

# AMENDED CLOSURE PLAN FOR BOTTOM ASH LANDFILL

Plant Gorgas  
Alabama Power Company  
Parrish, Alabama

July 2019

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**AMENDED CLOSURE PLAN  
PLANT GORGAS BOTTOM ASH LANDFILL  
ALABAMA POWER COMPANY  
40 C.F.R. § 257.102(b)(3) and ADEM Admin. Code r. 335-13-15-.07(3)(b)3.  
ADEM Admin. Code r. 335-13-4-.20**

**1. Introduction**

This Amended Closure Plan has been prepared to support the permit application previously submitted to the Alabama Department of Environmental Management (ADEM) for the CCR Landfill known as the Plant Gorgas Bottom Ash Landfill, located near Parrish, Walker County, Alabama. The permit application was submitted in accordance with ADEM Admin. Code r. 335-13-15-.09(1)(c) and r. 335-13-5-.02. This Amended Closure Plan, along with other documents, is intended to supplement the previous submittal in response to the ADEM letter dated May 24, 2019 which provided response comments to the original application.

**2. General**

The Plant Gorgas Bottom Ash Landfill received and stored coal combustion residuals produced during the electric generating process at Plant Gorgas. CCR products were conditioned, transported by truck and then compacted in the landfill for storage. The landfill covers approximately 56 acres, and currently stores about 4,100,000 cubic yards of CCR.

The Bottom Ash Landfill at Plant Gorgas has been in operation for many years, and there are not formal design plans available related to the original construction. The Bottom Ash Landfill is formed by excavations in previously placed mine spoil material and natural hillsides, as well as low earthen embankments. The foundation materials beneath the CCR unit generally consist of previously placed mine spoils.

The Plant Gorgas Bottom Ash Landfill is not constructed with a liner nor a leachate collection system. Prior to ADEM's promulgation of its CCR rule, the Bottom Ash Landfill was not subject to solid waste regulation under state or federal law. Thus, the Bottom Ash Landfill was not required to operate with the design features described in ADEM Admin. Code r. 335-13-4-.18. Since that time, the federal CCR rule was enacted without requiring an existing CCR landfill to have a liner. See 40 C.F.R. § 257.70 (imposing design criteria for new CCR landfills and expansions of existing landfills, but not for existing landfills). This was not an oversight on EPA's part, but rather a recognition that "the potential for disruption in CCR disposal capacity . . . would be significant" if such facilities were required to retrofit, and such disruptions "are associated with significant risks to public health and the environment in their own right." 80 Fed. Reg. 21,301, 21,370 (Apr. 17, 2015). EPA also noted that existing landfills like the Bottom Ash Landfill at Plant Gorgas would be subject to other protective measures of the CCR rule, including groundwater monitoring and corrective action. *Id.* The text of the comparable design criteria in ADEM's regulations is the same in substance as § 257.70 of the federal regulations. See ADEM Admin. Code r. 335-13-15-.04(1). Therefore, it is our

## Plant Gorgas Bottom Ash Landfill Amended Closure Plan

understanding that ADEM's CCR regulations do not require installation of additional design features at the Bottom Ash Landfill. If ADEM takes a different view of the requirements of its regulations, we will request a variance pursuant to r. 335-13-15-.15 on the grounds that such a determination is not any less stringent than the federal CCR rule and is protective of public health and the environment, which is supported by EPA's determination as expressed in the 2015 federal rule and preamble.

As of April 2019, Plant Gorgas has now been retired, and the Bottom Ash Landfill is being prepared for closure. The footprint will be consolidated, and the final cover system will be applied to the consolidated footprint of approximately 27 acres.

The final cover will be designed to minimize infiltration and erosion. Current plans are to have the cover system include a 60-mil geomembrane overlain with a geocomposite, both covered with 18 inches of protective soil and 6 inches of topsoil. The cover system to be used meets or exceeds the requirements of 40 CFR § 257.102(d)(3)(ii) and r. 335-13-4-.20(2)(b)1. in that the permeability of the final cover system will be less than or equal to the permeability of the subgrade beneath the landfill. Final design will ensure the disruption of the integrity of the final cover system is minimized through a design that accommodates settlement and subsidence, in addition to providing an erosion layer for protection from wind or water erosion.

The final cover system will be constructed to control, minimize or eliminate, to the maximum extent feasible, post closure infiltration of liquids into the waste and potential releases of CCR from the unit. This will be prevented by including sufficient grades and slopes as part of the final cover system which will: 1) preclude the probability of future impoundment of water, slurry, or sediment; 2) ensure slope and cover system stability; 3) minimize the need for further maintenance; and 4) be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.

Additional details regarding the cover system can be found in Sections 4.e. and 4.f. of this document. Cover system details are also shown on the attached design drawings.

**3. Notification of Intent to Close**

Notification of intent to close the Plant Gorgas Bottom Ash Landfill was placed in the plant's Operating Record on April 15, 2019. The notice of intent was subsequently submitted directly to ADEM. Closure of the landfill will be conducted under § 257.102(d) and r. 335-13-15-.07(3)(d), *closure performance standard when leaving CCR in place*. As described in more detail below, the landfill will be closed in a manner that will control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated runoff to the ground or surface waters or to the atmosphere. Closure will also preclude the probability of future impoundment of water, sediment or slurry. Measures will be taken during design and construction of the closure system that provide for major slope stability to prevent the sloughing or movement of the final cover system. Closure will also minimize the need for further maintenance of the CCR unit.

Major closure activities will commence following receipt of a CCR permit from ADEM pursuant to r. 335-13-15-.09.

**4. Written Closure Plan – § 257.102(b)(1)(i),(iii) and r. 335-13-15-.07(3)(b)1.(i),(iii)**

**a. Overview**

A written closure plan to comply with § 257.102(b) was posted to the Plant Gorgas Operating Record on October 17, 2016. A revised written closure plan incorporating reference to applicable ADEM Administrative Codes was submitted as a part of the original CCR Permit application.

As required by § 257.102(b)(3)(ii) and r. 335-13-15-.07(3)(b)3.(ii), the written closure plan must be amended whenever (i) there is a change in the operation of the CCR unit that would substantially affect the written closure plan or (ii) before or after closure activities have commenced when unanticipated events necessitate a revision of the written closure plan. The time frames for amendment to the written closure plan is in accordance with those specified in § 257.102(b)(3)(iii) and r. 335-13-15-.07(3)(b)3.(iii).

**b. Closure Steps**

The closure of the Plant Gorgas Bottom Ash Landfill will involve the following general activities:

- Installation of Erosion & Sediment Control/BMPs as part of site preparation activities
- Clearing and grubbing as part of site preparation activities
- General excavation and grading around the site
- CCR excavation, consolidation, and grading
- Installation of the final cover system
- Construction of final stormwater control and conveyance systems

Plant Gorgas formally ceased generation of electricity on April 15, 2019, and the Bottom Ash Landfill ceased receiving CCR on or before this date. A Notice of Intent to initiate closure was placed in the Plant Gorgas Operating Record on April 15, 2019.

A Contractor has been selected for the closure project and has mobilized to the site to begin preparation for closure. Their initial activities include installation of erosion and sediment control structures, followed by clearing and grubbing. Most of the site is relatively barren of vegetation, but there is a limited amount of vegetation scattered around the perimeter of the landfill, including an area of trees to the south that will need to be removed.

As this facility is a landfill containing dry stacking of CCR, there is no dewatering required to facilitate closure.

**c. Procedures During Closure**

**i. Erosion and Sedimentation Control**

Prior to initiation of closure activities, erosion and sedimentation controls will be established along with Best Management Practices. Erosion and sedimentation control details can be found on Drawings E720292 and E720293.

**ii. Stormwater Management**

The only stormwater generated within the Bottom Ash Landfill results from precipitation that falls within the Bottom Ash Landfill drainage basin. There is no current discharge from the Bottom Ash Landfill; water that collects within the cell at the southern end evaporates. As a part of the closure project, grading activities will develop new drainage patterns to drain stormwater to a new detention pond (to be installed in the early phases of the project.) The pond will have an outlet control structure. Stormwater collected during the project will be treated and/or rerouted to other Plant water treatment facilities prior to discharge.

Stormwater from adjoining areas will be diverted around the landfill and managed through existing stormwater facilities or NPDES permit points, as applicable.

**iii. CCR Removal Activities and Verification**

Closure construction is going to involve consolidation of the CCR footprint, which will involve excavation of ash from some areas, with the excavated ash placed and compacted in the consolidation footprint that will be beneath the final cover system. As previously stated, the Bottom Ash Landfill area will be reduced from approximately 56 acres to about 27 acres. CCR will be excavated from outside the consolidation footprint until all visible ash has been removed. CQA personnel will perform a visual inspection to note if any visible ash remains in these areas. If visible ash is noted, further excavation will be performed. If no visible ash is noted, a grid or other reference points will be established, and a survey of the area taken to document the excavated surface. Also, the exposed soils will be visually classified and photographed. The classification indicator will be gray to black, sand-to-gravel sized particles as this area was used predominately for bottom ash storage. If possible, visual classification will be supported by use of the Munsell color system. However, as this area was previously disturbed with surface mine activities, the Munsell color chart usage may not be fully viable. The area will then be overexcavated an additional 6 inches, with the excavated soil placed within the consolidation footprint. The bottom of the overexcavation area will also be surveyed to document the excavation took place over the entire excavation area. Hand auger borings, if possible, may also be performed to a depth of about 12 inches below the exposed surface to provide a further check against the presence of deeper ash. Hand auger borings will be performed at a frequency of approximately 1 per acre.

The Contractor selected for the closure construction project will retain the services of an engineering and testing firm to provide quality control (QC) services. Southern Company, on behalf of Alabama Power, will retain the services of an additional engineering and testing firm to provide quality assurance services during the closure project. The services of each firm are outlined in the attached Technical Specifications. The removal of ash from outside the consolidation footprint will be observed and documented by the Contractor, the QC firm and the QA firm, with records from this process included in the final closure certification report.

#### **iv. CCR Placement**

The new consolidated footprint will be in an area where dry stacking of ash has taken place for several years, so the area is relatively stable in its current condition. The subgrade will be assessed before the placement of any additional CCR using proofrolling or other similar techniques. Prior to any work in the area, erosion and sediment controls and other BMPs will be installed in accordance with the project plans and specifications.

As the area has been dry stacked for years, there is no dewatering involved in the closure process (either free water or interstitial water). The groundwater level is approximately 40 feet or more below the consolidated footprint.

CCR from the excavated area will be excavated using conventional earthmoving equipment and loaded in to trucks for transport to the consolidation area. The CCR is to be placed in loose lifts not exceeding 8-in thickness and compacted to a minimum of 95 percent of the materials standard Proctor maximum dry density. Following such measures will result in a compact and stabilized consolidation footprint.

#### **v. Fugitive Dust Control Plan**

Fugitive dust control will be performed in accordance with the previously established fugitive dust control plan for Plant Gorgas. During construction, water trucks and compaction will be used to minimize dust. Ash will be conditioned as needed for compaction and to minimize dust generation. Trucks transporting ash and other materials will be operated at speeds intended to reduce generation of dust along roadways and other travel paths.

On-site personnel will assess the effectiveness of the control measures by performing visual observations of the ash pond and surrounding areas and implementing appropriate corrective actions for fugitive dust, as necessary.

Should a complaint be received from a citizen regarding a CCR fugitive dust event at the facility, the complaint will be documented and investigated. Appropriate steps will be taken, including any corrective action, as appropriate.



**vi. Surface Water Management**

Water that accumulates within the Bottom Ash Landfill footprint during closure construction may be used for ash conditioning water to support compaction and dust suppression in conjunction with the Fugitive Dust Control Plan. Any water not used for such purposes will be conveyed to the Plant's permanent wastewater treatment system. Non-contact stormwater which will be diverted around the landfill during construction will be managed through the site's normal NPDES operations.

**vii. Equipment Decontamination**

Before moving a piece of equipment that has been in contact with CCR from the active work area, the equipment will be cleaned with water in a designated area. CCR generated from this cleaning process will be incorporated with other CCR within the consolidated footprint prior to construction of the final cover system. Water generated during this process will be managed as contact water using the methods described previously.

**viii. Site Security**

The Bottom Ash Landfill is located on Plant Gorgas property, and access to the Plant, and thereby the landfill, is restricted with security gates manned 24 hours a day. Public access is not allowed unless escorted by authorized personnel. Access to the construction area will be limited to authorized personnel only during the closure project.

**ix. Groundwater Monitoring**

A groundwater monitoring plan was submitted with the original Bottom Ash Landfill permit application. Please refer to Appendix 4 of the original permit application.

**x. Operational Inspections**

Inspections will be conducted by a Qualified Person at intervals not exceeding 7 days to look for appearances of structural weakness and for proper operation of all outlet structures maintained for use during closure. Furthermore, an annual inspection will continue to be conducted by a qualified Professional Engineer throughout the closure process.

**d. Closure Design Features**

The closure of the Gorgas Bottom Ash Landfill will include the consolidation of dry stacked ash within the landfill prior to the construction of the cover. The operational disposal footprint will be consolidated to reduce the acreage that will be under cover. A stormwater management pond will be constructed to manage non-contact runoff from the closed facility. Where needed, additional earthen berms will be constructed to separate the closed cell from the stormwater pond, contain the ash, and provide a berm for the closure geomembrane anchor trench. The cell is contained on many sides by existing berms. No special containment structures or slurry walls will be needed as a part of closure.

**e. Final Cover System**

As currently planned, the final cover system for the Bottom Ash Landfill will consist of a composite cover system incorporating a 60-mil HDPE geomembrane overlain with a geocomposite, both covered with 18 inches of protective soil and 6 inches of topsoil. This cover system meets the requirements of § 257.102(d)(3)(i)(I) and (II) and r. 335-13-15-.07(3)(d)3.(i)(I) and (II). Infiltration of liquids will be prevented by the presence of both an 18-in infiltration/protective layer and the 60-mil HDPE geomembrane. A minimum 6-in erosion layer of soil capable of sustaining native plant growth will cover the infiltration layer and provide erosion protection for the final cover system. The final cover system will be installed over the consolidated area, eliminating direct exposure of CCR to the surrounding environment.

Disruption of the integrity of the cover system will be minimized through a program of regular inspection and maintenance as outlined in the post-closure care plan.

**f. Achievement of Closure Performance Standards**

Closure of the Bottom Ash Landfill will meet the requirements of § 257.102(d) and r. 335-13-15-.07(3)(d). Details of how the cover system will meet the final cover system requirements of § 257.102(d)(3)(i) and r. 335-13-15-.07(3)(d)3.(i) were addressed in 4.e. above. [Consider including a reference to how the final cover system will meet 257.102(d)(1) and 335-13-15-.07(3)(d)1.]The site will be graded during closure to direct surface runoff to a central rip-rap lined conveyance channel discharging to the new detention pond located to the southwest of the closed landfill. Surface grades in the consolidated footprint will range from 25 percent to 3 percent. Therefore, Alabama Power will be requesting a variance from the minimum 5 percent grades. As the waste material will be compacted bottom ash, we do not anticipate significant settlement of the cap and cover that would create depressions or other impedances to surface flow of stormwater. Furthermore, with a majority of the slopes being approximately 6 percent or flatter, we have not incorporated benching into the design as required by r. 335-13-15-.07(3)(d)3.(i)(V).

**g. Corrective Measures**

Based on groundwater monitoring results and an Alternate Source Demonstration, submitted to the Department in July 2019, for the facility, no Assessment of Corrective Measures has been proposed for this facility and was therefore not incorporated into the closure design. However, site conditions will be monitored and, if necessary under § 257.96(a) and r. 335-13-15-.06(7)(a), corrective measures will be initiated.

**h. Completion of Closure Activities**

Closure of the facility is expected to be completed by November 2020. Pursuant to 335-13-15-.07(3)(f)2.(i), Alabama Power intends to submit a demonstration showing that it is not feasible to complete the closure of the CCR landfill within the 6 month timeframe contemplated by § 257.102(f)(1)(i) and r. 335-13-15-.07(3)(f)1.(i) . The timeline for closure is based on the volume of material to be moved and grading activities required to consolidate the closure footprint and construct the new detention pond.

**5. Maximum Inventory of CCR— § 257.102(b)(1)(iv) and r. 335-13-15-.07(3)(b)1.(iv)**

The maximum inventory of CCR stored in the Bottom Ash Landfill during its operation is approximately 4,100,000 cubic yards. The amount of CCR to be included in the consolidated footprint and under the cover system is approximately 3,800,000 cubic yards.

**6. Largest Area Requiring Final Cover— § 257.102(b)(1)(v) and r. 335-13-15-.07(3)(b)1.(v)**

The Gorgas Bottom Ash Landfill covers about 56 acres. The footprint will be consolidated, and the final cover system will be applied to the consolidated footprint of 27 acres.

**7. Schedule for Completing Closure Activities – § 257.102(b)(1)(vi) and r. 335-13-15-.07(3)(b)1.(vi)**

Notification of intent to initiate closure was placed in the Plant Gorgas Operating Record on April 15, 2019. A Contractor has been selected for the closure project and has mobilized to the site to begin preparation for closure. Their initial activities have included installation of erosion and sediment control structures, followed by clearing and grubbing. Initial excavation of CCR from the footprint of the new detention pond has also begun, with the excavated ash moved to the consolidated footprint. Closure construction is expected to be complete by November 2020. A detailed construction schedule is attached to this Amended Closure Plan.

**8. Certification of Closure**

In accordance with § 257.102(h) and r. 335-13-15-.07(3)(h), a notification of completion of closure will be prepared and placed in the Plant Gorgas Operating Record. The notification of completion of closure will include a certification by a qualified professional engineer licensed in the State of Alabama in accordance with § 257.102(f)(3) and r. 335-13-15-.07(3)(f)3. verifying that closure has been completed in accordance with the closure plan required by § 257.102(b) and r. 33-13-15-.07(3)(b).

APC will also submit confirmation that a notation on the property deed has been recorded in accordance with r. 335-13-15-.07(3)(h)(i).

#### **9. Directional Informational Signs**

Upon completion of closure, signs will be posted at the entrance to the facility notifying users that the landfill is closed. Contact information will be provided on the sign.

#### **10. Vegetative Plan**

The upper 6-in vegetative layer of the designed cover system is designed to promote vegetative growth while limiting erosion from wind and water. To promote the growth of vegetation, the vegetative layer of the cover system will be seeded and amended, as needed, with lime, fertilizer or similar products after installation. Details regarding the vegetative plan are shown on the closure design drawings.

Prior to the establishment of permanent vegetation, temporary stabilization measures will be incorporated as needed to limit erosion during closure construction completion.

#### **11. Site Equipment Needed**

The Contractor selected to perform closure construction will be responsible for all equipment needed during the construction period. For post-closure care, Alabama Power will provide all necessary company owned, leased or contracted equipment needed to perform maintenance and any necessary repairs.

#### **12. Sediment Removal**

On a periodic basis, accumulated sediment will be removed when necessary from drop inlets, drainage pipes, diversion ditches and other drainage structures.

#### **13. Erosion and Sediment Control**

Erosion and sediment control structures are included in the closure design structures and will be installed as a part of closure construction. Temporary erosion and sediment control and other BMP measures will be installed and maintained until construction is complete and permanent vegetation is established.

#### **14. Cost of Closure**

Through coordination with the engineering design team and the subcontractor selected to execute the closure activities, the estimated cost of closing Plant Gorgas's Bottom Ash Landfill is approximately \$27.6 million. The estimate is considered to be at control level with a high level of project definition. However, due to the complexity, quantities, and duration of the overall project, some variability in costs is expected. Additional expenses of post closure care, maintenance, and corrective action are currently estimated at \$6.6 million. Fully detailed long-term maintenance and corrective action strategies have not yet been determined which will have the potential to influence current estimates.

#### **15. Closure Schedule**

A construction schedule is attached to this Amended Closure Plan as Table 1.

#### **16. Recordkeeping/Notification/Internet Requirements**

As outlined in § 257.105 and r. 335-13-15-.08(1), each Owner or Operator of a CCR unit subject to the Department regulations must maintain files of certain information in an operating record at the facility. Each file is to be retained for at least five years following the date of each occurrence, measurement, maintenance, corrective action, report, record or study. Electronic storage of the records is acceptable. These records are to be made available to the Department upon request.

Certain notifications are to be made in accordance with the requirements of § 257.106 and r. 335-13-15-.08(2). In many instances, such notifications are to be placed in the facility's Operating Record. In certain instances, further notifications are to be made to the Department Directory within 30 days of placement of a notification into the Operating Records. Furthermore, a publicly accessible internet site must be established for posting of certain notifications and compliance information within 30 days of it being placed in the Operating Record.

Alabama Power and Plant Gorgas maintain an electronic Operating Record for the facility. In addition, a publicly accessible internet site has already been established for compliance with EPA's CCR Rule. Required notifications and compliance data, as outlined in § 257.105 through § 257.107 and r. 335-13-15-.08 and as applicable to the Plant Gorgas Bottom Ash Landfill, will be maintained in the electronic Operating Record, and as required, made available on the publicly accessible internet site within 30 days of placement in the Operating Record. Furthermore, required notifications will be made to the Department Director within 30 days of placement in the Operating Record.

Certain plans and assessments are required to be updated at specified intervals and/or upon modification of certain components of the facility. If and when applicable, updates will be made to the respective plans and assessments, and notifications placed in the Operating Record, posted to the publicly accessible internet site, and communicated in writing to the Department Director in accordance with the Department rules.

## 17. Written Post-Closure Plan

40 CFR § 257.104 and ADEM Administrative Code r. 335-13-15-.07(5) require the owner or operator of an existing CCR landfill that is closed in place to provide for post-closure care of the unit for a period of at least 30 years. Post-closure care includes maintenance of the facility, as well as groundwater monitoring in accordance with § 257.90 through § 257.98 and r. 335-13-15-.06(1) through r. 335-13-15-.06(9).

The Plant Gorgas Bottom Ash Landfill is currently expected to be closed in place under the performance standards outlined in § 257.102(d) and r. 335-13-15-.07(3)(d). Following closure, maintenance will be provided on the final cover system for the required post-closure care period so that the integrity and effectiveness of the final cover system will be maintained. Maintenance activities will include, as needed, repairs to the final cover to correct any effects related to settlement, subsidence, erosion or other events, and will be performed to prevent run-on or run-off from eroding or otherwise damaging the final cover. Maintenance tasks could include, but not be limited to, repair of erosion features, replacement of eroded cover soils and re-establishment of vegetation, where applicable. Maintenance will be performed on a semi-annual schedule, or more frequently if needed.

The groundwater monitoring system will be maintained throughout the required post-closure care period. Groundwater monitoring will be performed on a semiannual basis during the required post-closure care period as well.

The following office(s) can be contacted about the facility during the post-closure care period.

Gorgas Steam Plant  
Compliance and Support Manager  
460 Gorgas Road, Parrish, AL 35580-5715  
1-205-686-2103  
G2CCRPstGOR@southernco.com

At the present time, there is no planned use of the facility after closure. If current plans change, they will be noted in an amendment to the post-closure care plan. Any future use of the property after closure will not disturb the integrity of the final cover, liner or any other component of the containment system. Furthermore, the functionality of the groundwater monitoring system will be maintained.

No later than 60 days following completion of the post-closure care period of 30 years, Alabama Power Company will prepare a notification verifying completion of the post-closure care.

**Table 1: Gorgas Bottom Ash Landfill Closure Milestones Schedule (335-13-15-.07(3)(b)1.(vi))**

Closure Activity	Completion Date
Notice of Intent to Close	October 2016
Cease Receipt of Waste Streams/Initiate Construction Activities	April 2019
Initiate Free Water Dewatering Activities	n/a
Begin CCR Consolidation and Stabilization	May 2019
Begin Final Cover Cap Construction Activities	September 2019
End Final Cap Construction Activities	August 2020
Project Completion	December 2020

**SOUTHERN COMPANY GENERATION  
ENGINEERING AND CONSTRUCTION SERVICES**

**TECHNICAL SPECIFICATIONS  
SECTION 31 21 00**

**FOR**

**EARTHWORK AND FINAL COVER INSTALLATION  
FOR  
CLOSURE OF BOTTOM ASH STORAGE AREA**

**FOR**

**PLANT GORGAS**

**ALABAMA POWER COMPANY**



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**TECHNICAL SPECIFICATIONS  
EARTHWORK AND FINAL COVER INSTALLATION  
FOR  
CLOSURE OF BOTTOM ASH STORAGE AREA**

**1.0 GENERAL**

- 1.1 These technical specifications will pertain to the closure of the Bottom Ash Storage Area located at Plant Gorgas near Parrish, Walker County, Alabama. The storage area will be closed under the applicable requirements of ADEM Admin. Code 335-13-15, known hereafter as the “ADEM Solid Waste Regulations.”
- 1.1 These Specifications, and all related attachments and associated documents, cover the furnishing of all materials (unless otherwise noted), labor, and supervision required for the closure of the storage area, including installation of a final cover system for the storage area as described herein and presented on the Closure Drawings, and the technical and construction requirements, including notes, specifications, and design data contained in the Drawings. The Drawings and Notes are an integral part of these Specifications.
- 1.2 The following terms shall apply to these Technical Specifications ("Specifications"):
- a) The term "Purchaser" means Alabama Power Company (APC).
  - b) The term “Contractor” means the entity awarded the contract to furnish the materials and perform the work as described herein, and to construct the final cover system as specified in the contract documents.
  - c) The term “Construction Site Manager” (CSM) means the on-site manager of the project or his designated representative. He is the authorized representative at the site for the Purchaser.
  - d) The term "Purchaser's Representative" means the representative designated by the CSM to perform certain activities under these Specifications.
  - e) The terms “Accepted, Acceptable, or Approved” denotes that of which must be acceptable, accepted or approved by the CSM or his authorized representative.
  - f) The terms “CQC Firm”, “CQC Inspector”, and “CQC Professional Engineer” refer to the Contractor’s third-party firm responsible for construction quality control monitoring, testing and documentation for all work performed during the construction of the facility.
- 1.3 Any discrepancies between the Drawings noted in Section 3.1 and the provisions of the Specifications shall be brought to the attention of the Purchaser for resolution before the performance of the work. In the case of discrepancies between the scale dimensions on the Drawings and the written dimensions, the written dimensions shall govern.
- 1.4 The Contractor shall ensure that all work is performed in accordance with the Occupational Safety and Health Act of 1970 and other standards and codes listed herein (latest revision).

- 1.5 As necessary, the Purchaser will file for a National Pollutant Discharge Elimination System (NPDES) Construction General Permit for storm water discharge under ALR100000 (discharges from construction activities that result in a total land disturbance of one acre or greater and sites less than one acre but are part of a common plan of development or sale) from the Alabama Department of Environmental Management (ADEM). The Contractor shall be responsible for obtaining any other necessary permits for conducting the work covered by these Specifications.
- 1.4 All land disturbing activities shall be consistent with the minimum standards in the *Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas*, latest revision.
- 1.5 Installation and maintenance of erosion and sediment control measures (e.g. “BMPs”) and monitoring of surface waters during construction, if required, shall be performed by the Contractor in accordance with the NPDES Construction General Permit (Permit Number ALR100000) and the Construction Best Management Practices Plan (CBMPP), respectively.
- 1.6 The Contractor shall provide methods, means, and facilities to prevent contamination of the soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by the construction activities. Toxic liquids, chemicals, fuels, and lubricants shall be deposited into containers for subsequent removal offsite in accordance with all applicable federal, state, and local codes and standards.
- 1.7 The Contractor shall furnish and keep in good working condition at all times sufficient equipment of the proper design and capacity to do all work described under these Specifications and in accordance with the established schedule. The Purchaser’s acceptance of the Contractor’s list of equipment shall not be construed to mean that the listed equipment is adequate or sufficient to perform the work or that additional equipment shall not be required to maintain the schedule or perform the work specified herein.
- 1.8 The Contractor shall furnish appropriate equipment for minimizing fugitive dust. The Contractor shall continually take steps necessary to minimize dust created by all equipment, vehicles, work activities, or storage areas. These steps shall include, but not be limited to, watering roads and work areas. Open-bodied trucks handling sand, stone, gravel, or earth shall be covered if the truck is traveling off site. The Contractor shall not deposit dirt, mud, or debris on public roads, plant roads, or adjacent properties.
- 1.9 The Contractor is responsible for the unloading, handling, and storage of all materials supplied by him and shall ensure that all materials are handled and stored so as to prevent any damage. Materials damaged during handling, shipping, or storage shall be replaced at no cost to the Purchaser. The Contractor shall store materials only in areas as directed by the Purchaser. Any security measures taken for the protection of the Contractor's equipment shall be at the Contractor's expense.
- 1.10 Construction activities, except as shown on the Drawings, will not be performed within the areas designated as the Buffer Zone. This Buffer Zone is indicated on the Drawings. The Buffer Zone will be flagged and marked by the Contractor prior to construction.
- 1.11 The Contractor shall have the responsibility for obtaining third party QC testing for all

- work performed during the construction of the facility.
- 1.12 All earthwork, including ramps and access roads, done for the convenience of the Contractor, shall be done at his expense unless instructed to be completed by the purchaser. Such work will be restored to its original elevation at the Contractor's expense if the Purchaser so desires.
- 1.13 The Contractor shall install, at his expense unless expected to be completed by the purchaser, any drainage piping required because of the Contractor's mode of operation including ramps and roads.
- 1.14 Plant Gorgas is an active power generation site. The Contractor and the PCM, or his representative, shall mutually determine a designated path for vehicles that are used by the Contractor or that haul material to and within the site for the Contractor. The Contractor's vehicles outside the designated traffic path must not obstruct or hinder traffic flow on the site. The Contractor shall provide traffic control during roadway related construction activities and material deliveries. This shall be coordinated with other activities ongoing at the plant. If within active and congested areas around the plant, traffic control shall include flag persons, barriers, and other control aids to provide for the safe routing of traffic in the affected area.
- 1.15 At all times, the Contractor shall provide protection to prevent damage to existing facilities, roads, underground pipes, and other Purchaser's equipment and property that may be on site. The Contractor will be liable for any damages to APC property caused by the Contractor.
- 1.16 The Purchaser shall have the right to inspect the Contractor's work as deemed necessary. The Purchaser shall have the right to inspect the Contractor's work locations, to inspect the materials in use, to meet and discuss with the Contractor the progress of the work and the manner in which it is being done. The Purchaser shall have the authority to reject materials or suspend any work not performed in accordance with these Specifications. The Contractor shall be responsible for performing the work in strict accordance with these Specifications, and the presence of the Purchaser's Representative shall not relieve the Contractor and his subcontractors of that responsibility.
- 1.17 Piezometers and Groundwater Monitoring Wells located in the site area shall not be damaged or destroyed by construction activities. The Contractor shall provide Purchaser approved measures to protect the piezometers and wells in the site area. Any monitoring well(s) damaged or destroyed by the Contractor and/or his activities shall be replaced at no cost to the Purchaser.
- 1.18 Priority pollutant testing shall be performed of any off-site borrow materials or topsoil material. The Contractor shall provide the Purchaser notice at least three weeks before hauling begins so that the Purchaser can schedule a time for collecting soil samples for chemical analyses. No off-site borrow material may be brought onto the site until the Purchaser has reviewed the analytical results and approved the borrow source.

## **2.0 COVER SYSTEM AND CERTIFICATION**

### **2.1 Cover System**

Closure of the Bottom Ash Storage Area shall be accomplished by the installation of a final cover system designed to minimize infiltration and erosion. The cover system will be a composite system consisting of a 60-mil high density polyethylene (HDPE) textured geomembrane overlain by a geocomposite drainage material, a minimum 18 inches of protective cover soil, and a minimum 6 inches of topsoil.

## 2.2 Certification

The installation of the final cover system for the Storage Area shall be certified as being constructed in accordance with the applicable ADEM Solid Waste Regulations. This certification shall be performed by a professional engineer registered to practice in the State of Alabama and placed in the Bottom Ash Storage Area operating record within 60 days of the completion of all construction activities. This Certification will be provided by the Purchaser or the Purchaser's Representative.

## 3.0 APPLICABLE DOCUMENTS

### 3.1 Drawings

The Drawing List is contained on the Drawings.

### 3.2 Codes and Standards

The following Codes, Standards, Specifications, Publications, and/or Regulations shall be made part of these Specifications and will become part of the contract entered into for performance of the work covered herein. The latest edition in effect at the time of the contract shall apply. Other codes and standards shall be incorporated as referenced in this document. The omission of any Codes and/or Standards from this list does not relieve the Contractor of his responsibility to follow the latest revision of all applicable codes and standards for conducting the work.

If codes or standards are found to conflict with each other, it should be brought to the attention of the Purchaser to determine which is most applicable.

#### Occupational Safety and Health Administration

- Occupational Safety and Health Act of 1970

#### ASTM International (ASTM)

- ASTM C 117 - Standard Test Method for Materials Finer Than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C 136 – Standard Test Method for Sieve Analysis of fine and Coarse Aggregates
- ASTM D 422 – Standard Test Method for Particle-Size Analysis of Soils
- ASTM D 698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-

m/m<sup>3</sup>))

- ASTM D 792 – Standard Test Methods for Density and Specific Gravity (relative density) and Density of Plastics by Displacement
- ASTM D 1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
- ASTM D 1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
- ASTM D 1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique
- ASTM D 1603 - Standard Test Method for Carbon Black in Olefin Plastics
- ASTM D 1556 – Standard Test Method for Density and Unit Weight of Soil In - Place by the Sand Cone Method
- ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>))
- ASTM D 1587 - Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
- ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D 2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)
- ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D 2488 - Description and Identification of Soils (Visual-Manual Procedure)
- ASTM D 2937 - Standard Test Method for Density of Soil In Place by the Drive Cylinder Method
- ASTM D 3017 – Standard Test Method for Water Content of Soil and Rock In Place Nuclear Methods (Shallow Depth)
- ASTM D 3895 - Standard Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry
- ASTM D 4218 - Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
- ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

- ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
- ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles
- ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- ASTM D 4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
- ASTM D 4716 - Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile
- ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
- ASTM D 4959 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method
- ASTM D 5035 - Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
- ASTM D 5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- ASTM D 5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
- ASTM D 5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- ASTM D 5321 - Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
- ASTM D 5397 - Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
- ASTM D 5596 - Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics

- ASTM D 5721 - Standard Practice for Air-Oven Aging of Polyolefin Geomembranes
- ASTM D 5885 - Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
- ASTM D 5994 - Standard Test Method for Measuring Core Thickness of Textured Geomembranes
- ASTM D 6392 – Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
- ASTM D 6693 - Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
- ASTM D 6938 Rev B - Standard Test Method for In-Place Density and Water Content of Soil and Soil – Aggregate In Place by Nuclear Methods (Shallow Depth)
- ASTM D 7005 - Determining the Bond Strength (Ply Adhesion) of Geocomposites
- ASTM D1204 -Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
- ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
- ASTM D1907 - Standard Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method
- ASTM D2256 -Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method
- ASTM D3218 -Standard Specification for Polyolefin Monofilaments
- ASTM D5323 – Standard Test Method for Determination of 2% Secant Modulus for Polyethylene Geomembranes
- ASTM D5617 – Standard Test Method for Multi-Axial Tension Test for Geosynthetics
- ASTM D6913 -Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- ASTM D7007 – Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earth Materials

Geosynthetic Research Institute GRI Standards



- GM 10 - The Stress Crack Resistance of HDPE Geomembrane Sheet
- GM 11 - Accelerated Weathering of Geomembranes using a Fluorescent UVA Device
- GM 12 - Asperity Measurement of Textured Geomembranes Using a Depth Gage
- GM 13 - Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Geomembranes
- GM 19 – Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes
- GRI-GM17 – Test Methods, Test Properties, and Testing Frequency and for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

United States Environmental Protection Guidance

- Environmental Protection Agency (EPA) regulations
- EPA/600/R-93/182, September 1993, 305 pgs.
- U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities"

Corps of Engineers EM-LST, Appendix VII, Falling-Head Permeability Test

Alabama Department of Environmental Management (ADEM) regulations

Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas

#### **4.0 SITE CONDITIONS**

- 4.1 The Contractor shall visit the site and acquaint himself with site conditions, utility locations, and the proposed scope of work.
- 4.2 The Contractor is responsible for acquiring and maintaining a dig permit per Alabama state law.
- 4.3 Vibratory equipment shall have vibratory devices mechanically disengaged and rendered inoperable while operating on dikes or the Bottom Ash Storage Area.

#### **5.0 THIRD PARTY QUALITY CONTROL**

- 5.1 The Contractor shall provide to the Purchaser, for the Purchaser's acceptance and approval, the following documentation indicating that the Contractor's Third Party Quality Control firm and personnel that will participate on this Project meets the minimum experience and qualifications indicated herein.
- 5.2 The Contractor shall provide to the Purchaser the qualifications of a third-party CQC Inspector for construction quality control (CQC) for the placement and compaction of

- the compacted structural fill.
- 5.3 The Contractor shall provide to the Purchaser the qualifications of a third-party CQC Inspector for construction quality control (CQC) of the ClosureTurf™ Final Cover System installation documenting the minimum requirements of Section 11.3.5 of these Specifications.
- 5.4 The Contractor shall provide to the Purchaser a statement of qualifications of a third-party CQC Inspector for construction quality control (CQC) of the geomembrane liner and drainage geocomposite installation documenting the minimum requirements of Section 11.3.3 of these Specifications.
- 5.5 The Contractor shall provide to the Purchaser the qualifications of the third party's soil testing laboratory contracted to perform the CQC testing for the structural earth fill.

## **6.0 LINES AND GRADES**

The project shall be constructed to the elevations, lines, grades and cross sections shown on applicable Drawings. The Purchaser reserves the right to increase the foundation widths, change the embankment slopes, and to make such other changes in the embankment sections as conditions indicate are necessary for the construction of a safe and permanent structure. The Contractor shall be compensated for the changes in plan and/or sections resulting in changes in quantities of materials.

## **7.0 CLEAR, GRUBBING, AND STRIPPING**

- 7.1 Prior to any clearing or grubbing operations, initial BMPs shall be installed. Erosion control measures and best management practices shown on the construction drawings shall be followed.
- 7.2 The footprint of the Bottom Ash Storage Area shall be cleared of any woody vegetation prior to excavation and/or fill operations. Grassy vegetation and grass mats are not required to be removed.
- 7.3 Trees, stumps, and brush cleared from the above areas shall be disposed of outside the closure areas by mulching or burning, if allowed by Purchaser. Mulch may be used as a temporary perimeter BMP, but shall ultimately be disposed of off-site.
- 7.4 Spoil material shall be disposed of outside the closure areas only in areas to be designated by the Purchaser. The Contractor shall slope the spoil area for drainage and provide silt fences and a perennial stand of vegetation.
- 7.5 Bottom ash laden roots on grubbed and stripped material may be cleaned as much as practical by screening and washing processes, or other approved methods, prior to leaving the site for disposal. Usable material, as approved by the Purchaser, may be stockpiled for future use at Purchaser designated locations.
- 7.6 Adequate erosion control measures shall be installed around the spoil and stockpile areas in accordance with details shown on the construction drawings.
- 7.7 Burning of brush and debris will not be allowed.

## **8.0 FOUNDATION AND SUBGRADE PREPARATION**

### **8.1 Areas to Receive Fill**

- 8.1.1 The Contractor shall prepare, install and maintain erosion and sediment control measures, as required by the construction drawings. If measures beyond those in the construction drawings are deemed necessary, contact the PCM to have those reviewed & approved by the engineer and the construction drawings updated PRIOR to the measures being installed.
- 8.1.2 Material suitable for topsoil, material to be used for the eighteen (18) inch protective soil layer, and the material to be used as structural earth fill shall be stockpiled separately in a location specified by the Purchaser's Representative.
- 8.1.3 Proof-roll the entire subgrade utilizing loaded, off-road trucks with a gross machine weight, including payload of 40 tons of soil. Any areas failing proof-roll shall be undercut and replaced with structural soil fill and re-rolled, or modified through the use of bridging layer as described in section 9.0.
- 8.1.4 Prior to receiving structural earth fill, the foundation areas shall be scarified by harrowing or other suitable means. The moisture content of the roughened surface shall be adjusted to within the limits provided in section 10.1.9. No fill shall be placed on any part of the subgrade until such areas have been conditioned, proof-rolled, inspected, and approved in writing by the Contractor's QC Inspector and the Purchaser.
- 8.1.5 Work flow shall be planned such that the first embankment fill lift is placed soon after subgrade compaction to minimize subgrade exposure to inclement weather.

### **8.2 Geomembrane**

- 8.2.1 The Contractor shall maintain the subgrade suitability and integrity until the geomembrane installation is completed and accepted.
- 8.2.2 The Contractor shall repair rough areas and any damage to the subgrade caused by installation of the geomembrane.
- 8.2.3 Subgrade shall be smooth, uniform, firm and free from rocks or other debris. For deployment over soil subgrade, no rocks or protrusions greater than 1/2-inch in diameter shall be exposed at the subgrade surface.
- 8.2.4 The Contractor shall verify that the surface on which the geomembrane will be installed is acceptable. In so doing the Contractor shall assume full liability for the accepted surface.
- 8.2.5 The Contractor shall submit written certificates of subgrade acceptance, signed by the Contractor, CQC Inspector, and the Purchaser's Representative, for each area prepared for geomembrane placement.
- 8.2.6 The beginning of installation means acceptance of existing conditions. The Contractor shall be responsible for maintenance of the geomembrane covered subgrade once installation of geomembrane begins.

## **9.0 BRIDGING LAYER**

- 9.1 Where it can be demonstrated that it is impracticable to proof-roll the subgrade as

- specified in section 8.1 or achieve the degree of compaction specified in section 10.1, a bridging layer may be placed.
- 9.2 The bridging layer shall be of sufficient thickness to allow the passage of earthmoving equipment with minimal surface heaving, but no more than four feet in thickness
- 9.3 The bridging layer shall be end-dumped and spread in a single layer. The compaction requirements of Section 10.1 will not apply to the bridging layer.
- 9.4 Acceptable materials for the construction of the bridging layer include structural earth fill as defined in Section 10.1, bottom ash fill, sand, and rock fill materials.
- 9.5 Any bottom ash fill used in the bridging lift must have been excavated from the Bottom Ash Storage Area and not at any point been transported out of the pond.
- 9.6 Geogrid reinforcement may be used as part of the bridging layer. All geogrid should be placed in accordance with the manufacturer's recommendations.

## **10.0 STRUCTURAL EARTH FILL AND BOTTOM ASH FILL**

### **10.1 Structural Earth and Bottom Ash Fill**

- 10.1.1 The Contractor shall provide third party CQC testing for all earth work performed for the closure of the Bottom Ash Storage Area.
- 10.1.2 Compacted earth fill should generally consist of sandy clays (CL), clayey silts (ML), clayey sands (SC), and clayey to silty sands (SC/SM) from a Purchaser approved borrow area.
- 10.1.3 No earth fill or bottom ash shall be placed on any part of the foundation until such areas have proof-rolled, inspected, and approved in writing by the soils CQC Inspector and the Purchaser's Representative.
- 10.1.4 Fill materials shall be placed in uniform layers of eight inches, nominal thickness, loose measurement, for one foot beyond the full width of the fill on each side. The thickness of each layer shall be kept uniform with the necessary grading equipment. Upon completion of compaction, the slopes shall be cut back to the final slope. Particular care must be used to obtain the required compaction along the edges of the fill slopes.
- 10.1.5 If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layers, it shall be loosened by harrowing, or as directed by the Purchaser's Representative, before the succeeding layer is placed.
- 10.1.6 During the dumping and spreading processes, the Contractor shall maintain at all times a force of men adequate for removal of roots and debris from all structural earth fill materials and all stones and clay clods greater than three inch maximum. Clay clod size may be reduced in size to meet this Specification by disking, tilling or other means. The distribution of materials throughout the structural fill shall be essentially uniform and free of any lenses, pockets, streaks, or layers of materials differing substantially in texture, moisture content, or gradation from the surrounding material.
- 10.1.7 The compacted structural fill and bottom ash subgrade beneath the HDPE component of the final cover shall be free of roots, debris, and all stones and clay clods greater than one-half ( $1/2$ ) inch maximum. Clay clod size may be reduced in size to meet this Specification by disking, tilling or other means.

- 10.1.8 Structural earth fill and bottom ash material shall be compacted to a minimum of 95% of the relative maximum dry density as determined by the standard Proctor compaction test (ASTM D 698). The moisture content of the earth fill at the time of placement shall be within -2% and +2% of the optimum moisture obtained by standard Proctor compaction test.
- 10.1.9 When moisture content is too low, the moisture content shall be adjusted to within the above limits prior to compaction. Moisture adjustment shall be achieved by sprinkling and disking sufficiently to bring the moisture content within the specified range. Sprinkling and harrowing of the layer shall be done after deposition, but before compaction.
- 10.1.10 If the moisture content is too high, the Contractor will be permitted to disk in place or stockpile and disk the earth fill material to promote drying to bring it back within the allowable moisture range.
- 10.1.11 The Contractor will be required to remove any compacted material that does not comply with the compaction requirements and replace the compacted earth fill to comply with this Specification at his own expense.
- 10.1.12 Structural earth fill or bottom ash which cannot be compacted with roller equipment because of inadequate clearances shall be spread in four-inch layers and compacted with hand-guided power tampers to the extent required by these Specifications. Rocks two inches and greater, in any dimension, roots, and debris shall be removed from the fill and disposed of in an approved manner.
- 10.1.13 Field density and moisture content tests shall be performed daily in all types of material being placed. At a minimum, one in place density test shall be performed for each lift for each day fill material is placed.
- 10.1.14 For earth fill and bottom ash material, at least one field moisture content and density test shall be performed for every 1,000 cy of fill (one per acre of lift area) or more often if deemed necessary in the opinion of the Purchaser's Representative.
- 10.1.15 If an in-place density or moisture test fails to meet the requirements for compaction and/or moisture, the area shall be reworked and then retested. If, however, the second test fails to meet the criteria, the area failing the criteria shall be delineated, and reworked or removed, and then retested. The areas requiring reworking/recompacting shall be noted on record drawings and reported.
- 10.1.16 In the event of repeated failures, or water content and density test values plotting far from the Proctor curves used for comparison in computing percent compaction, it shall be the option of the Purchaser's Representative, to require one or two-point Proctor checks to verify that the proper Proctor curve is being referenced. If not, a new Proctor curve determined by a five-point test shall be required.
- 10.1.17 The surveyed location, lift designation, and elevation or depth of the field density and moisture tests (passing, failing, and retests) shall be recorded and noted on the respective test records. The locations of these tests shall be shown on a figure or drawing.
- 10.1.18 Excavations required for density and moisture tests shall be repaired by scarifying the walls of the excavation, backfilling, and compacting the fill material to the criteria specified above.

- 10.1.19 If the construction of the embankment is interrupted, the Contractor shall be required to shape and smooth the last layer of earth fill material placed on the fill to provide a surface that will shed as much water as possible during the interruption. When the work is resumed, the Contractor shall be required to level, scarify and compact the last layer of earth fill material before placing additional layers.
- 10.1.20 At least one Proctor compaction check plug shall be produced for each type of soil being placed during the day to ensure that the correct reference Proctor curves are being used for compaction check.
- 10.1.21 Earth fill areas, ditches, and other disturbed areas outside the cover area shall be grassed upon reaching final grade in accordance with these Specifications, the construction drawings and the Vegetation Schedule shown on the Drawings.

## **11.0 COMPOSITE COVER SYSTEM**

### **11.1 General**

- 11.1.1 The final bottom ash subgrade of the Bottom Ash Storage Area shall be covered with a 60 mil textured HDPE geomembrane overlain by a double sided geocomposite drainage layer with a minimum 18-inch protective soil cover. An erosion control layer consisting of a minimum of six inches of topsoil that will support vegetative growth shall be placed over the soil cover.
- 11.1.2 The HDPE and drainage material shall be placed in accordance with these Specifications, the manufacturer's recommendations, and the details indicated on the Drawings.

### **11.2 Submittals**

- 11.2.1 The Contractor shall provide to the Purchaser the Manufacturer's Quality Control (CQC) Program and Manual, or descriptive documentation for manufacture of the geomembrane and geocomposite from the manufacturer.
- 11.2.2 The Contractor shall provide to the Purchaser, for review and approval, qualification statements from the geomembrane and geocomposite manufacturer, certified installer, and CQC Inspector documenting the minimum requirements of sections 11.3 and 11.11 of these Specifications.
- 11.2.3 The Contractor shall provide to Purchaser placement procedures and a panel layout for placement of the geomembrane and geocomposite panels over the area of installation fourteen days prior to the start of liner installation.
- 11.2.4 Upon each shipment, the Contractor shall furnish the geomembrane and geocomposite manufacturer's Quality Assurance/Quality Control (QA/QC) roll certifications, signed by a responsible party employed by the manufacturer, to verify that the materials supplied for the project are in accordance with the requirements of sections 11.4 and 11.13 this Specification. The certifications shall reference the lot and roll number as well as the manufacturer's name and address.
- 11.2.5 As installation proceeds, the Contractor shall submit certificates of subgrade acceptance, signed by the Contractor, the CQC Inspector, and the Purchaser's

Representative for each area that is covered by the geomembrane.

- 11.2.6 After installation, the Contractor shall submit a certification, signed by the Contractor and signed and sealed by the CQC Firm's Professional Engineer, that the geomembrane and geocomposite was placed in accordance with these Specifications.
- 11.2.7 The Contractor shall provide certification that all resin used in the manufacture of the geocomposite drainage geonet for this job meets the Specifications and provide a copy of the quality control certificates issued by the resin supplier.

### **11.3 Geomembrane Contractor Qualifications**

- 11.3.1 The manufacturer of the geomembrane (HDPE) must have produced at least ten million square feet of product, with at least eight million square feet installed.
- 11.3.2 The geomembrane installer must either have installed at least one million square feet of product or must provide to Alabama Power satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the geomembrane will be installed in a competent, professional manner.
- 11.3.3 The Contractor shall provide, a third-party inspector for construction quality control (CQC) of the geomembrane installation. The inspector shall be an individual or company who is independent from the manufacturer and installer and shall be responsible for monitoring and documenting activities related to the CQA of the geomembrane throughout installation. The inspector shall have provided CQC services for the installation of the proposed or similar products for at least five completed projects totaling not less than one million square feet. The inspector should be an engineer registered to practice in the State of Alabama or a geosynthetics installation technician certified through the Inspector Certification Program (ICP) administered by the Geosynthetics Certification Institute (GCI). The Contractor shall provide the Purchaser with a statement of the inspector's qualifications with the bid.
- 11.3.4 A Manufacturer's Representative shall be on site during the initial phase of the geomembrane installation to provide assistance to the Contractor.

### **11.4 Geomembrane Material**

- 11.4.1 The geomembrane shall be a 60 mil textured high density polyethylene (HDPE) with a minimum 23 feet seamless width. There shall be no factory seams. Carbon black shall be added to the resin if the resin is not compounded for ultra-violet resistance.
- 11.4.2 The geomembrane shall be manufactured of polyethylene resins and shall be compounded and manufactured specifically for the intended purpose. The Contractor shall submit a certification from the manufacturer of the geomembrane that the raw materials meet the physical property requirements indicated in the following table.
- 11.4.3 The surface of the geomembrane shall not have striations, roughness, pinholes, or bubbles and shall be free of holes, blisters, undispersed raw materials, or any contamination by foreign matter except that, if in the opinion of the Purchaser's Representative, the blemish will not adversely affect properties and use of the liner.
- 11.4.4 The geomembrane shall be supplied in rolls; folds will not be permitted. Identify each roll with labels indicating lot number, roll number, thickness, length, width,

- manufacturer, and plant location.
- 11.4.5 Resin shall be HDPE, new, first quality, compounded and manufactured specifically for producing HDPE geomembrane.
- 11.4.6 Extrudate Rod or Bead shall be made from same resin as the geomembrane. Additives shall be thoroughly dispersed. The rods or beads shall be free of contamination by moisture or foreign matter.
- 11.4.7 The materials shall be stored in space allocated by the Purchaser.
- 11.4.8 The materials shall be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.
- 11.4.9 The materials shall be stored on level prepared surface (not on wooden pallets).
- 11.4.10 The materials shall be stacked per Manufacturer's recommendation but no more than three rolls high.
- 11.4.11 Appropriate handling equipment shall be used to load, move or deploy geomembrane rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Dragging panels on ground surface will not be permitted.
- 11.4.12 The Installer is responsible for storage, and transporting material from storage area to installation area.
- 11.4.13 Damaged geomembrane will be documented by the Purchaser's Representative.
- 11.4.14 Damaged geomembrane may be repaired, if approved by the Purchaser's Representative, in accordance with these Specifications or shall be replaced at no additional cost to the Owner.
- 11.4.15 The geomembrane shall have the following properties:



<b>TEXTURED HDPE GEOMEMBRANE - 60 mil</b>			
Property	Frequency	Test Method	Minimum Average Value
Density	Once per 200,000 lbs of resin	ASTM D 792	Max. 0.940 g/cc
Melt Index	Once per 200,000 lbs of resin	ASTM D 1238, 190°C, 2.16kg	≤ 1.0 g/10 min.
Oxidative Induction Time (OIT) Standard OIT Or High Pressure OIT	Once per 200,000 lbs resin	ASTM D 3895  ASTM D 5885	100 min. (min. avg.)  400 min. (min. avg.)
Thickness: Nominal Minimum Average Minimum 8 of 10 Lowest individual	per roll	ASTM D 5994	60 mil 57 mil 54 mil 51 mil
Asperity Height	Every 2 <sup>nd</sup> Roll	ASTM D 7466 GRI GM12	10 mil
Tensile Properties (avg. both directions) (min. avg) Break Strength Break Elongation	20,000 lbs.	ASTM D 6693, Type IV	≥90 lb/in 100 %
Tear Resistance	45,000 lbs	ASTM D 1004	42 lb (min. avg.)
Puncture Resistance	45,000 lbs	ASTM D 4833	90 lb (min. avg.)
Carbon Black Content	20,000 lbs.	ASTM D 4218	2.0 % - 3.0 %
Carbon Black Dispersion <sup>1</sup>	45,000 lbs.	ASTM D 5596	See Note (1)
Oxidative Induction Time (OIT) Standard OIT Or High Pressure	200,000 lbs	ASTM D 3895  ASTM D 5885	100 min. (min. avg.)  400 min. (min. avg.)
Oven Aging @ 85° C Standard OIT (min. avg.) – % retained after 90 days High Pressure OIT min. avg.) – % retained after 90 days	Per Each Formulation	ASTM D 5721 ASTM D3895  ASTM D5885	55%  80%
UV Resistance High Pressure OIT min. avg.) – % retained after 1600 hours	Per Each Formulation	GM11 ASTM D5885	50%

**Notes:**

(1) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than one (1) view from Category 3.

## 11.5 Equipment

- 11.5.1 Heavy vehicles shall not be permitted to operate directly on the liner material. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than six (6) psi.
- 11.5.2 In areas of heavy traffic, the geomembrane shall be protected by placing protective cover, with a minimum thickness of three (3) feet, over the geomembrane.
- 11.5.3 If the geomembrane is damaged by vehicular traffic, it shall be replaced at the

Contractor's expense.

## **11.6 Geomembrane Installation**

- 11.6.1 The geomembrane shall be packaged and shipped by appropriate means to ensure that no damage is incurred. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, solvents, moisture and excessive heat. Damaged material shall be stored separately for repair or replacement. Storage stacking of the rolls is allowed following manufacturer's recommendations.
- 11.6.2 The manufacturer assumes responsibility for initial loading the geomembrane. Off-loading and storage of the materials shall be the responsibility of the Contractor. The Contractor shall be responsible for replacing any damaged or unacceptable material at no cost to the Purchaser. No off-loading shall be done unless monitored by the Purchaser's Representative. Damage occurring during off-loading shall be documented by the Purchaser and the Contractor. The Purchaser shall be the final authority on determination of damage.
- 11.6.3 The installation of the geomembrane shall be in accordance with the manufacturer's recommendations and these Specifications. The Contractor shall submit a panel layout drawing and a detailed, written installation procedure for the Purchaser's review fourteen days prior to installation.
- 11.6.4 All seam and non-seam areas of the geomembrane shall be inspected by the CQC Inspector for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection.
- 11.6.5 The anchor trench shall be excavated to the lines, grades, and widths shown on the project construction drawings, prior to liner system placement. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the geomembrane.
- 11.6.6 The Contractor is responsible for ensuring that the geomembrane is handled and installed in such a manner that it is not damaged.
- 11.6.7 The geomembrane shall not be deployed during precipitation, in the presence of excessive moisture, in areas of ponded water, in the presence of excessive winds, or in excessive heat or cold.
- 11.6.8 Each panel shall be marked with an "identification code" (number or letter) consistent with the layout plan. The identification code shall be simple and logical. Markings shall not be used that permanently alter the line, such as stampings, weld marks, hydrocarbon marks, etc. The number of panels deployed in one day shall be limited by the number of panels which can be seamed on the same day. All deployed panels shall be seamed to adjacent panels by the end of each day.
- 11.6.9 The rolls shall be deployed using a spreader bar assembly attached to a loader bucket or by other methods approved by the Purchaser's Representative. The equipment shall not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, deployment or other means. The placement shall be observed by the CQC Inspector and the Purchaser's Representative.
- 11.6.10 The Contractor shall inspect the subgrade preparation prior to liner installation. The

- subgrade shall be compacted in accordance with the project specifications. Weak or compressible areas which cannot be satisfactorily compacted should be removed and replaced with properly compacted clay liner material. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects, stones greater than one-half inch in diameter, or debris of any kind. The subgrade shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. The surface shall contain no rutting, cracks or tire tracks. Standing water or excessive moisture shall not be allowed.
- 11.6.11 The Contractor, on a daily basis, shall approve the surface on which the geomembrane will be installed. After the supporting soil surface has been approved, it shall be the Contractor's responsibility to indicate to the Purchaser any changes to its condition that may require repair work.
  - 11.6.12 The Contractor shall submit written Certificates of Subgrade Acceptance, signed by the Contractor, CQC Inspector, and Purchaser's Representative, for each area prepared for geomembrane installation. This shall be done prior to commencing work.
  - 11.6.13 Equipment or tools shall not damage the geomembrane during handling, transportation and deployment.
  - 11.6.14 Personnel working on the geomembrane shall not smoke or wear damaging shoes.
  - 11.6.15 The method used to unroll the panels shall not cause scratches, crimps, or creases in the geomembrane.
  - 11.6.16 Unroll panels with the spike down and the stud side up for the structured geomembrane to assure that the deployment method protects the geomembrane from scratches and crimps and protects soil surface.
  - 11.6.17 Unroll panels with adequate tension to prevent undulations or wrinkles when placed on the ground. The spike side down prevents easy movement of the panel. Individual panels placed with more than 5 undulations greater than 2-inches in height shall be deployed again.
  - 11.6.18 Use a method to minimize wrinkles, especially differential wrinkles between adjacent panels.
  - 11.6.19 Place adequate hold-downs to prevent uplift by wind. Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).
  - 11.6.20 Protect geomembrane in heavy traffic areas by geotextile, extra geomembrane or other suitable materials.
  - 11.6.21 Do not allow vehicular traffic on unprotected geomembrane surface.
  - 11.6.22 Panels deployed on grades steeper than 12% shall extend a minimum of 3 feet beyond the crest or toe of that grade with no cross seams.
  - 11.6.23 Visually inspect sheet surface during unrolling of geomembrane and mark faulty or suspect areas for repair or test. Replace faulty (requires more than one patch per 200 square feet) geomembrane stock at no additional cost to the Owner.
  - 11.6.24 Geomembrane deployment shall proceed between ambient temperatures of 32° F and 104° F measured 6 inches above the membrane surface. Placement can proceed below 32° F only after it has been verified by the CQC Inspector that the material can be

seamed according to the Specification. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, rain, dew) or in the presence of excessive winds, as determined by the installation supervisor.

- 11.6.25 After panel deployment and before welding, any horizontal wrinkles must be walked down or wiggled down the slope to minimize wrinkles after welding.
- 11.6.26 Limit maximum wrinkle height to 4 inches during warmer ambient temperatures and 2 to 3 inches in cooler temperatures.
- 11.6.27 Geomembrane wrinkles shall not be folded over.
- 11.6.28 After each panel welding, the sheet should be hand pulled in order to avoid the formation of ridging along the seams (snapping).
- 11.6.29 Physically remove wrinkles by walking them or by pretension pulling on the sheet after welding each panel.

## **11.7 Geomembrane Field Seaming**

- 11.7.1 Field seams shall be made in accordance with the manufacturer's recommendations. The Contractor shall submit a copy of the proposed seaming procedures (both fusion and extrusion welding, including preparation procedures), prior to commencement of seaming, for the Purchaser's review and approval.
- 11.7.2 Remove studs and spikes from the structured geomembrane at butt weld locations. During the stud/spike removal operation, do not reduce the thickness of the barrier section of the geomembrane to less than the minimum thickness listed in section 12.4.
- 11.7.3 The only approved seaming processes are fusion and extrusion welding. On side slopes, seams shall be oriented in the general direction of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized. Cross seams will be allowed on slopes provided that cross seams are cut at 45° and adjacent cross seams are staggered. Cross seams shall be kept to the lower half of the slope. No more than one cross seam will be allowed per panel slope length.
- 11.7.4 No seam of any kind shall be closer than five feet from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles and "fishmouths". If a fishmouth or wrinkle is found, it shall be relieved and cap-stripped.
- 11.7.5 Geomembrane panels must have a finished minimum overlap of four inches for fusion welding and six inches for extrusion welding.
- 11.7.6 Cleaning solvents may not be used unless the product is approved by the liner manufacturer.
- 11.7.7 Generators used to power welding/grinding apparatus shall be placed on a rub sheet and/or on a HDPE tub to prevent damages caused by vibrations/equipment leaks and to protect the liner during refueling of these generators.
- 11.7.8 The Installer shall non-destructively test all field seams over their full length using either Vacuum Box Testing for extrusion welds or Air Pressure Testing for double fusion seams.

## **11.8 Geomembrane Field Trial Seams**

- 11.8.1 Field trial seams shall be made in accordance with the manufacturer's recommendations and these Specifications. The Contractor shall submit a copy of the proposed testing procedures for the Purchaser's review and approval.
- 11.8.2 Field trial seams shall be conducted, per seaming apparatus and per seamer, on the liner to verify that seaming conditions are satisfactory. Trial seams shall be conducted at the beginning of each seaming period, at least once every four hours for each seaming apparatus and personnel used that day. Additional field trial seams may be requested by and at the discretion of the Purchaser's Representative.
- 11.8.3 All trial seams shall be made in contact with the subgrade. Welding rod used for extrusion welding shall have the same properties as the resin used to manufacture the geomembrane.
- 11.8.4 Field trial seaming shall be conducted under the same ambient temperature and preheating conditions as the production seams.
- 11.8.5 Field trial seams shall be destructively tested in accordance with section 12.9.

**11.9 Geomembrane Destructive Seam Testing for Fusion and Extrusion Seaming**

- 11.9.1 Destructive seam testing should be minimized to preserve the integrity of the liner. The Contractor shall take one (1) destructive test sample once per 500 cumulative feet of seam length, per fusion welding device, from a location specified by the CQC Inspector. This frequency applies to extrusion seams as well. If the amount of extrusion seaming is < 500 feet then a minimum of one (1) extrusion destructive test shall be performed.
- 11.9.2 In order to obtain test results prior to completion of liner installation, samples shall be cut by the Installer as the seaming progresses. The Installer shall also record the date, location, and pass or fail description. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately patched and vacuum tested.
- 11.9.3 The samples shall be a minimum of 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three equal-length pieces, one to be given to the Installer, one to be given to the Contractor's CQC Inspector, and one to the Purchaser.
- 11.9.4 The Installer shall test ten one-inch wide specimens from his sample; five specimens for shear strength and five for peel strength. The CQC Inspector shall submit samples to an independent laboratory for confirmation testing. Seam test results shall be evaluated using the current GRI Test Method GM19 which allows for four of five specimens meeting the required seam strength and the fifth specimen meeting 80% of the required strength. Additionally, peel separation shall not exceed 25%.
- 11.9.5 Seams shall be tested according to the following methodology:

<b>Property</b>	<b>Test Method</b>	<b>Minimum Average Value</b>
Seam Properties	ASTM D 6392	
1. Shear Strength	GM19	120 lb/in
2. Peel Strength		

• Hot Wedge		91 lb/in
• Extrusion Fillet		78 lb/in

- 11.9.6 The Purchaser, at his discretion and expense, may send seam samples to a laboratory for testing. The test method and procedures to be used by the independent laboratory shall be the same as used in field testing.
- 11.9.7 The following procedures shall apply whenever a sample fails the field destructive test:
- The installer shall cap strip the seam between the failed location and any passed test locations.
  - The installer shall retrace the welding path to a location (initially a minimum of 10 feet on each side of the failed seam location) to identify and isolate the failed seam in both previous and next direction of failed destructive, by taking two new samples, one from each direction. If these tests pass, then the seam shall be cap stripped between the passing tests. If the test fails, then the process is repeated.
  - Over the length of seam failure, the installer shall either cut out the old seam, reposition the panel and reseam, or add a cap strip.
  - All seams and non-seam areas of the geomembrane shall be inspected by the inspector for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection.
  - Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate in the presence of the inspector. Each location that fails the non-destructive testing shall be marked by the inspector and repaired accordingly.

## 11.10 Geomembrane Repair Procedures

- 11.10.1 The geomembrane will be inspected before and after seaming for evidence of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. The geomembrane surface shall be swept or washed by the Installer if surface contamination inhibits inspection. The Installer shall ensure that an inspection of the geomembrane precedes any seaming of that section.
- 11.10.2 Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- 11.10.3 Repair, removal and replacement shall be at the Installers expense if the damage results from the Installer's activities.
- 11.10.4 Repair any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test. The Installer shall be responsible for repair of damaged or defective areas. Agreement upon the appropriate repair method shall be decided between the Purchaser's Representative and the Installer.
- 11.10.5 The following repair procedures shall apply:

- a) Defective seams shall be cap stripped or replaced.
- b) All holes of any size shall be patched.
- c) Tears shall be repaired by patching. If the tear is on a slope or an area susceptible to stress and has a sharp end it must be rounded prior to patching.
- d) Blisters, large cuts and undispersed raw materials shall be repaired by patches.
- e) Patches shall be completed by extrusion welding. The weld area shall be ground no more than 10 minutes prior to welding. No more than 10% of the thickness shall be removed by grinding. Grinding shall commence where the grinding started and must overlap the previous seam by at least two inches. Reseaming over an existing seam without regrinding shall not be permitted. The welding shall restart by grinding the existing seam and rewelding a new seam.
- f) Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of six (6) inches beyond the edge of defects.
- g) All T's and intersections shall be patched. Welding the excess overlap is not permitted.
- h) Geomembrane surfaces to be repaired shall be abraded (extrusion welds only) no more than 1/2 hour prior to the repair.
- i) All geomembrane surfaces shall be clean and dry at the time of repair.
- j) The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the Owner's Representative.
- k) Extend patches or caps at least 6 inches beyond the edge of the defect, i.e., be a minimum of 12 inches in diameter, and round all corners of material to be patched.
- l) Bevel the edge of the patch and do not cut patch with repair sheet in contact with geomembrane. Temporarily bond the patch to the geomembrane with an approved method, extrusion weld the patch and then vacuum test the repair.

### **11.11 Verification of Repairs**

- 11.11.1 Each repair shall be non-destructively tested. Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.
- 11.11.2 The inspector shall keep daily documentation of all non-destructive and destructive testing. This documentation shall identify all seams that initially failed the test and include evidence that these seams were repaired and successfully retested. (i.e., Test 1 followed by Test 1R1).

### **11.12 Geocomposite Contractor Qualifications**

- 11.12.1 The drainage material manufacturer shall have successfully manufactured five (5) million square feet of polyethylene drainage material.
- 11.12.2 Installation of the drainage material shall be performed by the manufacturer or be a manufacturer-approved dealer/installer. The drainage material installer must either have installed at least one (1) million square feet of product, or must provide to the

Purchaser satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the respective geosynthetic will be installed in a competent, professional manner.

- 11.12.3 The installation supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the contract documents.
- 11.12.4 The Contractor shall provide a third-party inspector for CQC of the geocomposite installation. The inspector shall be an individual or company who is independent from the manufacturer and installer and shall be responsible for monitoring and documenting activities related to the CQC of the geocomposite throughout installation. The inspector who is on site monitoring the installation activities every day that they are taking place, shall have provided CQC services for the installation of the proposed or similar products for at least five (5) completed projects totaling not less than one (1) million square feet. The inspector should be an engineer registered to practice in the State of Georgia or a geosynthetics installation technician certified through the Inspector Certification Program (ICP) administered by the Geosynthetics Certification Institute (GCI). The Contractor shall provide the Purchaser with a statement of the inspector's qualifications prior to starting installation of the geocomposite.
- 11.12.5 A Manufacturer's Representative may be on site during the initial phase of the geocomposite installation to provide assistance to the Contractor.

### **11.13 Geocomposite Labeling, Delivery, Storage, and Handling Requirements**

- 11.13.1 Each roll of material delivered to the site shall be wrapped and labeled by the manufacturer. The label shall contain the following information:
  - a) manufacturer's name
  - b) product identification
  - c) length and width
  - d) roll number
- 11.13.2 The material shall be stored as specified by the manufacturer in an area specified by the Purchaser. The storage will be free of materials capable of damaging the material.
- 11.13.3 Unloading of the drainage material from the delivery trucks will be performed by the Contractor. Unloading of the materials will be performed as directed by the manufacturer.
- 11.13.4 The rolls must be adequate for safe transportation to the point of delivery, offloading and storage. Storage measures will be taken as specifically stated by the manufacturer.

### **11.14 Geocomposite Material Properties**

- 11.14.1 The geocomposite shall consist of one (1) layer of HDPE drainage net (geonet) connected between two (2) layers of non-woven geotextile to create a double-sided geocomposite.
- 11.14.2 The drainage net shall be manufactured of new first quality polyethylene resin and shall be compounded and manufactured specifically for the intended application.
- 11.14.3 The Contractor shall provide written certification from the manufacturer that all resin used in the manufacture of the drainage net for this job meets the Specifications which



- shall include a copy of the quality control certificates issued by the resin supplier.
- 11.14.4 The Contractor shall provide written certification from the manufacturer that the material was manufactured in accordance with this Specification, together with a report of test results, prior to material shipment.
- 11.14.5 The minimum average properties of the geocomposite shall be as follows:

<b>DOUBLE-SIDED DRAINAGE GEOCOMPOSITE</b>				
<b>Tested Property</b>	<b>Test Method</b>	<b>Frequency</b>	<b>Value<sup>(1)</sup></b>	<b>Units</b>
<b>Geonet Core <sup>(2)</sup></b>				
Raw Materials:				
Density	ASTM D792, B	Per lot	0.94	g/cc
Melt Index	ASTM D1505 ASTM D1238	Per lot	≤ 1.0	g/ 10 min.
Thickness	ASTM D 5199	1/50,000 ft <sup>2</sup>	300	mil
Density	ASTM D 1505	1/50,000 ft <sup>2</sup>	0.94	g/cc
Carbon Black Content	ASTM D 4218	1/50,000 ft <sup>2</sup>	2.0 – 3.0	%
Tensile Strength	ASTM D 5035	1/50,000 ft <sup>2</sup>	75	lbs/inch
Transmissivity <sup>(3)</sup>	ASTM D 4716	1/50,000 ft <sup>2</sup>	8 x 10 <sup>-3</sup>	m <sup>2</sup> /sec
<b>Geotextile (prior to lamination)<sup>4</sup></b>				
Mass per Unit Area	ASTM D 5261	1/100,000 ft <sup>2</sup>	6.0	oz/yd <sup>2</sup>
Grab Tensile	ASTM D 4632	1/100,000 ft <sup>2</sup>	160	lbs
Flow Rate	ASTM D 4491	1/100,000 ft <sup>2</sup>	110	gpm/ ft <sup>2</sup>
Puncture Strength	ASTM D 4833	1/100,000 ft <sup>2</sup>	95	lbs
Permittivity	ASTM D 4491	1/100,000 ft <sup>2</sup>	1.5	Sec <sup>-1</sup>
AOS	ASTM D 4751	1/100,000 ft <sup>2</sup>	70 sieve	US Sieve
UV Resistance	ASTM D 4355	once per formulation	70	% retained
<b>Geocomposite</b>				
Transmissivity <sup>(3)</sup>	ASTM D 4716	1/500,000 ft <sup>2</sup>	9 x 10 <sup>-4</sup>	m <sup>2</sup> /sec
Peel Adhesion	ASTM D 7005	1/50,000 ft <sup>2</sup>	1.0	lbs/in

Notes

1. These are minimum average roll values (MARV values) and are based on the cumulative results of specimens tested. AOS in mm units is a maximum average roll value.
2. Component properties prior to lamination.
3. Gradient of 0.1, normal load of 10,000 psf, water at 70° F, between stainless steel plates for 15 minutes
4. Refer to geotextile product data sheet for additional specifications.

### **11.15 Geocomposite Placement**

- 11.15.1 The geocomposite roll shall be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the Purchaser's Representative.
- 11.15.2 In the presence of wind, all geocomposites shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.
- 11.15.3 Each component of the geocomposite will be secured or seamed to the like component at overlaps. Adjacent edges of the geonet along the length of the roll shall be placed with the edges of each geonet butted against each other. The overlaps shall be joined by tying the geonet structure with plastic cable ties spaced every five (5) feet along the roll length, located at least 3 intact ribs away from the leading edge and be a contrasting color to the geonet material.
- 11.15.4 Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of twelve (12) inches across the roll width. The overlaps shall be joined by tying the geonet structure with plastic cable ties spaced every twelve (12) inches along the roll width, located at least 3 intact ribs away from the leading edge and be a contrasting color to the geonet material.
- 11.15.5 The geonet portion shall be tied every six (6) inches in the anchor trench, located at least 3 intact ribs away from the leading edge and be a contrasting color to the geonet material.
- 11.15.6 Prior to covering the deployed geocomposite, each roll shall be inspected for damage resulting from construction.
- 11.15.7 Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every six (6) inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with sections 11.14.3 and 11.14.4 above.
- 11.15.8 All geocomposite geotextile overlaps shall be sewn at the seams.

### **11.16 Anchor Trenches**

- 11.16.1 As directed by the project Drawings and Specifications, the end of the geomembrane and geocomposite rolls shall be placed in an anchor trench. The front edge of the trench should be rounded so as to eliminate any sharp corners. Loose soil should be removed from the floor of the trench.
- 11.16.2 The geomembrane and geocomposite should cover the entire trench floor.
- 11.16.3 The anchor trench shall be backfilled by the earthwork contractor. Trench backfill material shall be well compacted by approved methods to minimize water intrusion or material pull-out.
- 11.16.4 The anchor trench shall be backfilled with soil meeting the requirements of Structural Fill as described in section 10.0 with the exception that the maximum particle size shall be limited to one (1) inch in the largest dimension.
- 11.16.5 Care shall be taken when backfilling the trenches to prevent any damage to the

geomembrane or geocomposite. If damage occurs, it shall be repaired prior to backfilling and at the Contractor's expense.

### **11.17 Protective Cover Soils**

- 11.17.1 The protective soil cover material shall be free of angular stones or other foreign matter that could damage the geocomposite and the geomembrane. The first lift placed over the geocomposite shall have no particles in excess of 1 inch in maximum diameter. Subsequent lifts shall have no particles in excess of 4 inches in maximum diameter.
- 11.17.2 In applying the protective cover material, no equipment shall drive directly across the geocomposite. The specified fill material shall be placed in loose lifts no thicker than nine (9) inches and spread utilizing vehicles with a low ground pressure.
- 11.17.3 The protective soil cover shall be placed on the geocomposite in a manner that prevents damage to the geocomposite.
- 11.17.4 Soil cover should be placed in a manner that prevents the soil from entering the geocomposite overlap zones. Soil cover shall be pushed from the toe of slopes up, not from top of slopes down, to minimize tensile forces on the geocomposite and geomembrane.
- 11.17.5 The protective cover shall be placed over the geocomposite using low contact pressure, wide-tracked construction equipment that minimizes stresses on the geocomposite. The cover shall be placed and spread by making a minimum of four complete passes with the tracks of the equipment. Special care and attention shall be made by the Contractor to ensure that the underlying geocomposite is not damaged.
- 11.17.6 The protective cover soil shall be a minimum eighteen (18) inches thick. This thickness does not apply to frequently trafficked areas or roadways, for which a minimum thickness of three feet is required.

### **11.18 Topsoil**

- 11.18.1 Topsoil material is generally defined as the upper surface of dark fertile soil, which contains decaying matter and roots. Topsoil shall be free of subsoil, clay, weeds, large roots, or foreign material that would interfere with seeding or maintenance.
- 11.18.2 Testing of samples of topsoil may be required to determine if any nutrients should be added to the soil in addition to the application of fertilizer and lime.
- 11.18.3 The topsoil cover shall be placed in a minimum loose lift thickness of six inches and then grassed. If erosion occurs before grassing operations, the area shall be repaired to the satisfaction of the PCM.

## **12.0 SEDIMENT AND EROSION CONTROL**

- 12.1 Minimum sediment and erosion control measures are shown on the Drawings for the Plant Gorgas Bottom Ash Storage Area Closure. Additional measures shall be taken as required or as directed by the Purchaser to minimize erosion of soil.
- 12.2 During the course of this project, the Contractor shall plan and coordinate his work to minimize the amount of suspended soil particles entering rivers and streams or leaving the general work area and being deposited in undesirable places. Any property damage

- or fines resulting from the Contractor's negligence shall be borne by the Contractor.
- 12.3 The Contractor shall not excavate, uncover or denude areas of work until adequate erosion and sediment control measures are installed. The Contractor's earthmoving operations shall at all times be in full compliance with the requirements of the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas
- 12.4 The Purchaser will inspect the sediment and erosion control practices (e.g. "BMPs") employed to evaluate their effectiveness. Any deficiencies shall be immediately corrected by the Contractor at no cost to the Purchaser.
- 12.5 Erosion and sediment control measures shall be utilized and maintained as indicated in the Plans.

### **13.0 VEGETATION**

- 13.1 A minimum six-inch layer of topsoil shall be placed on all areas to be grassed.
- 13.2 Earth fill areas and other disturbed areas shall be grassed. Hydroseeding methods may be used.
- 13.3 The Contractor shall produce a satisfactory stand of perennial grass in accordance with the Vegetation Schedule as shown on the Drawings. If it is necessary to repeat any or all the work, including plowing, fertilizing, watering, mulching and seeding, the Contractor shall repeat these operations until a satisfactory stand is obtained.
- 13.4 A satisfactory stand of grass is defined as 100% of soil surface being uniformly covered in permanent vegetation with a density of 70% or greater, or landscaped according to the Plan (uniformly covered with landscaping materials in planned landscaped areas), or equivalent permanent stabilization measures as defined in the Handbook (excluding a crop of annual vegetation and a seeding of target crop perennials appropriate for the region).
- 13.5 Measures shall be taken to prevent erosion of the topsoil layer and vegetation until a full vegetative growth has been obtained. After seeding, an erosion control biodegradable straw blanket shall be installed on any slopes equal to or steeper than 3H:1V. This material shall be as indicated on the Drawings. The blanket shall be installed per manufacturer's installation instructions. However, the blanket shall be tacked as necessary to the ground to withstand the upward growth of grass and to permit the establishment of grass through the blanket. Failure to accomplish this will require that the affected area be re-grassed.
- 13.6 Water required to promote a satisfactory growth shall be furnished and applied by the Contractor as often as necessary to achieve the results outlined above.
- 13.7 The Contractor shall make daily inspections of the seeded areas and repair all eroded areas to the satisfaction of the Purchaser.

### **14.0 RECORDS**

#### **14.1 Quality Control Records**

- 14.1.1 The quality control records of inspection and field quality control records shall be compiled by the Contractor's CQC Inspector and provided to the Purchaser on an on-

going basis or as directed. The final records will provide the background data necessary for the certification of the final cover construction. All records shall be forwarded to the Plant's permanent file to be retained as a permanent record of the project.

- 14.1.2 At the completion of the construction of the final cover, a Construction Quality Assurance Report (Construction Certification), prepared by the Purchaser, shall be submitted along with a registered engineer's certification that the final cover was constructed in accordance with the approved Closure/Post Closure drawings and the ADEM Solid Waste Regulations. The Contractor shall provide, at a minimum, the following information for preparation of the Certification Report:
- a) Elevation Contour Drawings of the subgrade on a maximum 100ft. by 100ft. grid. Drawings to be signed and sealed by a land surveyor registered to practice in the State of Alabama.
  - b) For the Composite Cover System:
    1. Final geomembrane panel layout
    2. Final geocomposite panel layout
    3. Elevation Contour Drawings of the top surface of the 18 inch Protective Soil Layer on a maximum 100ft. by 100ft. grid (as used for the subgrade). Protective Soil Cover thickness relative to the subgrade shall be indicated at the grid points. Drawings to be signed and sealed by a land surveyor registered to practice in the State of Alabama.
    4. Finished Grade - elevation contour drawings with thickness of topsoil indicated on the same maximum 100 ft. x 100 ft. grid as the Protective Cover Soil Elevation Contour Drawing. Drawings to be signed and sealed by a land surveyor registered to practice in the State of Alabama.
  - c) All survey shots shall be "storage stacked" in order to properly verify the given layer's thickness. The use of interpolation or other computer generated methods to achieve point storage stacking are not acceptable.
  - d) Thickness determinations obtained at grid points on slopes shall be made normal to the slopes.
  - e) All survey and topographic information shall be submitted in both pdf and dwg file formats which are compatible with AutoCAD 2016.
  - f) A summary of major construction activities which shall include a description of the activity and schedule dates. This summary shall be based on daily logs provided by the on-site inspector. This shall also serve to document the presence of a qualified member of the inspection team during any construction activity involving structural fill or any component of the liner.
  - g) Project CQC summary reports including all field testing and inspection results. This summary shall be inclusive of all passing tests as well as failing tests and retests. This shall include at a minimum, all field moisture content and density tests, Proctor curves, Atterberg limits, particle size distribution, CQC resumes, CQC welding rod certificates, subgrade acceptance forms, HDPE panel deployment logs, fusion and extrusion trial seam logs, fusion and extrusion seam logs, HDPE repair logs, pressure and vacuum test logs, fusion and

- extrusion destructive test logs, concrete cylinder break reports, concrete pour cards, concrete tickets, rebar mill certification reports, and all daily field reports.
- h) Copies of all field CQC reports for structural fill, bottom ash fill, and geosynthetic installation.

#### **14.2 Record Topographic Survey**

A record topographic survey will be performed by the Purchaser to fully document the lateral and vertical extent of the developed area. This survey will be maintained as part of the permanent record. Drawings to be signed and sealed by a land surveyor registered to practice in the State of Alabama.