Attachment E

Combustion By-Product Storage Facility Operation Manual

Operations Manual
Combustion By-Product Storage Facility
C. D. McIntosh Power Plant

City of Lakeland, Florida
Department of Electric Utilities

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1.0 Introduction

The operational requirements of the City of Lakeland (COL), C. D. McIntosh Combustion By-Products Storage Facility (Facility) are provided in this Operations Manual, which had been originally submitted and approved by the Florida Department of Environmental Protection (FDEP), formerly the Florida Department of Natural Resources in March 1992 and revised in February 2004. This manual addresses the following topics:

- Storm water management including collection, sedimentation control, and disposal.
- Development of Facility expansion.
- Operation of Facility development.

The scope of this manual is to provide the physical characterization and disposition of the materials handled at the Facility as well as a description of the management practices utilized by Facility personnel for storage, utilization, and reclamation of the by-products. Best management practices are utilized to promote by-product reuse, minimize impact to soil and groundwater, maximize storage volume of the Facility, and minimize impacts to the present plant operation and storm water management system.

Under the original Site Development Contract the following arrangement and detailed cross sections for the initial development of the Facility were completed:

- Site grading and development.
- Haul roads.
- Storm water diversion berms, collection ditches, and culverts.
- Sedimentation pond modifications.

This Operations Manual addresses the following:

- Stage and cell development, including traffic considerations.
- Stage and cell closure.
- Operational controls, including management of storm water, leachate and dust.

2.0 Material Characteristics

2.1 Properties of Materials

This section identifies the various materials handled at the Facility, including a description, source, approximate generation rate, and storage options. The various materials that will be handled at the Facility include:

- Bottom Ash
- Fly Ash
- Gypsum
- Secondary Materials

2.1.1 Bottom Ash

Characteristics: Bottom ash is formed from the non-combustible constituents of coal during the combustion process. These non-combustion constituents are commonly referred to as ash. As coal combusts in the boiler, the heavier ash particles fall from the combustion zone into collection hoppers located at the bottom of the boiler. Approximately once per eight-hour shift, plant operators sluice the accumulated bottom ash (and water) from the hopper to the hydrobins where it is then dewatered before being placed in the Facility. Processed bottom ash is granular and porous in appearance. The color ranges from gray to gray-black.

Generation Source and Rate: Bottom ash is generated and collected at a rate of approximately 11,000 tons per year (dwb). This approximation is based on the coal containing 8.33% ash. The bottom ash generation rate will correlate with the actual ash content of the fuel and plant operating hours. The portion of ash forming bottom ash represents approximately 14% of the coal's total ash content.

Destination and Utilization: After water is added for cooling purposes, the bottom ash is hydraulically transported to hydrobins that decant and drain the water. The end use market for bottom ash is historically very strong, and it is reasonable to expect that all of the bottom ash will be sold under contract for use in the production of concrete and cement. Bottom Ash generated will only be stored on site if there are marketing issues with the buyers.

2.1.2 Fly Ash

Characteristics: Fly ash is defined as the finely divided residue produced from the combustion of coal, transported by flue gas, and collected by electrostatic precipitation. Fly ash exhibits a gray to gray-brown appearance. The individual particles are referred to as cenospheres, small round particles of fly ash.

Generation Source and Rate: Fly Ash is generated and collected at a rate of approximately 68,000 tons per year (dwb). This is based on an ash content value of about 8.33%, with about 86% of the coal ash being converted to fly ash.

Destination and Utilization: All fly ash is deposited into the on-site silo for temporary storage. From the silo, the fly ash that is sold is loaded into a pneumatic tanker truck. The fly ash that can not be sold is processed through the existing byproduct processing facility where water is added and the material is transported to the Facility for storage. Fly Ash generated will only be stored on site if there are marketing issues with the buyers or used to stabilize other waste materials prior to storage on-site.

2.1.3 Gypsum

Characteristics: Gypsum is the by-product formed in the Flue Gas Desulfurization (FGD) System. Gypsum is formed as a result of the chemical reaction between limestone ($CaCO_3$) and sulfur dioxide (SO_2) within the FGD system. The gypsum is dewatered and is eventually discharged from a rotary drum vacuum filter as a moist filter cake. The gypsum is very fine, with an average particle diameter of 50 microns. The color of the gypsum is dependent on the color of the reagent limestone and the amount of fly ash that enters the FGD system. It will range from light brown to white.

The gypsum is then transported by conveyor belt to the stack-out pad for sale or storage at the Facility. In storage, gypsum tends to form an outer crust that protects the inner pile from wind and rain erosion.

Generation Source and Rate: The design rate of FGD by-product generation from the FGD System and FGD Waste Handling System is estimated to be 65,000 tons per year (wwb) based upon a 1.8% sulfur content in the fuel.

Destination and Utilization: The FGD system produces a quality, commercial grade gypsum. The end market for this material is historically very strong, and it is reasonable to assume that all gypsum will be sold under contract for use in the production of cement. Only a fraction of the Gypsum is anticipated to be disposed on-site.

2.1.4 Secondary Materials

Characteristics, Generation Source and Rate: Other operations at the Plant generate other incidental materials that are placed in the Facility. These materials are listed in the following table:

PROCESS / SAMPLE AREA	SOURCE AREA	ITEM	MATERIAL	FREQUENCY	VOLUME (3,000-GALLON TRUCK LOADS)
Material Holding Cell	Unit 3	turbine area sump	sand/grit/water	outage	4
		hotwell	sand/grit/water	outage	2
		condensate sump	sand/grit/water	outage	1
		precipitator hoppers	fly ash	outage	40
		economizer hoppers	fly ash	outage	8
		penthouse	fly ash	outage	4
		windboxes	fly ash	outage	2
		regen. sump	bottom ash, fly ash	monthly	7
		precip. sump	fly ash	6 months	5
		air heater hoppers	fly ash	outage	4
		air heater sumps	fly ash	outage	2
		bottom ash hoppers	bottom ash	outage	6
		secondary air ducts	fly ash	outage	5
		quencher cross over duct	fly ash	outage	3
		quencher inlet duct	fly ash	outage	2
		fly ash trunk lines	fly ash	outage	8
		pyrites	pyrites	weekly	1
	Condensate Polisher	condensate polisher sump	sand/grit/water	outage	4
		green sand filter media	green sand	yearly	1
	Scrubber	air sump	gypsum	monthly	3
		reheat sump	gypsum/sand/water	3 months	1

	make up sump	gypsum/sand/water	outage	3
	cooling tower blowdown	sand/grit/water	outage	3
	stack	gypsum	outage	10
	31 absorber module	gypsum	outage	15
	32 absorber module	gypsum	outage	15
	outlet duct	gypsum/fly ash	outage	7
	slurry storage tank	gypsum	outage	2
	mill product tank	gypsum	outage	2
Limestone	limestone area sump	limestone, gypsum	6 months	1
	limestone pit	limestone	6 months	4
	reclaim sump	fly ash, bottom ash, gypsum, quicklime	weekly	2
	co-132 sump	fly ash, bottom ash, gypsum, quicklime	weekly	1
	dewatering bin sump	fly ash, bottom ash, gypsum, quicklime	weekly	3
	surge tank	gypsum	outage	10
	fly ash silo	fly ash	outage	50
CSI	road run off sump	fly ash/grit/sand/water	3 months	1
	brine lagoon	fly ash/grit/sand/water	yearly	50
	thickener tank	gypsum	outage	60
	thickener underflow sump	gypsum	3 months	1
	quicklime silo	quicklime	yearly	1
Storage Facility	south sedimentation pond	fly ash, bottom ash, gypsum, quicklime	quarterly	2
Miscellaneous Areas	combined sump	CT's & PWTS blowdown water	yearly	3
	all manholes	sand/grit/water	as requested	

Units 1 and 2	u-2 cooling tower	sand/grit/water	outage	3
PWTS	thickener wash water recovery	sludge/water sludge/water	quarterly quarterly	10 10
Process Waste Treatment Sludge	sludge bed	sludge solids	weekly	1
Stackout Pad	PWW Pond	gypsum, fly ash, bottom ash, coal	2 years	20,000 cubic yards

1 - The Material holding cell is constructed on the stack-out pad. Material is mixed within the cell, and then hauled to the Storage Facility.

2 - The process waste treatment sludge is mixed directly in the storage facility.

CSI = Conversion System Incorporated – Designed Process Area

PWTS = Process Water Treatment System

Destination and Utilization: The materials presented above can be categorized into 3 main materials: PWTS Sludge solids, PWW Pond Dredgings, and Miscellaneous. The PWTS Sludge and Miscellaneous materials have no economic value; therefore, they are placed in the storage facility for permanent storage. The PWW Pond Dredgings will primarily be comprised of gypsum, and be used off-site for beneficial use.

2.2 Quantities of Materials

From historical production data, the following rates are predicted:

Material	Dry Density (lb/ft^3)	Amount Generated (tons per month)
Bottom Ash	80	917 [1]
Fly Ash	85	5,667 [2]
Gypsum	80	5,416 [3]
Secondary Materials	70	551 [4]

Notes:

[1]-Based on a generation rate of 11,000 tons/year (dwb).

[2]- Based on a generation rate of 68,000 tons/year (dwb).

[3]- Based on a generation rate of 65,000 tons/year (dwb).

[4]- Based on an average generation rate of 318 tons/year (dwb) of PWTS Sludge, 2,835 tons/year (dwb) of Process Wastewater Pond Dredgings, and 3,460 tons/year (dwb) of Miscellaneous Materials.

3.0 Site Description

3.1 Site Conditions

The original expansion area of the facility was formerly a phosphate pit. The site is confined by the plant coal unloading loop railroad.

The original design included several subsurface investigations that were performed in and around the Facility during different phases of the plant design and operation. Figure 3-1 provides a plan of the Facility with a compilation of the borings performed in that area. Borings designated TH were performed by Ardaman and Associates for the Facility feasibility study. The remaining borings were performed for C. T. Main by Law Engineering and Testing as a part of the original Plant design.

In general the soil stratigraphy underlying the Facility consists of a very loose to loose cast overburden fill sand with silty or clayey lenses or layers overlying the remnant phosphate matrix which overlies the dense hard calcareous silt or clay with decomposed limerock layers of the Hawthorn Formation. The thickness of the overburden fill materials vary in both depth and thickness across the site. Figures 3-2 and 3-3 provide generalized cross sections through the proposed expansion area. Section A-A' is cut through the existing Facility. Section B-B' is cut through the phosphate pit area.

The normal ground water level is shallow below the existing Facility and is generally consistent with the old phosphate pit water level elevation of approximately 132.0 feet. The ground water level varies with seasonal rainfall.

3.2 Existing Storage System Facilities

3.2.1 Storage System

The materials currently generated at the plant are temporarily stockpiled west of the Plant and south of the coal unloading structure on a concrete pad. The material to be stored is excavated from the stacker stockpiles and placed into 40 ton off-road trucks by front end loaders.

The material is transported by the off-road trucks along an asphalted haul road to the Facility. The material is spread in horizontal lifts by dozer and compacted by a smooth steel drum roller. As a cell is progressively filled, it is capped with topsoil and seeded. Facility access ramps are constructed of compacted material or soil as required.

Runoff entering the existing sedimentation basin is pumped to the existing process waste water ponds. Excess water from the process waste water ponds is either utilized in the plant, or treated at the on-site treatment facilities. None of the water entering the sedimentation basin reaches Fish Lake.

The Facility north of the main plant area reached capacity in early 1992. The capacity of the present operating Facility inside the rail loop is not expected to reach maximum capacity due to the economic value and ability to sell and/or reclaim and sell fly ash, bottom ash and gypsum and the minor fill rate of the secondary materials. A capacity analysis was performed to estimate the life of the facility in the event any of the materials were unable to meet buyer requirements. Based on conservative storage rates the capacity of the facility is calculated to be reached between 2014 and 2015.

3.2.2 Storm Water Management System

At the present time, clean storm water runoff from the Facility site drains into Fish Lake. Potential runoff from excess rainfall is directed to the Florida Department of Natural Resources (FDNR) Tenoroc Lake through two 48 inch diameter culverts, located at the northwest end of the existing Phase I Facility cell as permitted in the original site certification.

4.0 Expansion Area Site Development

4.1 General

The objective of the design is to maximize the storage volume of the Facility and minimize impacts to the present plant operation and storm water management system. This operations manual provides the arrangement and detailed cross sections for the continued development of the Facility, including:

- Grading and development.
- Haul roads.
- Storm water diversion berms, collection ditches, and culverts.
- Sedimentation pond.

4.2 Site Preparation

4.2.1 Site Grading

The Facility occupies the area of an old phosphate pit. The phosphate pit was entirely within the C. D. McIntosh site boundaries and was not under the jurisdiction of the Department of Natural Resources.

The old phosphate pit covered an area of approximately 12 to 15 acres with an average depth of 20 feet. The underlying materials below the initial portion of the Facility consist of very loose to loose cast overburden fill sand with silty or clayey layers overlying dense cemented silt clay or decomposed limerock of the Hawthorne Formation. The N-values of the fill material as recorded in the Ardaman & Associates exploration for the September 1990 Facility feasibility study were as low as zero for a 5 to 10 foot thickness of material.

Bordering the currently operating Facility on the north and east sides is the plant coal unloading loop railroad. The railroad embankments are constructed on the same loose cast fill deposits encountered in the phosphate pit by the recent Ardaman borings, and as logged in the earlier investigations performed for C. T. Main.

North of the currently operating Facility is a Department of Natural Resources (DNR) phosphate pit. East of the coal loop, on City of Lakeland property, are wetlands and small ponds. These ponds are reportedly remnants of previous phosphate mining in the area.

Site grading was originally performed under Specification 17757.71.0201 "Stabilized Sludge Landfill General Construction." The initial site grading is provided on the following Black & Veatch drawings:

Drawing No.	Rev. No.	Title
17757-CSTF-S3380	0	Stabilized Sludge Landfill Expansion Area Grading Plan
17757-CSTF-S3381	1	Stabilized Sludge Landfill Expansion Detail Grading Plan SHT-1
17757-CSTF-S3382	1	Stabilized Sludge Landfill Expansion Detail Grading Plan SHT-2
17757-CSTF-S3383	1	Stabilized Sludge Landfill Expansion Detail Grading Plan SHT-3
17757-CSTF-S3384	1	Stabilized Sludge Landfill Expansion Sections and Details

The site grading consisted primarily of backfilling of the pit by end dumping clean sand tailings from above the water and compaction by conventional earth moving equipment above the watertable. **The phosphate pit was filled in 1992.**

4.2.2 Stability

The stability of the material currently being placed in the Facility had previously been evaluated for a vertical expansion in February 2004 (Black and Veatch) and found to be stabile for 3H:1V sideslopes up to elevation 252 feet NGVD. The stability of the Facility was analyzed for a shear failure through the sand fill underlying the Facility. Conservative parameters were used to provide assurance against slope stability failure of the Facility. The design parameters for the compacted by-product and the sand fill below the Facility are provided below.

Testing performed on the compacted stabilized by-product solids indicates a median unconfined compressive strength of 8,800 psf at 120 days. This is equivalent to a cohesion of 4,400 psf. To allow for deviations in the strength of the compacted stabilized solids as tested, a cohesion of 2,000 psf was used in the analysis. The stabilized solids parameters used in the stability analyses are as follows:

Moist Unit Weight	=	90 pcf
Cohesion	=	2,000 psf
Angle of Internal Friction	=	0 degrees

From the soil borings and tests in the sand fill below the Facility, the fill material is variable in density with large areas of low relative density. For this reason a low angle of internal friction, equivalent to a relative density of zero percent for a silty sand soil, was chosen. The material parameters used in the stability analyses are as follows:

Total Saturated Unit Weight	=	110 pcf
Cohesion	=	0 psf
Angle of Internal Friction	=	25 degrees

With the process modifications (Forced Oxidation Conversion Project) at the FGD system, the Facility will be receiving the byproducts as separate streams instead of as a single stream in which the byproducts have been mixed together. The materials that are not sold will be placed in the Facility and compacted in lifts for longer term storage. The stability and settlement of the existing Facility has been re-evaluated to accommodate the different engineering properties that are anticipated.

Based on information from other similar facilities, the following characteristics are used for the materials being generated by the Plant:

Material	**Dry Unit Weight (PCF)**	**Cohesion (PSD)**	**Angle of Internal Friction(degrees)**
Bottom Ash	80	0	30
Fly Ash	85	0	34
Gypsum	80	0	30
Secondary Materials	70	0	15

Stability Evaluation

The evaluation on the stability of the material that will be placed in the Facility after the Plant modifications considered all the materials that would likely be placed in the Facility. Although a variety of scenarios are possible, the likely scenario evaluated due to strength of end-use markets includes when the Facility receives primarily a mixture of Secondary Materials. This mixture, comprised primarily of PWTS sludges, will be mixed in the Facility at a 1:1 ratio with other materials (i.e, fly ash, lime, water) to form a composite that closely resembles the pozzolanic material that had historically been placed in the Facility prior to the FGD system conversion. Due to its similar characteristics to the pozzolanic material previously placed in the Facility, the stabilized secondary materials will remain stabile in accordance with the parameters established in the previous stability analysis by Black & Veatch (2004).

In the unlikely event that the end-markets require the material being generated by the Plant to be placed in the Facility, the stability of the weakest material was evaluated. The worse-case scenario when considering the strength of the material being placed in the Facility as the limiting condition for evaluating stability would be if all the gypsum from the Plant would be placed in the Facility. By calculating a stable exterior slope using the most conservative parameters for materials being placed in the Facility, this results in a stable exterior slope for all materials being placed in the Facility.

Slope stability analyses were performed to determine: (i) the allowable maximum sideslope and the corresponding minimum shear strength required within the sludge/sand mixture to achieve adequate factors of safety against slope failure, and (ii) factors of safety against global slope failure through the clay layer as well as through the existing underlying pozzolanic materials. In these analyses it was assumed that the maximum landfill elevation would remain 252 feet.

Internal Slope Stability

The internal slope stability of materials will depend on both its shear strength and the fill sideslope. For this evaluation, the material to be disposed above the existing pozzolanic material will primarily consist of gypsum. Based on information developed from similar sites, a conservative value for an effective friction angle of 15 degrees was used in the evaluation. A long-term slope stability analysis using this friction angle shows that the fill sideslope should be limited to a maximum of 5.5H:1V. Also, if the material is found to be cohesive in nature, it should have a minimum undrained shear strength of 900 pounds per square foot (psf) to achieve a minimum factor of safety of 1.5 against deep circular failure under the short-term loading conditions.

Global Slope Stability

Sliding block type failure surfaces were investigated through the thin layer of clay (approximately 6 feet thick) that may be present below the Facility. According to Black & Veatch (2004), if present, the clay is likely to be discontinuous; therefore, the analysis performed using a continuous layer is conservative. Because the clay layer is relatively thin (i.e., assumed to be 6 feet thick) and is also likely to have double drainage boundary conditions, it is very likely to consolidate concurrent with placement of overburden material. Therefore, a long-term analysis using an effective friction angle (ϕ') is appropriate. The results of the analysis show that a ϕ' of 12 degrees is required within the clay to obtain a minimum factor of safety of 1.5. Based on a review of the description of the clay by Black & Veatch (2004), the clay can meet this requirement.

Assuming a cohesion intercept of 2,000 psf for the existing in-place pozzolanic material (Black and Veatch, 2004), both circular and block type failure surfaces through the existing in-place pozzolanic materials yielded acceptable factors of safety.

All materials, except gypsum, being stored within the Facility can be placed at 3H:1V final exterior slope. However, gypsum stored in the Facility for long-term storage, final exterior slopes should be established at 5.5H:1V.

Results of the stability analysis are presented in Appendix C.

4.2.3 Settlement

Settlement due to consolidation of the underlying soils at the Facility had been evaluated for a vertical expansion by Black & Veatch (2004). The density and depth of the materials that will be placed in the Facility after the Plant conversion to a FGD system will not exceed those previously evaluated. In addition, the period of time for which the underlying clay layer has been under consolidation and allowed to drain in both directions, although described as discontinuous, has likely passed its primary settlement phase. The materials being placed in the Facility will not increase the settlement values previously calculated, where the settlement of the center of the Facility was calculated for a top elevation of 252.5 feet NGVD. The settlement calculated will decrease towards the edges of the Facility. The Facility site was graded to elevation 138.5 feet NGVD prior to placement of by-product during construction of the expansion. With a Facility crest elevation of 252.5 feet NGVD, it is estimated that the base of the Facility would settle to elevation 134.4 feet NGVD at completion of operation. With a high water table elevation of 133.2 feet NGVD, this would result in the base of the center of the Facility above the high water table at the completion of the 50 foot vertical expansion. The separation between the by-product and the water table would be approximately one foot.

4.3 Storm Water Management

The original sedimentation basin had a total storage volume capacity of 8.7 acre-feet between elevation 135.0 and elevation 130.5. The Facility expansion, when filling moved to the currently operating area, was analyzed using the U.S. Soil Conservation Service Technical Release Number 55 (TR55), Urban Hydrology for Small Watersheds 2nd Edition. Based on the findings from the TR55 analysis, the maximum storage volume containment required occured when 100 percent of the active area for Stage 2 Cell 1 was open, which required a storage volume capacity of 13.7 acre-feet.

In 1992, the storage capacity was obtained by enlarging the sedimentation basin during the site development contract by constructing an addition to the south end of the existing basin. Under normal operation, the basin provides adequate storage volume between elevations 134.5 and 131.0. However, in the case of Stage 2 Cell 1 with 100 percent of the active area exposed, the volume must be contained between elevations 135.0 and 131.0 or between elevations 134.5 and 130.5. <u>To ensure that sufficient storage is</u>

available during the construction of Stage 2 Cell 1, it is essential that the basins be cleaned out prior to the start of this construction. **The sedimentation basin was expanded in 1992.**

The Facility perimeter ditch consists of a soil cement lined flat bottom trapezoidal section. The ditch will serve to collect runoff from the active Facility cells as they are developed. The soil-cement will act as a liner, facilitate cleanout by Facility equipment, and improve ditch flow. This flow will be directed to the enlarged sedimentation basin.

The existing sedimentation basin has been enlarged to handle the calculated volume of the active area runoff. The basin was enlarged to the south as far as the existing haul road, and to the east to meet the required storage capacity. The new addition is lined with soil cement in a similar manner as the existing basin.

4.4 Transport

Transport of by-product is along the existing roadway along the south toe of the Facility and ramps within the Facility. Drainage from the roadway is directed to a soil cement lined perimeter ditch that flows into the sedimentation basin.

5.0 Storage Facility Development

5.1 General

The Facility will maintain operational hours similar to those of the Plant. The materials generated by the Plant will be transported, stockpiled, hauled off-site, or placed on-site for long term storage. The appropriate space required for these activities can be found within the limits of the Facility. The materials will be managed separately within the Facility to preserve the possibility of future reclamation.

The expanded Facility area for material storage will proceed in four stages. Each stage will be constructed to a depth of material of approximately 30 feet. Both stage 1 and stage 2 development will be constructed in two cells. Stages 3 and 4 will be constructed in one cell each. The cells for Stages 1 and 2 will have an average storage capacity of approximately 573,000 cubic yards. Stage 3 has a storage capacity of approximately 350,000 cubic yards. Stage 4 has a storage capacity of approximately 340,500 cubic yards. These volumes were calculated by Black & Veatch (2004). The volume of Stage 4 includes the filing of the access ramps. The combined capacity of Stages 3 & 4 is calculated to be reached between 2014 and 2015. See Appendix B for the capacity analysis.

5.2 Active Cell Management

This section presents the operational practices that will be utilized to handle the scenarios that may develop when managing the materials at the Facility. For Bottom Ash, Fly Ash, and Gypsum, considerations are necessary for allowing the material to be stored separately and possibly reclaimed in the future. For Secondary Materials, permanent on-site storage is required.

5.2.1 Operational Considerations

The materials are generated at various locations at the Plant. Under most circumstances, the materials will not be placed in the Facility if they are going to be transported off-site for beneficial use. The following methods are to be used when the materials are being placed in the Facility for long term storage. Material will be placed in 18 to24 inch thick lifts and compacted. A proctor is performed at the produced moisture content and the density is then determined in the field with a nuclear density gauge. The compaction goal is to achieve 95% of the standard proctor value.

Fly Ash, Bottom Ash & Gypsum

- Transport: Trucks will deliver the materials to be placed from on-site locations to the active areas of the Facility.
- Placement: Since each material is separate at the generation point, each material will arrive as a separate stream and be directed to a designated area in the active cell to maintain material segregation. The materials will be placed apart from one another to the fullest extent possible to preserve future reclaimation opportunities.
- Reclaim: The stockpiles of reclaimable material will remain accessible to a front-end loader which can be used to reload the material for beneficial use projects.
- Dispose or Long Term Storage: If it is determined that the material will not be marketed, the stockpiles will be incorporate into the Facility by spreading the material with a dozer and compacted to conserve airspace.
- Cover: Due to the non-putrescible nature of the material, there are no vector or odor issues, and therefore, no daily or intermediate soil cover is used.

Secondary Materials

Secondary materials will be handled as described in the agreement with FDEP dated July 17, 2001, titled "RE: Request for Authorization to Dispose of Ash and Sludge, Submittal of June 17, 2001, Attachment #3":

- Transport: Vacuum Trucks, PWTS storage containers, or PWW Pond dredging will deliver the materials from on-site locations to be placed in the active areas of the Facility.
- Placement: - Construction of a temporary material holding ponds on the stack-out pad to be used for drying material prior to placement in the storage facility. The walls will be constructed in a height sufficient to contain the sludge at minimum 2 feet above the material level.

  - Dewatering these secondary materials placed in these temporary ponds will be by evaporation. When necessary, excess water from these ponds would be pumped to the process wastewater ponds.

  - Once the material is dry enough to handle, it will be mixed in a 1-to-1 ratio with pozzolanic material using a front-end loader.

  - The dried material, including most of the temporary pond, will be placed in the Storage Facility.

  - The placement of secondary materials will be recorded on the daily graphs and will be kept in a file for future reference.

  Cover: Due to the non-putrescible nature of the material, there are no vector or odor issues, and therefore, no daily or intermediate soil cover is used.

5.2.2 Sequencing

Sequencing for the Facility will follow the previously approved plan, with the possible exception of the exterior slopes for gypsum, as calculated in Section 4 of this document.

Stage 1 Cell 1

The first cell of the initial stage has reached capacity. It was constructed at the north end of the enclosed coal train loop immediately east of the existing Phase I Facility. Material placement in the cell began in the northwest corner of the cell and progressed in horizontal lifts to the southeast corner. The horizontal lifts were sloped to the east at a 0.5 percent grade to promote drainage. Runoff was directed to the perimeter ditch along the north and east sides and toward the diversion berm along the south perimeter. As progress dictated, a ramp was constructed at the southeast corner of the cell to reach the final elevation of approximately 170. The ramp was constructed at a maximum grade of 6 percent.

An intermediate cover of topsoil was placed when the cell reached final elevation of 170 feet. The 3H:1V side slopes was covered with the soil and a portion of the perimeter ditch filled and regraded as shown as the Stage 1 Cell 1 drawings to divert the clean water runoff to Fish Lake. **This cell is presently filled.**

Stage 1 Cell 1 development is shown on the following drawings.

Drawing No.	Title
17757-S1C1-1	Stabilized Sludge Landfill Expansion Stage 1, Cell 1 - SHT 1
17757-S1C1-3	Stabilized Sludge Landfill Expansion Stage 1, Cell 1 - SHT 3

Stage 1 Cell 2

Stage 1 Cell 2 has reached capacity, and was constructed by placing stabilized sludge atop the south end of the old phosphate pit bounded by the rail loop on the south and east. In addition, stabilized sludge was placed along the east side slope of Phase I Facility and on the bench at elevation 155 feet in the southwest corner of the area.

Prior to the start-up of Stage 1 Cell 2, the clean water diversion drain was plugged. The plugging consisted of placing a grout filled fabric-formed bag in the drain outlet and pumping sand cement grout fill into the remainder of the drain. A culvert placed in the perimeter ditch under the haul road for Stage 1 Cell 1 was relocated to the west when the ramp is required for access to the increasing elevation of the cell. The perimeter ditch around Stage 1 Cell 1 was regraded to divert clean water to Fish Lake. Topsoil on the bench of the existing Phase I Facility was stripped and stockpiled as development of the new cell proceeded in that direction. Surface drainage from the active Facility area was directed to the perimeter ditch. Surface drainage from the Phase I bench area was directed to the perimeter ditch along the northwest toe of the side slope for the access ramp. **This cell is presently filled.**

Stage 1 Cell 2 development is shown on the following drawings:

Drawing No.	Title
17757-S1C2-1	Stabilized Sludge Landfill Expansion Stage 1, Cell 2 - SHT 1
17757-S1C2-2	Stabilized Sludge Landfill Expansion Stage 1, Cell 2 - SHT 2
17757-S1C2-3	Stabilized Sludge Landfill Expansion Stage 1, Cell 2 - SHT 3

Stage 2 Cell 1

The initial cell of second stage development has reached capacity, which consisted of placing the stabilized sludge atop the previous Stage 1 Cell 1. In addition the material was placed on top of the existing northwest corner of the Phase I Facility from elevation 170 feet to elevation 200 feet.

At elevation 170 feet, a bench was incorporated to facilitate the construction of a perimeter ditch designed to collect active area runoff and divert it into the main soil cement lined perimeter ditch at approximate elevation 135 feet. Along the south side of the cell and along the west toe of the access ramp, a diversion berm was constructed to separate active area runoff from the clean water runoff of Stage 1 Cell 1.

Development of the cell proceeded from the northwest corner to the southeast corner. Again, as in the development of the first stage cell, a ramp was constructed at the southeast corner of the cell to reach a final elevation of 195 feet. The ramp constructed in association with Stage 1 Cell 2 was utilized to access the initial and final placement of material into this cell. **This cell is presently filled.**

An intermediate cover of topsoil was placed when the cell reached a final elevation of 170 feet. The 3H:1V side slopes were covered with the soil and a portion of the perimeter ditch filled and regraded to divert the clean water runoff to Fish Lake.

Stage 2 Cell 1 development is shown on the following drawings:

Drawing No.	Title

17757-S2C1-1	Stabilized Sludge Landfill Expansion Stage 2, Cell 1 - SHT 1
17757-S2C1-3	Stabilized Sludge Landfill Expansion Stage 2, Cell 1 - SHT 3

Stage 2 Cell 2

Development of this cell is currently underway, and consists of placing stabilized sludge on top of the previous Stage 1 Cell 2 area from elevation 170 feet to elevation 200 feet. Again, as in Stage 2 Cell 1, a perimeter bench drain will be constructed at approximate elevation 170 feet. In addition, a slope drain channel, constructed with 8 inch uniform fabric form liner, will be placed along the west slope. This channel will initially direct active area runoff from the perimeter bench drain and the active storage area to the sedimentation basin. As the height of this cell is completed to approximately elevation 200 feet, the slope drain channel will be extended upward from elevation 170 feet to the final elevation. **This cell is presently in use.**

Similar to the current plant practice, the three horizontal to one vertical side slopes will be covered with the closure soil and a portion of the perimeter ditch filled and regraded to divert the clean water runoff to Fish Lake when the cell has reached final elevation of 200 feet.

Stage 2 Cell 2 development is shown on the following drawings:

Drawing No.	Title
17757-S2C2-1	Stabilized Sludge Landfill Expansion Stage 2, Cell 2 - SHT 1
17757-S2C2-2	Stabilized Sludge Landfill Expansion Stage 2, Cell 2 - SHT 2
17757-S2C2-3	Stabilized Sludge Landfill Expansion Stage 2, Cell 2 - SHT 3

Stage 3

The third stage development will consist of placing the material atop the previous Stage 2 from elevation 200 feet to elevation 225 feet NGVD. One cell will be constructed as the total active area will be less than 20 acres. The ramp from Stage 2 will be extended to the west on the north end of Stage 3 to an elevation of 225 feet. Intermediate closure will be placed on the exterior slopes of the ramp below elevation 200 feet. Development of the Stage will proceed from the northwest corner of the stage south and east. The active area of this stage is less than 20 acres.

Again, as in Stage 2, a perimeter bench drain will be constructed at approximate elevation 200 feet. In addition a slope drain channel, constructed with 8 inch uniform fabric form liner, will be placed along the south slope of Stages 1 and 2. This channel will initially direct active area runoff from the perimeter bench drain and the active storage area to the sedimentation basin. In addition runoff from the closed portions of Stages 1 and 2 and the intermediate closure of the access ramp will be diverted from the sedimentation pond and directed to Fish Lake.

Similar to the current plant practice, the final closure will be placed on the Stage 3 west slope when the stage has reached final elevation of 225 feet. The three horizontal to one vertical side slopes will be covered with the closure soil and a portion of the perimeter ditch filled and regraded as shown as the Stage 3 drawings to divert the clean water runoff to Fish Lake.

Stage 3 development is shown on the following drawings:

Drawing No.	Title
136614-S3-1	Stabilized Sludge Landfill Expansion Stage 3- SHT 1

Stage 4

Development of this stage will consist of placing material on top of the previous Stage 3 from elevation 225 to elevation 250. The stage active area is less than 20 acres. The cell will be filled from the north to south with the solids placed on a slope no steeper than 4 horizontal to 1 vertical. Again, as in Stage 3, a perimeter bench drain will be constructed at approximate elevation 225 feet. In addition a slope drain channel, constructed with 8 inch uniform fabric form liner, will be placed along both the north and southeast slopes of Stage 3. This channel will initially direct active area runoff from the perimeter bench drain and the active storage area to the sedimentation basin. Storm water runoff from the closed west slope of Stage 3 will be directed by two new channels on the west side of the Stage 2 slopes to Fish Lake.

As Stage 4 is brought to final closure, the access ramp will be filled and the side slopes dressed and covered with the soil closure material. The culvert previously placed in the soil cement lined perimeter ditch will be removed.

Stage 4 development is shown on the following drawings:

Drawing No.	Title
136614-S4-1	Stabilized Sludge Landfill Expansion Stage 4 - SHT 1

If Stages 3 and 4 entirely receive gypsum, the exterior slopes will be modified to 5.5H:1V, while continuing to follow the remaining sequencing operations.

5.3 Operational Controls

5.3.1 Personnel

The Facility will be managed, operated, and maintained by personnel that are trained in the operations of the Facility.

Responsibilities of the Owner

- Determines the operational requirements and maintenance needs of the Facility.
- Implements this Operations Manual for the Facility.
- Conduct daily inspections of Facility, including workface and general conditions of the surrounding area.

5.3.2 Emergency Telephone Numbers

The emergency plan for the Facility will be followed in the event of an emergency. Due to changes in security at the station, all emergencies are to be reported to the control room. The control room will coordinate with outside emergency response agencies and with the station security to allow access. The phone number for the Plant Control Room is (863) 834-6681.

5.3.3 Equipment and Operational Procedures

Where appropriate, equipment will be fitted with safety cabs, fire extinguishers, and radio communication equipment. The radio equipment and telephone service will also be located in offices on-site.

COL's administrative offices provide shelter for employees during inclement weather. The offices include potable water, sanitary facilities, emergency first-aid supplies, and electricity.

COL operators and the following equipment is provided for the Facility:

- Front-End Loader.
- Dump Truck(s).
- Dozer.
- Scraper

5.3.4 Traffic Control

The primary entrance into the Facility will continue to be from the north, where the material is transferred from the stack-out pad using front-end loaders, and transported to the Facility using dump trucks. As the dump truck end dumps the material, a dozer spreads and compacts the material. There is no other traffic in the vicinity of the material handling vehicles.

Access to the Facility is controlled by a lockable gates and manned guard station. Security will be maintained by locking the entrance gates during the times the Facility is not operating.

5.3.5 Environmental Controls

<u>Stormwater Management</u>

Management of stormwater and leachate for the Facility, as previously approved by FDEP, and will continue with careful operations at the working face. Stormwater will be diverted from active handling areas through the use of berms, swales, and ditches, and be directed to the western perimeter, where it can be collected in the Facility's sedimentation basin. Stormwater runoff does not leave the Facility in an uncontrolled manner.

During operation of the Facility, all active area runoff will be directed to the enlarged sedimentation basin for containment prior to being pumped to the process waste water ponds. As the development of the Facility progresses, clean runoff from the completed inactive areas will continue to be directed to Fish Lake. By separating the active area runoff from the clean water runoff, the impact on the existing treatment facilities will be minimized. It is anticipated that at any one time during the cell development, the active area runoff will be held to 20 acres.

The present pumping and treatment facilities capacity will handle the expected average flows that may occur during operation. Using a 10 year 24 hour design storm having a total rainfall of 6.6 inches (C. T. Main report), runoff entering the sedimentation basin from the design storm during the operation of any active cell is calculated to be 2.9 million gallons. Based on the present average daily excess capacity in the water treatment facility of 300 gpm, this flow could be treated and discharged in 6 to 7 days, if not used in the plant water system.

Direct discharge from the stormwater that comes in contact with the materials being managed at the Facility into surrounding surface waters is prohibited.

Eroded material from the sideslopes will be collected within the limits of the property.

Components of the stormwater management systems will be routinely inspected by COL personal. Inspections include visually observing drainage channels, surface impoundment conditions, pipes, structures, and pump stations. As necessary, COL will conduct maintenance and cleaning operations on the stormwater management system components.

Leachate

The materials being managed on-site will be stored over the existing compacted and stabilized pozzolanic material placed at the Facility, which is approximately 70 feet thick, and has a very low saturated hydraulic conductivity. Liquids within the materials being stored at the Facility will be controlled through minimized infiltration from the low permeability of the underlying material. In addition, the Facility incorporates a perimeter conveyance swale near the edge of the slope for controlling stormwater. The swale collects runoff from the top of the Facility to convey it in a controlled manner into the existing stormwater management system for proper treatment before being discharged from the Facility. Leachate analysis by the SPLP method have been provided in Appendix D. These analyses were previously provided to FDEP in correspondence dated on June 6, 2002 under cover letter "Lakeland Electric – C.D. McIntosh, Jr. Power Plant, Polk County Consent Order OGC Case #01-1498 (Contamination Assessment Report Phase I)".

Fugitive Dust Control

The Facility transportation and placement operations will be performed to minimize the generation of fugitive dust. This will be accomplished by the following techniques during combustion by-products solids transportation and Facility operations.

- Transportation:
  - Moisture conditioning of the solids prior to loading of transport trucks.
  - Watering of haul roads.
  - Washing of trucks periodically to minimize carry-over of solids.
- Facility Operations:
  - A program of watering of all active exposed faces of stored material solids.
  - Intermediate and final covers of soil materials.
  - Development of the Facility in cells to minimize the length of active Facility area.

5.3.6 Record Keeping & Submittals

COL will maintain monthly capacity reports, and submit information to the FDEP if requested. COL will furnish all inspection records or copies thereof and plans relative to operations of the Facility as requested by the FDEP. All monitoring information, maintenance records, weight records and copies of all reports will be maintained at Facility.

Copies of the Conditions of Certification, Conditions of Clarification, design drawings, Operator certification, groundwater monitoring plan, and sampling results will also be maintained at Facility.

The Operations Manual will be kept at the Facility and shall be accessible to the COL Facility Operator, Environmental Coordinator, or COL designated personnel. The Operations Manual will be substantially complied with at all times by COL and shall be revised if operational procedures change. Revisions will be subject to review and approval by the FDEP prior to implementation.

6.0 Final Closure

6.1 General

The filled Facility stage will be closed to minimize infiltration of rainfall into the stored materials, and to prevent erosion of the Facility. The closure operations will be performed progressively as the stages are filled as monitored and determined by the Owner.

6.2 Closure Description

Closure of the site will remain as previously approved. Three major steps occur in the Facility closure:

- The access ramp on the east side of the Facility will be filled with material.
- The material disposed of in the Facility will be graded to direct runoff to the drainage pattern that surrounds the Facility. Proper drainage patterns will also minimize the chance for erosion of the closed Facility.
- The Facility will be closed, in which the Facility area will be covered with topsoil and seeded.

Closure of the Facility will begin when the Facility reaches its final elevation along the boundary of Stage 4 and will continue progressively as Stage 4 is filled. The Facility will be fine graded to conform to site drainage patterns. Side slopes will have a maximum slope of three horizontal to one vertical to minimize erosion.

The final step in closure of the Facility is reclamation. After the site is appropriately graded, an 18 inch layer of earth and topsoil shall be spread over the Facility. Following placement of the topsoil, the Facility area will be seeded with shallow rooted grass.

The top of Stage 4 will be regraded with material and closed starting from the west and progress to the east to redirect the final drainage to the slope drain channels.

Drainage and erosion control systems will be installed in areas of runoff concentration on slopes of the Facility.

The following drawings provide the final Facility grades:

Drawing No.	Title
133614-FC-4	Stabilized Sludge Landfill Expansion Final Closure - SHT 1
133614-FC-5	Stabilized Sludge Landfill Expansion Final Closure - SHT 2

6.3 Final Storm Water Management

After completion of the Facility, all remaining surface areas will be covered with an 18 inch layer of topsoil and seeded with native grasses. Both the perimeter ditch and the perimeter bench drain shall be graded to ensure clean water flows are diverted directly into Fish Lake.

The final storm water runoff area contributed by the Facility will be between 40 and 45 acres. Some of this area is currently being included in runoff directed to Fish Lake, i.e., Phase I Facility. The average annual rainfall in the vicinity of the plant site is in excess of 43 inches. The average annual inflow into Fish Lake from the Facility will be approximately 32 million gallons or 98 acre feet. Ignoring evaporation and assuming an area of 35 acres for Fish Lake, this would raise the lake level 2.8 feet.

At present, the existing plant water treatment facility has an excess capacity of 300 gpm. Assuming a 32 million gallon inflow to Fish Lake, the treatment facility could dispose of this flow in 74 days assuming no evaporation or percolation. The present pumping facilities at Fish Lake can pump at a rate of 2,000 gpm in excess of the rate necessary to handle the excess runoff from the final Facility. Therefore, conservatively assuming no evaporation or percolation losses, the existing plant treatment facilities can accommodate the final Facility closure runoff.

6.4 Monitoring

The existing Phase I Facility west of the currently operating area is monitoring by wells 1-S and 12-S. These wells were within the Facility expansion area and were properly abandoned. The groundwater flow is from the northwest to the northeast. Three monitoring wells (24-S, 25-S, and 26-S) were installed on the east and southeast boundaries of the currently operated Facility. The sampling frequency and parameters used on the existing wells will remain.