# PROPOSED COAL REFUSE DISPOSAL PLAN

# ENGINEERING REPORT

**COAL REFUSE DISPOSAL AREAS**
**CONCORD PREPARATION PLANT**
**CLIFFS NATURAL RESOURCES – OAK GROVE MINE**
**JEFFERSON COUNTY, ALABAMA**

**EXPANSION EASTWARD TO SITE 3a FOR CCR DISPOSAL**

FACILITY ID No. 01-00329
MSHA ID 1211-AL11-00043-02 (Site 2c - CCR Disposal)

**ASMC, 3A ONLY**
*May 2014*

*Prepared For:*
**Cliffs Natural Resources**
**Oak Grove Mine**
**Jefferson County, Alabama**

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I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O Dickey Jr
(Signature)

Date: 5/12/14

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public.
This 12 day of MAY, 2014.
My commission expires 10/17/17.

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
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My commission expires October 17, 2017

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| B | Guideline Technical Specifications |
| C | Calculation Brief |
| D | MEC Reference Calculations |
| E | Almes , 1991 & PERC, 2007Approved Plans (on DVD disc only) |

# ENGINEERING REPORT

## COAL REFUSE DISPOSAL AREAS
## CONCORD PREPARATION PLANT
## CLIFFS NATURAL RESOURCES – OAK GROVE MINE
## JEFFERSON COUNTY, ALABAMA

## EXPANSION EASTWARD TO SITE 3a FOR CCR DISPOSAL

## 1.0 GENERAL INFORMATION

Marshall Miller and Associates (MMA) has prepared this Engineering Report for a proposed plan (Plan) for expansion eastward to Site 3a for coarse coal refuse (CCR) disposal at the Oak Grove Resources LLC (OGR) Concord Preparation Plant in Jefferson County, Alabama. This report encompasses the features of work that are necessary to prepare the sites being modified for coal refuse disposal, including:

- Implementation of local erosion and sedimentation controls (E&SC);
- Development of access and haul roads;
- Storm drainage controls (channels/ditches and culverts);
- Related tasks necessary to prepare the sites for coal refuse disposal.

Refuse disposal requirements, instrumentation, and abandonment capping details and storm water drainage controls are addressed in the existing, previously approved, documents: (1) Report – Proposed Coal Refuse Disposal Area – Expansion Plan, Project No. 90-555-27, September 1991 by Almes and Associates (Almes, 1991) and (2) Oak Grove Resources, LLC – Concord Preparation Plant – Refuse Disposal Area Expansion by PERC Engineering Co., Inc. (PERC, 2007). The requirements of these previously approved plans remain in affect except as modified herein.

### 1.1 OVERVIEW OF PROPOSED PLAN

The existing conditions are shown on Figure 2 and the overall proposed expansion plan and site designations are shown on the Key Plan, Figure 3 located in Appendix A.

On the east side of Site 2c, a new, larger coarse refuse buttress will be constructed in the area labeled Site 3a (Figure 3). This coarse refuse buttress will enlarge the foot print of the refuse facility to the east and will require a new haul road, additional drainage controls and additional environmental permitting. Others will address the environmental permitting issues associated with the Site 3a expansion with the Alabama Surface Mining Commission (ASMC). McGehee Engineering Company, MEC, has designed the E&SC measures, including two new ponds that will receive the runoff from the Site 3a embankment. The MEC design information is included for reference in Appendix D.

Drainage control for the entire site will be slightly modified with some new diversion ditches and riprapped flumes. Overall these changes will be relatively minor: a new haul road at Site 2b and surface drainage structures and a new haul road at Site 3a. These items are included in this Plan and will comply with current criteria of the Mine Safety and Health Administration (MSHA) and ASMC.

The following companion documents are enclosed in support of the Plan for the proposed expansion of Site 3a (CCR):

- Figures 1-4, 9, 10, 12, 13, 15 (Design Drawings) – Appendix A
- Guideline Technical Specifications – Appendix B
- Calculation Brief – Appendix C
- Geotechnical Data and Laboratory Testing Reports – Section B, Calculation Brief Appendix C
- MEC Calculations– Appendix D

Together these documents comprise the engineering submission for the proposed Plan. Figures 2, 3, and 9, Appendix A, present an existing conditions plan, an overall key plan of the proposed expansion and the final disposal configurations for Site 3a. Several concepts for the final reclamation and abandonment of the sites are proposed, the details of which will be developed and finalized prior to abandonment. Two of the three abandonment options are very similar to what is currently shown in the approved Almes, 1991 and PERC, 2007 plans.

## 1.2 FACILITY IDENTIFICATION [§ 77.216-2(A) (1)]

Oak Grove Resources, LLC (OGR) is currently operating the Concord Refuse Disposal Facility (Facility) Facility ID No. 01-00329. The MSHA ID Numbers are: 1211-AL11-00043-02 (Site 2c - CCR Disposal). OGR is seeking the approval of MSHA and ASMC for the modification to its currently approved plan as defined by Almes, 1991 and PERC, 2007. The Facility is operated by:

Oak Grove Resources LLC
8800 Oak Grove Mine Road
Adger, AL 35006
Contact: Mr. Ralph Lopez
Telephone: (205) 497-3615

## 1.3 SITE LOCATION [§ 77.216-2(A) (2)]

The Facility is located in Jefferson County, approximately 0.5 miles North of Hueytown, AL off of Warrior River Road, towards Concord, AL. OGR owns the surface property within the existing and proposed permit boundary. This Facility has been previously operated by other mining companies since the earlier 1950's.

## 1.4 FACILITY PURPOSE [§ 77.216-2(A) (3)]

The proposed expansion of the Facility is necessary for the continued operation of the Oak Grove Mine and Concord Preparation Plant. After evaluating the proposed coal production from this facility, OGR has requested that its life be extended for continuous operation until early 2020 . Various options were evaluated by MMA to expand the life of the refuse facility. Some options could have added several years in excess of the minimum required life, but those options would have resulted in a much larger footprint than the currently proposed Plan. The larger footprint would require considerable additional acreage. All of these options were evaluated and it was determined that the currently proposed Plan would minimize the impacts associated with all of these variables while satisfying operational needs of the Facility.

## 1.5 WATERSHED INFORMATION [§ 77.216-2(A) (4)]

The existing refuse facility area is located on the drainage divide between two unnamed tributaries of Lick Creek. A freshwater reservoir (Impoundment 1), used as water supply for the coal preparation plant, is located on the head waters of the unnamed tributary along the west side of the Facility. The Concord coal preparation plant is located on the north side of the Facility and a series of sedimentation ponds, water treatment ponds and associated features are located on the east side. These will be excavated and restored to competent material during the Site 3a buttress construction, as required in the Guideline Technical Specifications, Appendix B.

## 1.6 EFFECTS OF UNDERGROUND MINE WORKINGS [§ 77.216-2(A) (13 & 14)]

Documentation of previous mining beneath the Facility is included on Figure 2. The abandoned mine works lies approximately 600 feet below natural grade. The impact of mine works under this facility has been previously studied and included with previously approved expansion plans (Almes, 1991). The summary within the Almes report indicates "future subsidence affects are unlikely since the majority of subsidence in this area has probably already occurred."

The east buttress area at Site 3a will expand the CCR disposal footprint slightly to the east, over abandoned mining areas. Since Site 3a is only being proposed as a coarse refuse disposal area, no impacts due to the underlying mining are anticipated in this area.

# 2.0 FOUNDATION CHARACTERISTICS

## 2.1 SITE EXPLORATION [§ 77.216-2(A) (5)]

The exploration program undertaken by MMA in the Spring of 2011 is presented on Figure 4. The previous studies and expansion plan designs (Almes, 1991 and PERC, 2007) already have addressed the existing CCR dams and embankments and downstream stability.

In Site 3a, three (3) conventional test borings (MMA-9 through MMA-11) were performed to explore the existing foundation conditions around the area of proposed expansion. Southern Earth Sciences, Inc. (SESI) performed the drilling and cone penetrometer testing on the project, under the supervision of MMA personnel.

Standard Penetration Testing (SPT), undisturbed piston-tube sampling of FCR and native soil, and selective rock coring (to confirm bedrock) were performed in the conventional borings. Section B – *Geotechnical Properties* of the Calculation Brief, Appendix C includes:

1. Excerpts of previous design information from the Almes,1991 and PERC, 2007 expansion plans;
2. Survey data, exploration information, key elevations, and a report of the SPT-system Energy Transfer for the two drilling rigs employed by SESI (Diedrich B-50 and CME 45-B);
3. Boring logs;
4. SPT data, including raw blow counts (N-values) and corrected N-values from $N_1$ through $N_{1,60(cs)}$ (overburden, energy transfer, and clean sand corrections);
5. Laboratory Test results, including index and shear strength testing results; and

## 2.2 REGIONAL GEOLOGY [§ 77.216-2(A) (5)]

The regional geology was previously presented in the Almes,1991 Engineering Report.

## 2.3 SITE FOUNDATION SOILS [§ 77.216-2(A) (5)]

### 2.3.1 Description

**Site 3a (CCR):**

In Site 3a, Borings MMA-9 and MMA-11 encountered native foundation soils consisting of moist, stiff to very stiff clay to sandy clay underlain by dense sand. In MMA-9, medium dense CCR was encountered above the native foundation level. Weathered bedrock, characterized as dense to very dense highly weathered sandstone, was encountered immediately below existing CCR in MMA-10. Similar to Site 2a & 2b, a native soil layer with shear strength lower than the overlaying CCR was not encountered in any of these borings.

### 2.3.2 Design Parameters

Pertinent geotechnical design parameters are summarized in Table B-1, Calculation Brief Section B, Appendix C. The design parameters for native foundation materials were selected based on the results of the recent subsurface exploration and laboratory geotechnical testing, typical values for similar materials, previously obtained data, and MMA's experience with similar materials. For consistency with the Almes 1991 design (refer to Table B-2 in Section B1.1 of Calculation Brief), MMA presumed the existence of a native foundation soil layer with lower shear strength (effective stress friction angle of 31 degrees), although a lower shear strength native layer was not encountered in MMA-1 through MMA-11. Bedrock/Weathered Rock properties were selected to effectively represent bedrock as a limiting boundary for slope stability analyses. The foundation rock is markedly stronger than the embankment materials, such that the bedrock does not influence slope stability. The critical slope stability failure surfaces are confined to the embankment, and foundation soils (where present).

The design parameters for CCR coal refuse materials are discussed in Section 3.0 Embankment Characteristics.

# 3.0 EMBANKMENT CHARACTERISTICS

## 3.1 COAL REFUSE MATERIALS [§ 77.216-2(A) (6)]

### 3.1.1 Description of Materials

The cross section locations are labeled in plan on Figure 9 and shown on Figures 12 & 13. The cross sections are the same as Almes, 1991 although E has been extended eastward into Site 3a. They identify the foundation materials encountered in the recent site exploration (Spring 2011) and ascertained from the previous Almes,1991 and PERC, 2007 studies SPT, and laboratory test data for materials recovered from Site 3a are summarized in Section B of the Calculation Brief, Appendix C.

### 3.1.2 Design Properties

The design unit weights, effective stress and total stress shear strength properties, and hydraulic properties for pertinent materials within the 3a site foundation are summarized in Table B-1, Section B of the Calculation Brief (Appendix C) along with supporting data.

The design effective stress shear strength properties for CCR are based on SPT-based correlation, , laboratory testing, and previously reported data. Notably, the present evaluations and data support higher effective stress shear strength properties for CCR than applied in the Almes 1991 design (refer to Table B-2 in Section B1.1 of Calculation Brief). Undrained conditions are typically not applicable to CCR because of its granular, cohesionless nature and drainage characteristics; and therefore, were not characterized.

# 4.0 FACILITY LAYOUT AND OPERATION

## 4.1 GENERAL BACKGROUND

Figure 3 provides the overall Key Plan for the proposed expansion of Site 3a. The Plan also discusses a proposed construction sequence for accomplishing the planned development. The proposed Plan primarily involves:

- Implementation of local erosion and sedimentation controls (E&SC);
- Development of modified access and haul road system;
- Construction of the Site 3a CCR disposal area;
- Discussion of the final abandonment cover and storm drainage controls.

## 4.2 HAUL ROADS AND ACCESS ROADS [§ 77.216-2(A) (7)]

The proposed major access road and haul road are shown on the Site 3a Figures 9 and 10. Haul roads were configured with a maximum grade of 10 percent, transverse slope of 2 to 5 percent, an appropriate traffic width, surface drainage collection ditches and outslope berms. Figure 10 includes plans, profiles, and representative cross sections detailing Haul Roads No. 2.

# 5.0 IMPOUNDMENT HYDRAULIC & HYDROLOGIC DESIGN [§ 77.216-2(A) (7 & 12)]

## 5.1 GENERAL CONSTRUCTION SEQUENCE

This general construction sequence is suggested, but many of the tasks may be done concurrently or in different order, depending upon the amount of coarse refuse and fine refuse production from the preparation plant. The construction shall be in accordance with the Guideline Technical Specifications (GTS). The General Construction Sequence, is as follows:

Site 3a

- Excavate and backfill existing five (5) drying ponds.
- Construct Haul Road No. 2
- Construct two new sediment Ponds B and C
- Eliminate existing sediment ponds 3A, 3B and Basin 018E
- Place coarse refuse.
- Install and maintain surface drainage controls as needed.

# 6.0 EROSION AND SEDIMENT CONTROLS (E&SC)

## 6.1 EXISTING SEDIMENTATION PONDS

The existing sedimentation ponds will remain in place during the construction of the proposed Plan until the construction of Site 3a is ready to begin. Once the ASMC permit is approved, two new sedimentation ponds (Ponds B & C) will be constructed to the east of the three existing sediment ponds (Ponds 3A, 3B and Basin 018E) currently used to control runoff. The two new sedimentation ponds and associated drainage channels, which were design by McGehee Engineering Corporation (MEC), to conform to the ASMC regulations, are provided for reference in Appendix D.

Runoff from the new Site 3a embankment will be directed to these ponds.

## 6.2 LOCAL EROSION AND SEDIMENT CONTROLS

Local E&SC measures will be of the same types as currently specified by Almes, 1991 and PERC, 2007. Details of the new ditches and flumes associated with this Plan (Site 3a) are provided on Figure 15. Also, see Section F of the Calculation Brief.

### Hydraulic Capacity

Permanent channels are designed to convey the peak runoff rate due to a Type II, 24-hour duration, 100-year recurrence interval design storm, per MSHA guidelines.

### Freeboard

The freeboard depth for each channel was determined as recommended by the MSHA Engineering and Design Manual for Coal Refuse Disposal Facilities as follows:

$$\text{Freeboard} = C + 0.025VD^{1/3} \quad \text{(feet) where,}$$

C= 0.25 feet for minor channels or,

C = 1.0 feet for more critical channels

A minimum of one foot of freeboard was provided in all cases.

### Channel Linings

All permanent drainage structures have been provided with the appropriate protections to minimize the potential for channel erosion. If velocities exceeded 5.0 feet per second then riprap channel lining protections were used. The two primary types of channel lining prescribed for the project are:

- Vegetated Channel Linings (i.e., grass-lined used on gutter drains)
- Riprap (used on haul road/down drains)

## 6.3 MISCELLANEOUS BEST MANAGEMENT PRACTICES (BMPS)

Other miscellaneous E&S control structures will be implemented during the initial site development and CRDA construction and operation, as needed. These structures include:

- Coarse aggregate surfacing will be provided on permanent access and haul road corridors, and on construction support and staging areas to stabilize the areas and reduce erosion.
- Rock construction entrances will be constructed/maintained at the main site access points to reduce the transport of sediment away from the permitted work area.
- Fill slopes will be covered with topsoil (where the fill soil is not suitable for direct vegetation) and be vegetated, as soon as practical, to reduce erosion potential.
- Similarly, soil cut slopes will be directly seeded as soon as practical following completion.
- Temporary siltation measures such as siltation fences, straw bales, and/or temporary sumps may be used as necessary for erosion protection.

# 7.0 GEOTECHNICAL ANALYSES AND DESIGN

## 7.1 EMBANKMENT SEEPAGE CONTROL [§ 77.216-2(A) (6 & 7)]

### 7.1.1 Monitoring

Seepage will be monitored by observation of the piezometers, during the MSHA 7-day inspections. The locations and details of the piezometers and weirs are given on Figure 4.

## 7.2 EMBANKMENT SLOPE STABILITY [§ 77.216-2(A) (13)]

A summary Results of Analysis, Section 7.2.3 is provided below. Detailed results are provided in Section E of the Calculation Brief, Appendix C. The findings reported in this section pertain to the final embankment configurations of Site 3a.

### 7.2.1 Methods of Analysis and Assumptions

Slope stability analyses were performed for the outslope of the Site 3a disposal embankment buttress for pertinent conditions using the slope stability module of the computer program SLIDE version 6.0 by Rocscience, Inc. The slope stability analyses evaluated the final embankment configurations.

Only steady-state (static) conditions were analyzed for the Site 3a (CCR) disposal embankment. Where foundations soils were encountered in Site 3a, the soils are predominantly sandy and do not pose a risk of undrained failure during construction or at the end-of-construction.

### 7.2.2 Conditions Analyzed and Required Factors of Safety

The cases/conditions that were evaluated and the required factors of safety are summarized in the table below.

| CASE/CONDITION | REQD SAFETY FACTOR |
|---|---|
| Static/Steady-State Seepage | 1.5 |
| Seismic (or Post-Earthquake)(1) | 1.2<br>also see MSHA Manual Chapter 7 |

NOTES:

(1) Based on the current MSHA design manual, seismic stability is satisfied via conformance with the static stability design requirements in cases where there are no materials susceptible to earthquake-induced strength loss within the embankments or their foundations.

### 7.2.3 Results of Analysis

As reflected by the supporting calculations, the proposed embankment configurations satisfy the required minimum slope stability safety factors previously listed for all cases/conditions analyzed.

For the Site 3a (CCR) disposal embankment, the minimum factor of safety calculated for long-term/steady-state (static) conditions for a slip surface that comprises the entire embankment outslope is 1.9 at Cross Section Z-Z.

Refer to Section E of the Calculation Brief in Appendix C for detailed results of the slope stability analyses.

## 8.0 INSTRUMENTATION [§ 77.216-2(A) (8)]

There are thirteen (13) standpipe piezometers proposed going forward for this facility at the locations shown on Figure 4. All piezometers **WERE** restored or installed in the **SUMMER** of 2012.

A graphic display or tabulation of the 7-day MSHA impoundment inspection piezometer readings along with the trigger levels shall be kept file at the mine office for easy access and review.

## 9.0 MONITORING AND MAINTENANCE [§ 77.216-2(A) (8 & 15)]

### Coal Refuse Quantities

Records of coal refuse quantities disposed at the facility shall be maintained by OGR. These records allow for comparison with the quantities used for predicting the CCR and FCR facility disposal life and making modifications to the disposal plan, if necessary. The records shall be reviewed semi-annually.

### General Observations

Observations of the embankment, its instrumantation and appurtenant equipment shall be made at intervals not exceeding 7 days and immediately following any unusual events such as floods, heavy rainfalls, heavy frost periods, abnormal structural behavior, etc. in accordance with MSHA impoundment inspection requirements. Reports or records from field observations and testing results shall be maintained at the mine office. A report of the observations shall be reviewed at least semi-annually. Any unusual features shall be reported immediately to the Certifying Engineer. Items to be recorded by OGR and the Certifying Engineer include the following:

- Embankment Slopes - Any irregularities such as tension cracks, scarps, slumps, wet areas or vegetation disturbance shall be recorded.
- Working Disposal Surface - Irregularities shall be recorded.
- Bench and Perimeter Sediment Ditches - General condition of channels, soil erosion adjacent to or beneath riprap and seeded slopes, blockage by debris, etc., shall be recorded.
- Vicinity of the Embankment - General conditions throughout the area of the embankment shall be observed to note any changes, which could be associated with the behavior of the embankment and its foundation.
- Piezometer Readings and Impoundment Level - Piezometer readings and the impoundment level shall be recorded at intervals not exceeding seven days. Should the piezometers become damaged during operations they

shall be replaced. To evaluate sensitivity of the piezometers pumping or bailing of water may be performed to determine the time to recharge/refill the piezometer. Adding water to the piezometers shall not be permitted.

- Graphs- Graphs of the 7-day inspection results of the flows from each internal drain outlet and levels of each piezometer shall be prepared. The graphs will assist in identifying abnormal readings and dievations from trends. These graphs shall be kept with the 7-day inspection report information at the mine office.

**Maintenance**

The following maintenance activities shall be performed regularly:

- Routine Maintenance - Continuous maintenance, including replacement or patching of grouted riprap, reseeding of gutters, removal of debris from the ditches at the site, etc.
- Maintenance After Unusual Meteorological Events (Heavy Rainfall, Extreme Frost Periods, Severe Droughts, Floods, High Winds, Etc.) - The most important maintenance tasks, at these times, are the immediate backfilling of all scarps or slumps, repair of erosion rills or gullies and the repair and improvement of drainage systems and riprap lined ditches.
- Maintenance After Abnormal Changes in the Behavior of the Structure - If abnormal behavior of any portion of the embankment is observed, qualified persons knowledgeable of the facility design characteristics shall be advised immediately by the Certifying Engineer and any recommended maintenance measures undertaken.

**Data Review**

All facility performance data and maintenance data obtained during periodic inspections shall be reviewed by qualified persons knowledgeable of the facility construction. All performance data such as the relative compaction (or in-place dry density) of embankment fill materials, fill placement moisture content, filter fabric, underdrain stone, etc, must meet the requirements described within the Guideline Technical Specifications (Appendix B), the design recommendations presented in this Plan and the Almes, 1991

and PERC 2007 approved plans. If the required CCR fill material properties do not meet these specifications during construction of the refuse facility, the Certifying Engineer will determine if changes need to be made to the placement procedures or shall re-evaluate the stability of the upstream and downstream slopes and/or intermediate benches.

## 10.0 ABANDONMENT PLAN [§ 77.216-2(A) (16)]

The final reclamation of this facility will consist of the placement of the final soil cover material and applying the appropriate seed mixture according to the currently approved plans, Almes, 1991 and PERC, 2007.

A tentative abandonment plan for capping and covering the slurry impoundment was included in the Almes, 1991 and PERC, 20007 plan approvals. However, other options may be implemented at the actual time of abandonment and a Final Abandonment Plan will be submitted to MSHA for approval prior to initiation of abandonment of the Facility. The Final Abandonment Plan for the slurry impoundments must eliminate any potential to impound water at the Facility. Options to eliminate the potential for impounding water at this Facility may include, but are not limited to, the following:

- Filling in the fine slurry area with coarse refuse generated from the plant while operating towards the closure date.
- Breaching one side of the embankment and placing cover material over the fine slurry area to create a positive drain towards the breach area.
- Lowering the entire embankment crest and placing this coarse refuse material over the fine slurry area to create a positive drainage area.
- Once the final abandonment of the slurry impoundment has started the impounding potential will be eliminated within two years.

The final reclamation surface will be graded such that a minimum 2-percent grade is provided to promote positive drainage toward the appropriate surface drainage control structures.