond, dry fly ash conversion will be needed to facilitate dry disposal of the fly ash. Bottom ash dewatering will also be required and achieved through the installation of hydrobins.

2.3.2 FGD

The Plant Generation Table provided in **Appendix A**, shows the future production forecast for the Asheville Plant based on the assumptions stated in **Section 1** of **Part I**. The Asheville Plant is expected to generate an average of approximately 168,000 tons/year of gypsum with an average of approximately 135,000 tons/year being disposed of under this Plan, resulting in 2,872,300 tons of accumulated gypsum by the end of the year 2025.

2.3.3 Future Beneficial Reuse Opportunities

A contract exists for 50,000 tons/year of gypsum to be beneficially used through December 2014. There are no current beneficial reuse opportunities identified for the Asheville Plant's ash, although dry conversion of the fly ash and bottom ash may make materials more acceptable for utilization for various future beneficial reuse opportunities

2.4 LAND USE OPTIONS

2.4.1 On-Site Land Use

On-site land at Asheville Plant is limited to the land within the existing ash pond and areas immediately surrounding the existing ash pond including an old ash storage area (Area 1). See

Figure C-2 in **Appendix C** for delineation of these areas. The area adjacent to the Lake Julian dam along the main plant access road is not being considered a potential disposal area because of concern with access to the dam face for inspection.

2.4.2 Off-Site Land Use

If practical or regulatory constraints prevent on-site Area 1 from being utilized as a disposal facility, off-site properties will have to be identified by a future siting investigation. A previous study by Law Engineering dated March 2002 indicated that a feasible site for off-site monofill construction could be 20 miles or more away from the Asheville Plant. For this plan, an evaluation of off-site disposal incorporating the economics of land purchase and hauling expense was performed to evaluate Option D1.

2.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE ASHEVILLE PLANT

Due to the on-site land limitations, all CCP will be disposed of dry in a monofill, as there is no land available of adequate size to utilize any of the wet disposal options. All of the wet options considered required more than 100 acres.

An unidentified off-site location approximately 20 miles away was evaluated for a new off-site monofill (Option D1). Area 1 (the existing ash pond and the adjacent old ash storage area) was evaluated for use as a new potential disposal area for construction of a new monofill sited above an existing ash pond (Option D2).

General details regarding each of these options are given in **Section 5** of **Part I** of this Plan.

2.5.1 New Off-site Monofill (Option D1)

To implement Option D1, disposal must be at an offsite location. Previous studies indicated that the land available for construction of a new landfill would be at least 20 miles away. Therefore, the economic evaluation for Option D1 for Asheville Plant incorporated a 20 mile haul cost and the cost for purchasing 200 acres at approximately $40,000/acre.

2.5.2 Monofill Sited on Existing Pond Over Separatory Liner (Option D2)

The use of a monofill sited above the existing ash pond at Asheville will present siting and engineering challenges. Permitting of the landfill at the Asheville site will be difficult due to the community's environmental concern, the new housing developments located immediately adjacent to the existing ash pond, some of which is owned by Congressman Charles Taylor.

In addition to the permitting opposition that can be expected at this site, there are significant technical considerations that may make it difficult to construct this option. Loose, saturated deposits of fly ash underlying the landfill will be susceptible to liquefaction and seismic instability if an earthquake occurs in close proximity to this landfill. It should be noted that the seismic risk at Asheville Plant is significant with predicted peak ground accelerations similar to those found near Sacramento, California. The feasibility and/or required engineering controls will not be known until a more comprehensive investigation is completed on the conditions of the existing ash pond and a stability evaluation for a new landfill constructed on the loose wet ponded ash.

2.6 EVALUATION

Disposal options have been evaluated by the screening criteria previously mentioned in **Section 1** of **Part II** and shown on the Asheville Plant Evaluation, in **Appendix E**. Although the rankings are subjective, **the construction of a new monofill sited above the existing ash pond (Option D2, $8.88/ton) onsite is recommended** above the other viable options as the best long-term option for the Asheville Plant. This is mainly driven by the economic advantage of this option being on-site as compared to Option D1.

If any constraints to land use arise that were not considered in this evaluation, the options of constructing a new monofill (Option D1) off-site would be the second-highest ranked option. Note that either option may experience significant public opposition which may delay implementation.

SECTION 3: CAPE FEAR PLANT

3.1 EXISTING CCP MANAGEMENT

Two existing ash ponds are located at the Cape Fear Plant as shown in **Figures C-3A**, and **C-3B, Appendix C**. The 65-acre unlined 1983 pond currently receives both fly ash and bottom ash. The second unlined pond is 90 acres and is comprised of the 1963, 1970, and 1983 ponds. The 1978 portion of the pond is still in use and receives low volumes of CCP from the Cape Fear Plant. The 1963 and 1970 portions of the pond are no longer in use and are currently overgrown with vegetation.

3.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Cape Fear Plant.

3.1.2 FGD

The Cape Fear Plant does not currently produce gypsum. A dry FGD or Furnace Sorbent Injection (FSI) system is being considered for 2011/2012 operations.

3.1.3 Current Beneficial Reuse Opportunities

There are currently no known ash beneficial reuse opportunities being utilized at the Cape Fear Plant.

3.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the possible CCP disposal options for the Cape Fear Plant:

Cape Fear is scheduled for a dry FGD or FSI system. This plan assumes that there will be no wetting of dry FGD due to this causing thixotropic and/or cementitious qualities once wetted. Therefore, dry conversion of ash will be required once the SO2 removal system is operational. This limits the disposal options to dry options (options D1, new monofill, or D2, monofill sited on existing pond over separatory liner). However, both dry and wet options were evaluated for economic purposes and future reference.

Wet options evaluated for economic purposes include; a new lined pond (option W1), multiple cycled lined ponds and monofill disposal (option W2), ash pond excavation, monofill disposal and pond relining (option W3A), dike extension on existing pond over separatory liner (option W4), geotubes stacked on existing pond over separatory liner (option W5), and geotubes stacked over separate lined structure (option W6)

Ash pond excavation and restacking over separatory liner (option W3B) was eliminated from the options, because there is not enough space to restack on a single pond and continue sluicing CCP.

Two available on-site areas are the 1985 (73 acres) and the combined 1960, 1970 and1978 (89 acres) Ash Ponds. The remainder of the plant area is either insufficient in contiguous area, or in the floodplain.

If the option of a monofill constructed over an existing pond were chosen, a portion of the existing 1985 pond will be reserved to provide for emergency ash sluicing. Therefore, no cost associated with a new wet area to serve this function is required.

To avoid construction in the floodplain, the only potential locations for construction of new CCP disposal facilities on virgin territory are several off-site (Progress Energy owned) parcels located within 3 miles northeast of the site.

3.3 FUTURE CCP PROJECTIONS

3.3.1 Ash

The Plant Generation Table provided in **Appendix A**, shows the projected future production for the Cape Fear Plant, based on the assumptions stated in **Section 1 of Part I** in this Plan. The Cape Fear Plant is expected to generate an average of 104,400 tons/year of ash, resulting in 1,670,100 tons of accumulated ash by the year 2025.

3.3.2 FGD

The Cape Fear Plant is expected to install and be operational with either dry FGD or FSI systems by 2011/2012. The Plant Generation Table provided in **Appendix A**, shows the projected future production for Cape Fear, based on the assumptions stated in **Section 1** of **Part I** in this Plan. Cape Fear is expected to generate an average of 118,500 tons/year of dry FGD/FSI, resulting in 1,777,000 tons of accumulated dry FGD/FSI by the year 2025.

3.3.3 Future Beneficial Reuse Opportunities

There are no known guaranteed beneficial reuse opportunities planned for ash or FGD byproduct at the Cape Fear Plant.

3.4 LAND USE OPTIONS

3.4.1 On-Site Land Use

The majority of Cape Fear's land is located within the 100-year flood plain. Only two portions of the onsite property with significant land area met our initial project siting criteria (described in **Section 1** of **Part II)**. These are the combined 1960, 1970 and 1978 ash ponds and the 1983 ash pond, referred to as Area 1 and Area 2, as shown in **Figure C-3A and C-3B, Appendix C**.

3.4.2 Off-Site Land Use

If Area 1 or Area 2 cannot be developed as disposal facilities due to either practical or regulatory constraints, there is a significant amount of off-site land owned by Progress Energy located to the northeast of the plant proper that could potentially be utilized for CCP management. These off-site parcels are referred to as Area 3 and Area 4 in **Figure C-3A, Appendix C** and are both greater than 100 acres in size and located within three miles of the current Plant.

3.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE CAPE FEAR PLANT

As previously stated, this Plan assumes that there will be no wetting of dry FGD due to this causing thixotropic and/or cementitious qualities once wetted. Therefore, dry ash handling conversion will be required thereby dictating that the disposal option will be one of the designated dry disposal options (options D1, new monofill, or D2, monofill sited on existing pond over separatory liner).

Several on-site parcels are located within three miles to the northeast of the site, and could be potentially used for construction of a new monofill (option D1).

General details regarding each of these options are given in **Section 5** of **Part I** of this Plan.

3.5.1 New Monofill (Option D1)

As mentioned previously, Cape Fear Plant has adequate land off-site that would meet preliminary siting criteria for construction of a dry monofill facility. The required footprint of the monofill is estimated as 45 acres with a height of 80 ft. The general design methodology used as the basis for the conceptual sizing of this disposal option is discussed in **Section 5** of **Part I** of this Plan. The new off-site monofill will require access road construction/improvements for hauling CCP to Area 3 and Area 4.

3.5.2 Monofill Sited on Existing Pond Over Separatory Liner (Option D2)

Due to generally higher development costs (when compared to a new monofill on a previously undeveloped site), the use of a monofill sited above the existing ash pond is typically used when a plant has a shortage of available or useable land. To avoid construction in the 100-year flood plain, Area 1 or 2 can be used for option D2. Area 1 might be slightly more favorable for this option, since it is not solely used for sluicing of ash, and western portions of the Area (old 1960 & 1970 ash ponds) appear overgrown and unused. The required footprint of the monofill on the existing pond is estimated at 45 acres with a height of 80 ft.

3.6 EVALUATION

The options are evaluated by the screening criteria previously mentioned in **Section 1 of Part II** and shown on the Cape Fear Plant Evaluation, in **Appendix E**. Although the rankings are subjective**, the construction of a monofill sited on an existing pond over a separatory liner (option D2) onsite is recommended above the other viable options as the best long-term option for the Cape Fear Plant**. This is mainly driven by the limited amount of onsite lands meeting the siting criteria and the economic advantage of this option in comparison with option D1. Option D1 is slightly more expensive ($10.94/ton) than option D2 (estimated cost including capital and O&M of $37,396,000 or $10.85/ton) due to the construction/improvement of access haul roads. A portion of one of the existing ponds will be set aside for emergency ash sluicing.

If any constraints to land use arise that were not considered in this evaluation, the options of constructing a new lined monofill off-site (Option D1) would be the second-highest ranked option. Note that neither option is as economically favorable as the construction of a new lined pond; however a new lined pond is not being considered because this Plan assumes that there will be no wetting of dry FGD or FSI .

SECTION 4: CRYSTAL RIVER PLANT

4.1 EXISTING CCP MANAGEMENT

Ash is currently managed using a dry system and disposed in an unlined monofill, located in the northeast portion of the Crystal River Plant area, as shown in **Figure C-4, Appendix C**. The unlined monofill was permitted in 1978 for a waste footprint of 90 acres and maximum height of 80 feet. Prior CCP waste occupies approximately 30 acres of this 90 acre footprint.

4.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Crystal River Plant.

4.1.2 FGD

The Crystal River Plant does not currently produce gypsum. A wet FGD system is planned for Units 4 & 5, and is projected to be online in November and April 2009, respectively.

4.1.3 Current Beneficial Reuse Opportunities

Crystal River currently beneficially reuses 100% of the ash generated to produce medium weight aggregate for the cement industry.

4.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the possible CCP disposal options for the Crystal River Plant:

Only Crystal River North (CR Units 4 & 5) will be generating FGD.

In 2009, after FGD equipment is on-line, 80% of ash generated (a conservative assumption) will be beneficially reused for at least the duration of the CCP Management Plan (through 2025).

Beginning in 2010, 80% of the gypsum generated will be beneficially reused.

Progress' Environmental Services Section (ESS) believes that, due to difficulties with permitting new ponds, no new ponds or wet disposal methods will be permitted in Florida. Therefore, the disposal option will be a new lined monofill (option D1). Crystal River is currently operating with a dry ash system.

The current monofill must be re-permitted to allow for the addition of wet FGD byproduct. This will require an upgrade to a lined monofill including a leachate collection system and related requirements to meet permitting requirements in the state of Florida.

4.3 FUTURE CCP PROJECTIONS

4.3.1 Ash

The Plant Generation Table provided in **Appendix A**, shows the projected future production for the Crystal River Plant, based on the assumptions stated in **Section 1** of **Part I** in this Plan. The Crystal River Plant is expected to generate an average of 957,100 tons/year of ash, resulting in 3,062,900 tons of accumulated ash (after considering beneficial reuse) by the end of year 2025.

4.3.2 FGD

The Crystal River Plant is expected to install wet FGD equipment by 2009 for Units 4 & 5 only. The Plant Generation Table provided in **Appendix A** shows the projected future production for Crystal River, based on the assumptions stated in **Section 1** of **Part I** in this Plan. The Crystal River Plant is expected to generate an average of 603,200 tons/year of FGD gypsum, resulting in 2,791,900 tons of accumulated FGD gypsum (after considering beneficial reuse) by the year 2025.

4.3.3 Future Beneficial Reuse Opportunities

After 2009, 80% of the ash generated at Crystal River will be beneficially reused. Beginning in 2010, 80% of the FGD gypsum will be beneficially reused. This amounts to approximately 20,212,100 tons of beneficially reused material for the period from 2010-2025.

4.4 LAND USE OPTIONS

4.4.1 On-Site Land Use

The majority of the land south and west of the main plant areas is located within the 100-yr floodplain. Approximately 65 acres in the northwest portion of the land is currently utilized as an unlined monofill for ash disposal. This area is referred to as Area 1, as shown in **Figure C-4** in **Appendix C**.

4.4.2 Off-Site Land Use

If Area 1 cannot be developed as a disposal facility due to other practical or regulatory constraints, future studies will have to identify off-site land that could be used to develop a CCP disposal facility.

4.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE CRYSTAL RIVER PLANT

As previously stated in the Plant Specific Assumptions, due to difficulties with permitting new ponds, it is assumed that no new ponds or wet disposal methods will be permitted in Florida. Therefore, the disposal option will be a new lined monofill (option D1).

General details regarding option D1 are given in **Section 5** of **Part I** of this Plan.

4.5.1 New Monofill (Option D1)

As mentioned previously, Crystal River Plant appears to have adequate land on-site that would meet preliminary siting criteria, as described in **Section 1** of **Part II**, for construction of a new lined monofill facility. A new separatory liner will be placed over the waste within the existing unlined monofill and the facility will be required to operate under a new permit. The required footprint of the monofill is estimated as 54 acres with an ultimate height of 115 ft. The required footprint was increased by approximately 10% to account for the additional liner material (separatory liner) needed to overlay the existing unlined monofill, resulting in a 60 acre footprint. The general design methodology used as the basis for the conceptual sizing of this disposal option is discussed in **Section 5** of **Part I** of this Plan.

4.6 EVALUATION

A new lined monofill (option D1) was the only disposal option evaluated for Crystal River. The option was evaluated by the screening criteria previously mentioned in **Section 1** of **Part II** and shown on the Crystal River Plant Evaluation, in **Appendix E**. The estimated cost (capital and O&M) for Option D1 is estimated at approximately $37,809,000 or $6.46/ton.

If any constraints to land use arise that were not considered in this evaluation, future studies will be needed to identify off-site properties for disposal.

SECTION 5: LEE PLANT

5.1 EXISTING CCP MANAGEMENT

Currently, both fly ash and bottom ash are managed in one combined unlined ash pond located onsite north of the Neuse River, as shown in **Figure C-5**, **Appendix C**. The Lee Plant's existing pond has approximately 4 years of residual storage capacity (as of Jan. 2006), based on estimates made by the Lee Plant's engineers. As a short-term management solution (2005-2010), an inner dike system has recently been completed which gives the pond an additional estimated 3 years (total of approximately 7 years of capacity). The remaining capacity from this short-term management solution was assumed to be unavailable for use in the long-term management plan, which covers from 2010 through the end of 2025.

5.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Lee Plant.

5.1.2 FGD

The Lee Plant does not currently produce gypsum, nor is it scheduled to receive any SO2 removal technologies.

5.1.3 Current Beneficial Reuse Opportunities

There is currently no ash being beneficially reused from the Lee Plant.

5.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the CCP disposal options for the Lee Plant:

Progress owns land located south of the Wayne County CT Plant that is currently being used for farming, but would be available for the development of a future CCP disposal facility.

FGD systems will not be installed at Lee Plant.

Units 1 through 3 will remain active through the end of 2025.

5.3 FUTURE CCP PROJECTIONS

5.3.1 Ash

The Plant Generation Table provided in **Appendix A**, shows the projected future production for the Lee Plant, based on the assumptions stated in **Section 1** of **Part I** in this Plan. The Lee Plant is expected to generate an average of 99,300 tons/year of ash, resulting in 1,569,400 tons of accumulated ash by the year 2025.

5.3.2 FGD

The Lee Plant is not expected to install FGD equipment over the next 20 years, and FGD processes are not considered in this Plan.

5.3.3 Future Beneficial Reuse Opportunities

There are no known beneficial reuse opportunities planned for ash at the Lee Plant.

5.4 LAND USE OPTIONS

5.4.1 On-Site Land Use

Two portions of the onsite Lee Plant property with significant land area meet these initial siting criteria. These are labeled Areas 1 and 2 on the attached **Figure C-5**, with each being separated from one another by the existing overhead electrical transmission lines.

Area 1 is approximately 55 acres and is undeveloped woods. Area 2 is approximately 140 acres and is currently used for growing cotton.

Other issues such as current land use agreements (hunting lands, cotton farming) are not considered a significant flaw to preclude the use of these onsite lands.

5.4.2 Off-Site Land Use

If Areas 1 and 2 cannot be developed as solid waste disposal facilities due to other practical or regulatory constraints, there is a significant amount of offsite land located to the south and southwest of the plant property that potentially could be utilized for CCP management. If Areas 1 and 2 cannot be developed as a disposal facility due to other practical or regulatory constraints, future studies would be needed to identify portions of off-site land in relative proximity to the plant property that could be used to develop a CCP disposal facility.

5.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE LEE PLANT

For the Lee Plant, CCP management options that incorporate wet conveyance will be the most logical and economical choices for this facility. Dry conveyance oriented disposal options were also evaluated. The expense of the plant converting to a dry handling system, along with the cost of material handling associated with conveying the material (either by truck or by conveyor system) adds significant cost to the dry disposal options.

The existing Lee ash pond is not lined, therefore options involving reuse of the existing pond's footprint that do not involve relining the pond will require the use of a separatory liner. All of the alternatives discussed in **Section 5** of **Part I** associated with ash were evaluated in this study for Lee Plant.

General details regarding each of these options are given in **Section 5** of **Part I**.

5.5.1 New Lined Pond (Option W1)

Specific to Lee Plant, there are minimal obstacles to the construction of a new lined pond. Lee Plant appears to have sufficient land to construct a pond of adequate size on its own property. Assuming a pond with an average depth of 25 feet, 3 foot of freeboard, and a capacity equal to 80% of the height of water, a pond of approximately 80 acres would be required to store the volume of CCP (approximately 1.5 million tons) that are not currently managed by existing structures.

5.5.2 Multiple Cycled Lined Ponds and Monofill Disposal (Ash W2)

Although this option is not economically favorable due to the relatively small size of the plant, a preliminary evaluation of this option was performed. The land area required for two cycled ponds and a disposal facility was similar to what would be required for a new lined pond due to the minimum sizing (approximately 15 acres each). Although the economics may be unfavorable, and considering the anticipated increased effort associated with permitting, both the cycled ponds and a monofill, this option was evaluated for comparison purposes..

5.5.3 Ash Pond Excavation, Monofill Disposal and Pond Relining (Option W3A)

This option could be considered for Lee Plant as an efficient use of land. Both Area 1 and Area 2, assuming no additional significant site constraints, may be adequate for a monofill. The estimated required footprint to store the CCP (approximately 1.5 million tons) not already managed by existing structures would be approximately 25 acres.

This option allows for minimal infrastructure and operational changes to the facility and may allow for little to no modification of the existing NPDES permit for the existing pond. Lee Plant does not appear to have significant land use constraints, but this option may be considered if permitting of a monofill facility presents less difficulty than permitting a new lined pond.

5.5.4 Ash Pond Excavation and Restacking Over Separatory Liner (Option W3B)

This option is expected to be among the most challenging to implement, thereby increasing the relative cost. If reuse of the existing pond is desired, these cost implications may offset the costs associated with the monofill in option W3A which may make option W3B option more attractive.

5.5.5 Dike Extensions on Existing Pond Over Separatory Liner (Option W4)

The predominant difficulties associated with this option are common to all of the options requiring the construction of a separatory liner in an active pond. Considerable construction challenges including the construction of a temporary separatory dike, construction of a settlement crown, feasibility of increasing dike height significantly, etc will need to be overcome in order to implement this option. This leads to an increase in relative cost. To be economically favorable, this would have to outweigh the expense of building a new facility on Progress Energy owned property.

5.5.6 Geotubes Stacked on Existing Pond Over Separatory Liner (Option W5)

An estimated 55 acres of the existing ash pond will need to be relined for implementation of this disposal option. The geotubes would be placed over the newly lined area and filled with sluiced ash to a maximum stacked height of 20 feet.

5.5.7 Geotubes Stacked Over Separate Lined Structure (Ash W6)

This option allows for efficient land use by allowing ash to be stacked vertical with reduced handling compared with the other monofill structures. An estimated 55 acres of a separate structure will need to be relined for implementation of this disposal option. The geotubes would be placed over the lined area and filled with sluiced ash to a maximum stacked height of 20 feet.

5.5.8 New Monofill (Option D1)

Dry conversion at Lee Plant may be desirable if there is a strong potential for beneficial reuse of ash, depending on the potential market in proximity to the plant. The Lee Plant has adequate land that would meet preliminary siting criteria for construction of a dry monofill facility. Currently there is no indication that the market warrants dry conversion at the Lee Plant and the use of a dry monofill, but this option was evaluated for comparison purposes.

5.5.9 Monofill Sited on Existing Pond Over Separatory Liner (Option D2)

Due to generally higher development costs (when compared to a new monofill on a previously undeveloped site), the use of a monofill sited above the existing ash pond is typically used when a plant has a shortage of available land. Central North Carolina has seismic risk which may potentially require the use of engineered control measures to reduce the risk of slope instability and/or other seismic failure mechanisms such as liquefaction. The economic impact of implementing these engineered controls was not included in the cost evaluation.

5.6 EVALUATION

The options are evaluated by the screening criteria previously mentioned in **Section 1** of **Part II** and shown on the Lee Plant Evaluation, in **Appendix E**. T**he construction of a new lined pond (Option W-1) onsite is recommended** above the other viable options as the best long-term option for the Lee Plant. This is mainly driven by the relative abundance of onsite lands and the economic advantage of minimal handling of the ash for disposal in the new lined pond.

The estimated cost of Option W1 at this plant is approximately $17,045,000 or $10.86/ton, including capital, O&M, and miscellaneous costs.

If any constraints to land use arise that were not considered in this evaluation, the options of constructing a vertical dike extension for the existing pond along with a separatory liner (option W4) would be the second-highest ranked option.

SECTION 6: MAYO PLANT

6.1 EXISTING CCP MANAGEMENT

A single 120-acre unlined ash pond is exists at the Mayo Plant as shown in **Figure C-6, Appendix C**. Dry fly ash is currently collected in a silo and then wet to enable sluicing to the on-site ash pond. Bottom ash is also currently sluiced to the same pond. The existing pond has available storage space through 2015 based on projected annual disposal rates.

6.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Mayo Plant.

6.1.2 FGD

The Mayo Plant does not currently produce gypsum. FGD equipment is planned for May 2009 startup.

6.1.3 Current Beneficial Reuse Opportunities

Mayo ash is under contract through 2007. However, poor contractor performance has resulted in no ash being moved off site. The plant is beginning a bottom ash test that is expected to beneficially reuse approximately 75% of annual production. In addition to the ash utilization, Mayo, conjunction with Roxboro, currently has a contract to beneficially reuse 600,000 tons/year of gypsum through 2025. Progress preference is to utilize the Roxboro gypsum before the Mayo gypsum.

6.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the CCP disposal options for the Mayo Plant:

Mayo currently collects dry fly ash in a silo and sluices ash to an on-site pond. This should be considered a wet/dry system for the purposes of this Plan. However, URS is to evaluate the disposal of CCP using dry disposal options only, with the exception of bottom ash.

The existing ash pond has capacity through 2015.

An additional dry disposal option, option D3, is included for the Mayo Plant only. Under this option, FGD product would be transported to Roxboro from 2009 through 2015. During this time, ash will be sluiced to the existing Mayo pond, a new monofill will be constructed at Mayo and begin receiving ash and FGD product in 2016.

An additional cost of $250,000 is included in the cost evaluation for repair of non-functional redundant equipment to permit dry handling of 100% of Mayo's fly ash.

Mayo's FGD sludge will go to on-site settling basins to be constructed as part of the FGD project.

Bottom ash will continue to be sluiced to the on-site pond.

A sizable amount (775 total acres) of on-site land exists west of US15-501 that could be used for a future CCP disposal facility.

6.3 FUTURE CCP PROJECTIONS

6.3.1 Ash

The Plant Generation Table provided in **Appendix A**, shows the projected future production for the Mayo Plant, based on the assumptions stated in **Section 1** of **Part I**. The Mayo Plant is expected to generate an average of 203,700 tons/year of ash, resulting in 2,037,100 tons of accumulated fly ash by the end of year 2025.

6.3.2 FGD

The Mayo Plant is expected to be operating a FGD system by May 2009. The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Mayo Plant, based on the assumptions stated in **Section 1** of **Part I**. The Mayo Plant is expected to generate an average of 262,400 tons/year of wet FGD (gypsum), resulting in 4,465,600 tons of accumulated gypsum by the end of year 2025.

6.3.3 Future Beneficial Reuse Opportunities

Although there is a joint contract between the Roxboro Plant and the Mayo Plant for beneficial reuse of FGD gypsum, the entire contracted amount could be supplied by the Roxboro Plant. Therefore, there are no known beneficial reuse opportunities planned for ash or FGD at the Mayo Plant. Should the actual sulfur content of coals at Roxboro be less than current projections (under Nov 2005 GFF), then it is possible that Mayo's FGD product can be used to fulfill the BPB contract at Roxboro.

6.4 LAND USE OPTIONS

6.4.1 On-Site Land Use

Four portions of the onsite property with significant land area meet the initial siting criteria as described in Section 1 of Part II. These are Area 1, Area 2, Area 3 (the existing ash pond), and Area 4 as shown in Figure C-4, **Appendix C**.

6.4.2 Off-Site Land Use

If Areas 1 through 4 cannot be developed as disposal facilities due to either practical or regulatory constraints, future studies would have to identify off-site land that could be used to develop a CCP disposal facility.

6.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE MAYO PLANT

As previously stated in the Plant Specific Assumptions, this Plan assumes only dry disposal options for the Mayo Plant, with the exception of bottom ash. Therefore, the disposal option will be one of the designated dry disposal options (option D1, new monofill, or option D2, monofill sited on existing pond over separatory liner, or option D3, new monofill with initial FGD transport to Roxboro). Option D3 is a separate disposal option that is unique to the Mayo Plant and is described in **Section 6.5.3**.

A portion of the existing ash pond will be set aside for emergency ash sluicing.

General details regarding each of these options, with the exception of option D3, are given in **Section 5** of **Part I** of this Plan.

6.5.1 New Monofill (Option D1)

As mentioned previously, the Mayo Plant has adequate land on-site that meets preliminary siting criteria for construction of a dry monofill facility. Either area 1, 2 or 4 could be used for construction of a new monofill. The required footprint of the monofill is estimated at 65 acres with an ultimate height of 125 ft.

6.5.2 Monofill Sited on Existing Pond Over Separatory Liner (Option D2)

Due to generally higher development costs (when compared to a new monofill on a previously undeveloped site), the use of a monofill sited above the existing ash pond is typically used when a plant has a shortage of available land. Area 3 can be used for option D2. The required volume of the monofill on the existing pond is the same as Option D1 (65 acres x 125 feet high.)

6.5.3 Monofill with initial FGD transport to Roxboro (Option D3)

For this option, FGD product and sludge would be transported via truck from the Mayo Plant to the Roxboro Plant from 2009 through 2015. During this time, fly and bottom ash will be sluiced to the existing Mayo pond, while a new monofill is constructed to enable future ash and FGD product to be disposed in 2016. This option was included in this evaluation primarily for economic purposes. Initial transport of FGD would delay capital expenditures for construction of the new monofill, and the reduced quantity of CCP would lead to a lower overall disposal cost. The required footprint of the Mayo monofill is estimated as 50 acres with a height of 110 ft.

6.6 EVALUATION

The options are evaluated by the screening criteria previously mentioned in **Section 1** of **Part II** and shown on the Mayo Plant Evaluation, in **Appendix E**. **The construction of a new monofill (Option D1) onsite is recommended** above the other viable options as the best long-term option for the Mayo Plant. This is mainly driven by economics. Option D1 is the least expensive disposal method, estimated at total cost (capital and O&M) of $41,563,000 or $6.39/ton. A portion of the existing pond will be set aside for emergency ash sluicing.

If any constraints to land use arise that were not considered in this evaluation, the option of constructing a new lined monofill sited above the existing ash pond (option D2) would be the second-highest ranked option. The total cost (capital and O&M) of option D2 is estimated at $42,535,000 or $6.54/ton. Note that although the monofill with initial FGD transport to Roxboro (option D3), estimated at $46,012,000 or $7.08/ton is the most expensive of the three dry disposal options; it would have the benefit of significantly delaying capital expenditure.

SECTION 7: ROBINSON PLANT

7.1 EXISTING CCP MANAGEMENT

Ash from the Robinson Plant is currently managed in a single ash pond, as shown in **Figure C-7, Appendix C**. The 48-acre unlined pond currently receives both fly ash and bottom ash.

7.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Robinson Plant.

7.1.2 FGD

The Robinson Plant does not currently produce gypsum. FGD equipment is planned for installation and is projected to be online by May 2009.

7.1.3 Current Beneficial Reuse Opportunities

There is currently no ash being beneficially reused from the Robinson Plant.

7.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the CCP disposal options for the Robinson Plant:

Robinson is scheduled for a dry FGD system. This plan assumes that there will be no wetting of dry FGD due to this causing thixotropic and/or cementitious qualities once wetted. Therefore, dry conversion of ash will be required at this plant and thereby forcing the disposal option to one of the dry options (option D1 or D2). However, both dry and wet options were evaluated for economic purposes.

Both bottom ash and fly ash will be converted to dry for reasons mentioned above.

There is a Progress directive not to use the footprint of Robinson's existing ash pond for CCP management/disposal. Therefore, a new lined pond, (option W1), multiple cycled lined ponds and monofill disposal (option W2), geotubes stacked over separate lined structure (option W6), and a new monofill (option D1), are the only remaining options for purposes of the Robinson evaluation.

Land is available on-site for construction of a new monofill on the west side of Lake Robinson north of the existing plant.

7.3 FUTURE CCP PROJECTIONS

7.3.1 Ash

The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Robinson Plant, based on the assumptions stated in **Section 1** of **Part I** in this Plan. The Robinson Plant is expected to generate an average of 52,600 tons/year of ash, resulting in 841,000 tons of accumulated ash by the end of year 2025.

7.3.2 FGD

The Robinson Plant is expected to be operating a FGD system by May 2009. The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Robinson Plant, based on the assumptions stated in **Section 1** of **Part I**. The Robinson Plant is expected to generate an average of 56,700 tons/year of dry FGD, resulting in 964,500 tons of accumulated dry FGD by the end of year 2025.

7.3.3 Future Beneficial Reuse Opportunities

There are no known beneficial reuse opportunities planned for ash or dry FGD product at the Robinson Plant.

7.4 LAND USE OPTIONS

7.4.1 On-Site Land Use

Several portions of the onsite property with significant land area meet the initial siting criteria as described in **Section 1** of **Part II**. These are Areas 1 through 4, as shown in **Figure C-7, Appendix C**.

7.4.2 Off-Site Land Use

If Areas 1 through 4 cannot be developed as disposal facilities due to either practical or regulatory constraints, future studies would have to identify available offsite lands that could be used to develop a CCP disposal facility.

7.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE ROBINSON PLANT

As previously stated, this Plan assumes that there will be no wetting of dry FGD due to this causing thixotropic and/or cementitious qualities once wetted. Therefore, dry conversion of ash will be required at this plant. In addition, no work is to be done within the footprint of the existing ash pond. This dictates that the disposal option will be new monofill (option D1). However, both dry and applicable wet options will be evaluated for economic purposes and future reference.

Wet options evaluated for economic purposes include: a new lined pond (option W1), multiple cycled lined ponds and monofill disposal (option W2), and geotubes stacked over separate lined structure (option W6). The economic evaluations of the possible wet options are included in **Appendix D**.

A portion of the existing ash pond will be set aside to serve as emergency ash sluicing, emergency spill control, and backup ash dewatering.

General details regarding each of these options are given in **Section 5** of **Part I**.

7.5.1 New Monofill (Option D1)

As mentioned previously, Robinson Plant appears to have adequate available on-site land that would meet preliminary siting criteria as described in **Section 1** of **Part II**, for construction of a dry monofill facility. The required dimensions of the monofill is 30 acres with an ultimate height of 55 ft.

7.6 EVALUATION

Due to the previously stated plant specific assumptions, **a new lined monofill (Option D1) was the only disposal option fully evaluated for Robinson plant and is the recommended option**. The option was evaluated by applying the screening criteria previously mentioned in **Section 1** of **Part II** and shown on the Robinson Plant Evaluation, in **Appendix E.** The estimated total cost (capital and O&M) of option D1 at this plant is approximately $26,494,000 or $14.67/ton.

If any constraints to land use arise that were not considered in this evaluation, future studies would be needed to identify off-site properties and other disposal options. Note that neither option is as economically favorable as the construction of a new lined pond (option W1), however a new lined pond is not being considered because this Plan assumes that there will be no wetting of dry FGD at this plant.

SECTION 8: ROXBORO PLANT

8.1 EXISTING CCP MANAGEMENT

Fly ash from Roxboro Plant is currently managed in a landfill located southeast of the plant; refer to **Figures C-8A** and **8B** in **Appendix C**. This landfill is currently permitted to take FGD, fly ash, and bottom ash and has capacity, based on current estimates, through 2013. Bottom ash is currently being sluiced to a bottom ash pond located south of the plant. Current beneficial reuse projects, along with the construction projects associated with the FGD treatment ponds which will utilize bottom ash, will enable the existing bottom ash pond to maintain capacity for disposal beyond 2025.

8.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Roxboro Plant.

8.1.2 FGD

The Roxboro Plant does not currently produce gypsum. The Roxboro Plant is anticipated to install the first of 4 wet FGD units, which will produce wallboard grade gypsum, in 2007. The last unit with the final unit will be installed by the end of 2008.

8.1.3 Current Beneficial Reuse Opportunities

Roxboro Plant currently utilizes approximately 200,000 tons/year of fly ash and utilizes approximately 75% of the bottom ash produced for beneficial reuse. In addition to the ash utilization, Roxboro, in conjunction with the Mayo Plant, currently has a contract to beneficially reuse 600,000 tons/year of gypsum through 2025. Progress preference is to utilize the Roxboro gypsum before the Mayo gypsum.

8.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the possible CCP disposal options for the Roxboro Plant:

600,000 tons/year of gypsum will be beneficially reused for at least the duration of the Plan.

200,000 tons/year of fly ash will continue to be beneficially reused beyond the current ash marketing contract through 2025.

75% of the bottom ash will be beneficially utilized through current and future contracts. In addition, construction projects associated with the FGD treatment ponds will allow for adequate space through 2025.

All CCP at Roxboro (with the possible exception of bottom ash) are to be handled and disposed of dry. The existing bottom ash pond may remain in service for some time as the FGD project is dredging this pond for bottom ash for use as structural fill.

The existing landfill has capacity for all excess FGD (including FGD sludge) and all fly ash generated through the end of 2013.

Land that is most readily available for CCP disposal is the land surrounding the existing ash monofill. A lateral and vertical ("piggy-back") expansion of this existing monofill will likely be the preferred method to implement (Option D1). A portion of the expansion may be constructed over an old ash pond in which case the new landfills bottom liner will serve as the sepratory liner over the legacy ash pond.

8.3 FUTURE CCP PROJECTIONS

8.3.1 Ash

The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Roxboro Plant, based on the assumptions stated in **Section 1** of **Part I** in this Plan. The Roxboro Plant is expected to generate an average of 625,000 tons/year of ash with approximately 200,000 tons/year being beneficially utilized. This results in 5,104,300 tons of accumulated ash between the beginning of 2014 (when the current landfill is anticipated to reach capacity) and the end of 2025.

8.3.2 FGD

The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Roxboro Plant, based on the assumptions stated in **Section 1** of **Part I**. The Roxboro Plant is expected to generate an average of approximately 840,000 tons/year of gypsum with approximately 240,000 tons/year being disposed of under this Plan, resulting in 3,386,000 tons of accumulated gypsum by the year 2025.

8.3.3 Future Beneficial Reuse Opportunities

Approximately 600,000 tons/year of gypsum from Roxboro and Mayo (with preference to the utilization of Roxboro gypsum) are contracted to be beneficially used through the end of this Plan. In addition, it is anticipated that current fly ash will continue to be utilized at a minimum rate of 200,000 tons/year through the end of the 2025. This quantity is considered to be a conservative estimate of fly ash utilization, as it is anticipated that this will increase significantly with Progress Energy's increased marketing of Roxboro's fly ash. Bottom ash utilization is anticipated to continue at 75% of the total bottom ash generated (about 88,000 tons/year out of the total bottom ash production of approximately 117,000 tons/year).

8.4 LAND USE OPTIONS

8.4.1 On-Site Land Use

Land north and south of the existing landfill is the most readily available land for CCP disposal. A Northern Expansion and Southern Expansion, as shown on **Figure C-8B** in **Appendix C** are possible expansion areas for the existing landfill. No other on-site properties meet the preliminary siting criteria and are of significant size to allow for on-site disposal at the Roxboro Plant site.

8.4.2 Off-Site Land Use

If the Northern and Southern Expansion Areas cannot be developed as disposal facilities due either practical or regulatory constraints, future studies would have to identify portions of land in relative proximity to the plant property that could be used to develop a CCP disposal facility.

8.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE ROXBORO PLANT

Although a relatively small portion of the Southern Expansion Area is located above a former ash pond, this proposed footprint would be sited predominantly over undeveloped ground. Therefore, this expansion is considered to more closely resemble Option D1 rather than Option D2. Since the bottom ash pond will remain active through the end of 2025, only a new monofill (Option D1) will be evaluated for Roxboro Plant.

8.5.1 New Monofill (Option D1)

Option D1 will be implemented by a lateral and vertical expansion of the existing landfill. See **Figure C-8B** in **Appendix C**. The general design methodology used for the conceptual sizing of this disposal option is discussed in **Section 5** of **Part I**.

8.6 EVALUATION

Due to the stated practical, economic, or regulatory constraints, **a new monofill (Option D1) was the only disposal option fully evaluated and is the recommended CCP disposal option for Roxboro**. The option was evaluated by the screening criteria previously mentioned in **Section 1** of **Part II** and shown on the Roxboro Plant Evaluation, in **Appendix E**.

The estimated cost of Option D1 at this plant is approximately $50,579,000 or $5.96/ton, including capital, O&M, and miscellaneous costs.

If any constraints to land use arise that were not considered in this evaluation, the option of constructing a new monofill off-site would be the second-highest ranked option.

SECTION 9: SUTTON PLANT

9.1 EXISTING CCP MANAGEMENT

Ash from Sutton Plant is currently managed in two ash ponds, the 1983 ash pond and the larger 1984 ash pond; refer to **Figure C-9** in **Appendix C**. Both ponds are currently considered to benear or at capacity. Regional Engineering is implementing the construction of an interior dike extension in the 1983 pond as a short term CCP management solution. . A previous evaluation conducted by Progress Energy recommended the implementation of an on-site structural fill project to create an industrial park as a solution to empty the existing ash ponds to allow for continued management of ash. This project has not been implemented to date and was placed on a hold principally due to the pending status of Progress Energy's Ash Reuse Permit, as previously discussed in **Section 4**. The ash reuse permit has since been resolved favorably, however the Industrial Park project would have to be evaluated against the recommended long term CCP management facility of this study. Removal of ash from the existing ash ponds may not be necessary.

9.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Sutton Plant.

9.1.2 FGD

The Sutton Plant does not currently produce gypsum or other FGD byproduct. Dry FGD equipment is scheduled to be operational on Sutton Unit 3 by 2012.

9.1.3 Current Beneficial Reuse Opportunities

There are currently no known significant ash beneficial reuse opportunities being utilized at the Sutton Plant. Several high volume structural fill and alternative reuse opportunities have been identified with DOT and others in near proximity, but are longer term ventures which would be contingent on the company's position on off-site structural fills. See **Section 4** of **Part I** for additional discussion of this subject in the context of Progress Energy's ash reuse permit issued by NCDENR.

9.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the possible CCP disposal options for the Sutton Plant:

Sutton 3 is scheduled for a dry FGD system. Therefore, Sutton's 20-year plan assumes that there will be no wetting of dry FGD due to this causing thixotropic and/or cementitious qualities once wetted. As a consequence, dry conversion of ash will be required at this plant and the recommended disposal option will be a dry disposal option (option D1 or D2).

There is an inherent environmental advantage to a lined CCP disposal option that is constructed on top of the footprint of the unlined 1983 pond due to this new CCP facility removing the infiltration and potentially reducing leaching and groundwater quality concerns associated with the 1983 pond.

For the purposes of this plan, the land located to the northeast of the plant that has been proposed for the industrial park construction will not be used for CCP disposal under this plan. However, if the industrial park project does not proceed, that area could be used for siting a landfill.

If a monofill constructed over an existing pond (option D2) is recommended, a portion of the existing 1984 pond will be set aside to serve as emergencyash sluicing, and backup ash dewatering. Therefore, no costs associated with a new structure to serve this function will be included in the facility plan.

It is assumed that if a dry fly ash conversion system is utilized, bottom ash will be converted to dry handling via the hydrobins.

9.3 FUTURE CCP PROJECTIONS

9.3.1 Ash

The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Sutton Plant, based on the assumptions stated in **Section 1** of **Part I** in this report. The Sutton Plant is expected to generate an average of 117,100 tons/year of ash, resulting in 2,721,300 tons of accumulated ash by the end of year 2025. If dry FGD equipment is installed on Sutton 3, fly ash will require a dry conversion to facilitate dry landfilling and bottom ash will be dewatered in hydrobins.

9.3.2 FGD

The Sutton Plant is expected to commence operation of a Dry FGD system on Unit 3 by 2012. Units 1 & 2 are not programmed for SO_2 removal technologies. The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Sutton Plant, based on the assumptions stated in **Section 1** of **Part I**. The Sutton Plant is expected to generate an average of 145,900 tons/year of dry FGD, resulting in 2,042,600 tons of accumulated dry FGD by the end of year 2025.

9.3.3 Future Beneficial Reuse Opportunities

There are two possible future beneficial reuse opportunities planned for ash at the Sutton Plant; the on-site industrial park structural fill project and the North Carolina Department of Transportation (NCDOT) Wilmington Bypass project in which embankment construction may include the use of fly ash as structural fill. Other potential large volume reuse opportunities exist as well. None of these projects have an existing contract that guarantees beneficial reuse, therefore, these potential beneficial projects were not considered in the disposal quantities for Sutton Plant for this long-term plan.

9.4 LAND USE OPTIONS

9.4.1 On-Site Land Use

On-site land at Sutton Plant is limited to the locations of the existing 1983 and 1984 ash ponds (Area 1), lands located northeast of the plant (Area 2), and lands located south of the proposed NCDOT Wilmington Bypass alignment (Area 3). If the industrial park structural fill project is implemented, Area 2 may not have adequate room to be utilized for future CCP disposal. See **Figure C-9** in **Appendix C** for delineation of these areas.

9.4.2 Off-Site Land Use

If Areas 1, 2, or 3 cannot be developed as on-site disposal facilities due to other practical or regulatory constraints, land adjacent to the plant property that would be available for development of a CCP disposal facility is scarce. Future studies would be required to identify potential off-site properties in the event that the identified on-site areas are not available for disposal.

9.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE SUTTON PLANT

As previously stated, this Plan assumes that there will be no wetting of dry FGD due to this causing thixotropic and/or cementitious qualities once wetted. Therefore, dry conversion of ash will be required at this plant thereby dictating that the disposal option will be one of the designated dry disposal options (options D1, new monofill, or D2, monofill sited on existing pond over separatory liner). However, both dry and wet options thought to be feasible at Sutton Plant will be evaluated for economic comparison purposes, but wet options will not be further considered as a viable long-term option for Sutton Plant. The economic evaluations of both the dry and the wet options are included in **Appendix D.**

Areas 2 and 3, both considered potential on-site potential disposal areas, could be used for construction of a new monofill (Option D1), while Area 1 could be potentially used to implement a new monofill constructed above and existing ash pond (Option D2).

General details describing each of these options are given in **Section 5** of **Part I**.

9.5.1 New Monofill (Option D1)

As mentioned previously, Sutton Plant has adequate land on-site that meets the preliminary siting criteria for construction of a dry monofill facility. The required dimensions of the monofill is 60 acres with an ultimate height of 75 ft. The height of the monofill was capped at 75 vertical feet to limit the potential visibility of the disposal area from the surrounding area.

9.5.2 Monofill Sited on Existing Pond Over Separatory Liner (Option D2)

The construction of a monofill sited above an existing ash pond is typically less economical than the construction of a monofill over undeveloped land. This is due to the engineering controls required to construct over the relatively soft, saturated ash in the pond. At Sutton Plant, construction of a monofill above the unlined ash ponds may decrease concerns over potential legacy groundwater impacts present east of the 1983 and 1984 ash ponds. Groundwater impacts may be reduced by effectively closing off the existing ponds from further water infiltration into the underlying soils, thereby reducing the potential for ash-related constituents to enterthe groundwater.

9.6 EVALUATION

The various disposal options are evaluated by the screening criteria previously mentioned**, Section 1** of **Part II** and shown on the in **Appendix E,** Sutton Plant Evaluation. **The construction of a new monofill (Option D1) onsite is recommended** above the other viable options as the best long-term option for the Sutton Plant. This is mainly driven by economics. It was deemed by Progress Energy that the environmental advantage of construction the monofill above the existing 1983 and 1984 ponds was not significant enough and had too many unknowns to outweigh the economic advantage of the new landfill.

The estimated cost of Option D1 at this plant is approximately $44,420,000 or $9.32/ton, including capital, O&M, and miscellaneous costs.

If any constraints to land use arise that were not considered in this evaluation, the option of constructing a new monofill sited above the existing ash ponds (Option D2) would be the second-highest ranked option. Note that neither option is as economically favorable as the construction of a new lined pond, however a new lined pond is not being considered because this Plan assumes that there will be no wetting of dry FGD.

SECTION 10: WEATHERSPOON PLANT

10.1 EXISTING CCP MANAGEMENT

Ash from the Weatherspoon Plant is currently managed in a single ash pond, as shown in **Figure C-10, Appendix C**. The 50-acre unlined pond currently receives both fly ash and bottom ash.

10.1.1 Ash

Table 1.1 provided in **Part I**, shows current ash production, handling and disposal methods for the Weatherspoon Plant.

10.1.2 FGD

The Weatherspoon Plant does not currently produce gypsum.

10.1.3 Current Beneficial Reuse Opportunities

There is currently no ash being beneficially reused from the Weatherspoon Plant, although there has been substantial interest from NCDOT in ash utilization for a future highway interchange nearby.

10.2 PLANT SPECIFIC ASSUMPTIONS

The following assumptions were used in developing the possible CCP disposal options for the Weatherspoon Plant:

The Weatherspoon Plant will discontinue coal-fired generation at the end of 2013, and FGD systems are not planned for Weatherspoon prior to then. In addition, the amount of ash generated from 2010 to 2013 is relatively small compared to other plants in this study (112,500 tons). Based on these factors, new CCP structures (ponds, monofills) will likely not be economically viable, and will not be evaluated in the CCP Management Plan.

Ash pond excavation and restacking over a separatory liner (option W3B), dike extensions on the existing pond over separatory liner (option W4), and geotubes stacked on the existing pond over separatory liner (option W5) will be evaluated as viable options.

10.3 FUTURE CCP PROJECTIONS

10.3.1 Ash

The Plant Generation Table, provided in **Appendix A**, shows the projected future production for the Weatherspoon Plant, based on the assumptions stated in **Section 1** of **Part I**. The Weatherspoon Plant is expected to generate an average of 37,500 tons/year of ash, resulting in 112,500 tons of accumulated ash by the end of year 2013.

10.3.2 FGD

The Weatherspoon Plant is not expected to install FGD equipment prior to the plant's retirement date.

10.3.3 Future Beneficial Reuse Opportunities

There are no known beneficial reuse opportunities planned for ash at the Weatherspoon Plant, however Progress Energy has been involved with detailed discussions with NCDOT for ash utilization in a future highway interchange nearby.

10.4 LAND USE OPTIONS

10.4.1 On-Site Land Use

All disposal options considered for this Plan involve construction within the footprint of the existing ash pond, referred to as Area 1 and shown in **Figure C-10, Appendix C**.

10.4.2 Off-Site Land Use

As previously stated, no new CCP facilities will be built, and therefore, offsite land use was not evaluated. If Area 1 cannot be developed as a disposal facility due to either practical or regulatory constraints, future studies would have to identify off-site properties .

10.5 FUTURE CCP MANAGEMENT OPTIONS APPLICABLE TO THE WEATHERSPOON PLANT

As previously stated, no new structures (such as dry conversion systems) will be built at the Weatherspoon Plant. Therefore no dry disposal options will be evaluated.

The existing Weatherspoon ash pond is not lined. Therefore, based on the Overall Plan Assumptions as stated in **Section 1** of **Part I**, the existing pond's footprint cannot be used for new CCP disposal unless the pond is either relined, or, a separatory liner is installed. Ash pond excavation and restacking over a separatory liner (option W3B), dike extensions on the existing pond over separatory liner (option W4), and geotubes stacked on the existing pond over separatory liner (option W5) have been evaluated for the Weatherspoon Plant.

General details regarding each of these options are given in **Section 5** of **Part I** of this Plan.

10.5.1 Ash Pond Excavation and Restacking Over Separatory Liner (Option W3B)

As discussed in **Part I**, this option is expected to be among the most challenging to implement – from a construction and O&M standpoint – which will increase the relative cost of this disposal option. For the Weatherspoon Plant, it is estimated that 16 acres of the pond would be required to provide ash disposal for 2010 through 2013.

10.5.2 Dike Extensions on Existing Pond Over Separatory Liner (Option W4)

The predominant difficulties associated with this option are common to all of the options requiring the construction of a separatory liner in an active pond. Considerable construction difficulties (including the construction of a temporary separatory dike, construction of a settlement crown, feasibility of increasing dike height significantly, etc.), will lead to an increase in relative cost for this option. It is estimated that 16 acres of the pond would be required for ash disposal, with an additional dike extension height of 12 feet.

10.5.3 Geotubes Stacked on Existing Pond Over Separatory Liner (Option W5)

An estimated 8 acres of the existing ash pond would need to be relined for implementation of this disposal option. The geotubes would be placed over the newly lined area and filled with sluiced ash to a stacked height of 15 feet. Note, that the 20 feet height of the geotube stacks used in other plants is not achievable at Weatherspoon due to the small quantity of material being disposed of under this Plan.

10.6 EVALUATION

The options are evaluated by the screening criteria previously mentioned in **Section 1** of **Part II** and shown on the Weatherspoon Plant Evaluation, in **Appendix E**. **The construction of a dike extension on the existing pond over a separatory liner (Option D2) onsite is recommended** above the other viable options as the best option for the Weatherspoon Plant. This is mainly driven by the economics. This option is estimated to cost a total of approximately $4,204,000 or $37.37/ton. The high unit cost is attributable to the small quantities of CCP to be placed in the facility over the 3 year life (2010-2013).

If any constraints to land use/construction arise that were not considered in this evaluation, the options of geotubes stacked on the existing pond over a separatory liner (Option W5) would be the second-highest ranked option. Note that all options evaluated for the Weatherspoon Plant have a significantly higher cost per ton than the other plants.

SECTION 11: Conclusions

Each plant has been evaluated at a conceptual level in accordance with the overall project assumptions discussed in **Section 1** of **Part I** of this Plan. In addition, several plant-specific assumptions were used in developing the viable CCP disposal options and were also essential in the ultimate selection of the recommended disposal option for each plant. The assumptions related to the economic evaluation have been provided in **Section 5** of **Part I** of this Plan. A summary of the recommended disposal option for each plant and the respective total cost (capital and O&M) and total cost per ton is provided in the following table.

Table 2.1 Summary of Recommended Plant Disposal Options

Plant Decision Summary			
Plant	**Recommended Disposal Option**	**Estimated Total Cost (includes O&M)**	**Estimated Cost/ton**
Asheville	Option D2 – Monofill Sited over Existing Pond over Separatory Liner	$46,398,000	$8.88/ton
Cape Fear	Option D2 – Monofill Sited over Existing Pond over Separatory Liner	$37,396,000	$10.85/ton
Crystal River	Option D1 – Monofill	$37,809,000	$6.46/ton
Lee	Option W1 – New Pond	$17,045,000	$10.86/ton
Mayo	Option D1 – Monofill	$41,563,000	$6.39/ton
Robinson	Option D1 – Monofill	$26,494,000	$14.67/ton
Roxboro	Option D1 – Monofill	$50,579,000	$5.96/ton
Sutton	Option D1 – Monofill	$44,420,000	$9.32/ton
Weatherspoon	W4 – Dike Extension	$4,204,000	$37.37/ton
Total Fleetwide		**$305,908,000.00**	

The recommendation of this Plan is that the majority of the plants implement conversion to dry handling systems and manage CCP via a dry CCP disposal solution in the form of a new monofill (Option D1) or new monofill constructed over existing ash ponds (Option D2). For each of the plants that dry disposal is the preferred long-term solution and that are currently managing ash with wet ponds, dry conversion of ash handling systems will also be a mandate. Although the evaluation of potential beneficial reuse of CCP was beyond the scope of this project, dry ash handling systems do open the door to more lucrative reuse/sales in the concrete industry assuming CCP meet ASTM specifications and markets are available.

The predominance of the selection of dry disposal solutions has in large part been dictated by FGD pollution control systems planned, and in some cases, plants that were already operating a dry ash management system (Roxboro, Crystal River and Mayo (for clarification, Mayo's ash is dry collected and put in silos, then wet sluiced to on-site ponds)). For those plants already dry converted, there was no driver to switch to a long-term wet CCP disposal solution. Progress' plan that each plants' long-term CCP plan provide for one common disposal facility, either wet or dry, was also a primary driver for the recommendation for dry CCP disposal for 7 of the 9 plants evaluated.

Preliminary cost estimation indicates that Option D1 has an associated total cost ranging from $5.96/ton to $14.67/ton. The large total unit cost range is due to the size of the plant, the projected tonnage of CCP, transportation distance, and available land for construction of the Monofill.

The monofills recommended for Asheville and Cape Fear are to be sited above the existing ash pond (Option D2) and have an associated total unit cost of $8.88/ton and $10.85/ton, respectively. This option has been recommended because at each of these plants, it was determined that the existing ponds represented the only available land in close proximity to the plant that met the preliminary siting criteria.

This Plan recommends that the Lee Plant, which is not currently scheduled to receive SO_2 removal technology, construct a new lined ash pond (Option W1) to manage CCP for an associated cost of $10.86/ton. Finally, Weatherspoon, which has been scheduled for plant retirement in 2013, is recommended for a dike extension over the existing pond and utilization of a separatory liner (Option W4) for an associated cost of $37.37/ton. The cost for disposal at Weatherspoon is considerably higher because of the relatively low quantity of CCP production, the overarching requirement to install a liner under CCP disposed of after 2010, along with the costs being amortized over a relatively short time period (3 years) until the plants retirement.

Duke Energy Progress, LLC's
Late-Filed Exhibit No. 22

Docket No. E-2, Sub 1219

Request: Requesting whether the costs in the 2012 Plant Retirement Comprehensive Program Plan were internally developed, based on Burns & McDonnell decommissioning studies or developed externally by another independent party?

Response: The process for deriving the cost estimates for plant retirements is substantially the same today as it was in 2012. Power plant demolition estimates are initially obtained from the dismantlement studies. If the plant retirement project managers have updated information based upon receipt of bids for similar activities or scopes, or if any of the assumptions made in the dismantlement study are revised, then the cost estimates are updated as appropriate by the project managers.

The 2011 Plant Retirement Program Comprehensive Program Plan, dated August 2011, included estimated costs for ash pond closure. While the document states that the baseline assumption for ash pond closure was $100k per acre, the estimates provided on a per site basis averaged $130k per acre. Based upon conversations with employees who were part of the Plant Retirement Program during this time period, these estimates were based upon internal estimates and a study that had been performed by the URS Corporation in 2010 for the HF Lee plant. The company has not been able to locate a copy of the URS coal ash basin estimate document.

The 2011 Dismantlement Study was authorized in April 2011, with site visits occurring in July 2011. Per the 2011 Dismantlement Study, "the decommissioning costs were developed using the information provided by Progress, in-house data available to BMcD, and information supplied by LVI." Burns & McDonnell used all of this information to "make a recommendation to Progress regarding the total cost to decommission the facilities at the end of their useful lives."

The cost estimates between the Dismantlement Study and the Plant Retirement Program Plans are shown in the table below. The estimates were relatively comparable between the 2011 Plant Retirement Program Plan, the 2012 Dismantlement Study, and the 2012 Plant Retirement Program Plan. Therefore, the independent evaluation by Burns & McDonnell of ash basin closure costs were generally in line with the internal Progress Energy estimates, which were based, at least in part, by an evaluation of HF Lee by URS Corporation.

Station	August 2011 Plant Retirement Program Plan	January 2012 Dismantlement Study	October 2012 Plant Retirement Program Plan	October 2013 Plant Retirement Program Plan
Weatherspoon	$ 7,700,000	$ 7,000,000	$ 7,402,229	$33,401,000
HF Lee	$ 32,250,000	$ 43,000,000	$ 32,051,651	$70,747,000
Cape Fear	$ 21,200,000	$ 22,000,000	$ 21,205,496	$86,054,000
Sutton	$ 19,550,000	$ 21,000,000	$ 19,555,000	$63,686,000
Robinson	N/A	$ 11,000,000	$ 14,008,378	$32,197,000
Total	$ 80,700,000	$104,000,000	$ 94,222,754	$286,085,000

Estimates were revised in the October 2013 document based upon updated information, following the process described in the first paragraph of this response. The baseline assumption in both the 2012 document and the 2013 document was that coal ash basin closures would range from $100k to $300k per acre. The Plant Retirement Program Plan prepared in late 2014 did not contain coal ash basin closure estimates. Following passage of the North Carolina Coal Ash Management Act in September 2014, a legal requirement to close the basins was created and it was determined that coal ash costs were to be captured as an Asset Retirement Obligation.

The October 2012 Plant Retirement Program Plan, produced after Duke Energy and Progress Energy merged, did include estimates for the ash basins at the retired DEC locations. The estimates were developed internally and averaged approximately $400 per acre. Assumptions made in the internal estimates by the two pre-merger companies were compared and consolidated in 2012 and 2013, resulting in a closer alignment of costs on a per acre basis between the two legacy companies in the October 2013 document.

Station	October 2012 Plant Retirement Program Plan	October 2013 Plant Retirement Program Plan
WS Lee	$22,265,501	N/A
Dan River	$22,265,501	$23,993,000
Buck	$35,503,734	$46,501,000
Riverbend	$35,503,734	$40,867,000
Total	$115,538,470	$111,361,000

The Company has not determined why a cost estimate for WS Lee was not included in the October 2013 plan update.

Duke Energy Progress, LLC's
Late-Filed Exhibit No. 23

Docket No. E-2, Sub 1219

Duke Energy Progress
Docket E-2, Sub 1219
Late-Filed Exhibit No. 23
Page 1 of 1
October 23, 2020

Request: Any earlier or later version or iteration of the DEP twenty-year plan for management of waste ash referred to by Charles Gates in the Commission's dam safety proceeding in Docket No. E-100, Sub 23A, however such earlier or later version or iteration is titled or denominated, and whether such additional version or iterations were for the same or for a shorter or longer planning period.

Response:

In the hearing transcript of Docket No. E-100, Sub 23A, page 21, Lines 14-19 states:

> "Your question about the dry versus wet, we've contemplated the issue in terms of looking at the future. We have a 20-year plan laid out for handling ash at our facilities as we reach capacity on these ponds. We have to decide at that point what to do going forward. So we have laid out a plan."

The date of the public hearing was Monday, February 23, 2009.

The Company has not been able to locate earlier or later versions of the 20-Year CCP Management Plan, dated April 12, 2006, provided in Docket E-2, Sub 1219, Late Filed Exhibit #5. Additional documents that include ash management strategy are included in the response to Docket E-2, Sub 1219, Late Filed Exhibit #19.

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing *Late-Filed Exhibit Nos. 4, 5, 22, and 23* as filed in Docket No. E-2, Sub 1219, were served via electronic delivery or mailed, first-class, postage prepaid, upon all parties of record.

This, the 2nd day of November, 2020.

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