TECHNICAL SPECIFICATION

FOR

INSTALLATION & CONSTRUCTION OF

CLAY LINER

ASH POND D EXPANSION
POSSUM POINT POWER STATION

TECHNICAL SPECIFICATION NO. CES 2329
REVISION 1 (1)

JUNE, 1987 (1)

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102-JAC-1014S-1

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CES-2329, REVISION 1 (1)

TABLE OF CONTENTS

Subject	Page
1.0 GENERAL INFORMATION	
1.1 Scope	3
1.2 Location	3
1.3 Definitions	3
1.4 Codes and Standards	3
1.5 Related Specifications	4
1.6 Engineering Drawings	5
1.7 Reference Document	5
2.0 MATERIAL REQUIREMENTS	5
2.1 General	5
2.2 Clay Liner Material	5
2.3 General Fill Material	5
3.0 EQUIPMENT REQUIREMENTS	6
3.1 Compaction Equipment	6
4.0 INSTALLATION AND CONSTRUCTION REQUIREMENTS	
4.1 Borrow Areas	6
4.2 Subgrade Preparation	6
4.3 Drainage and Dewatering	7
4.4 Liner Fill Placement	7
4.5 Moisture Control	8
4.6 Compaction Requirements	8
5.0 QUALITY ASSURANCE AND TESTING REQUIREMENTS	
5.1 General	9
5.2 Qualification of Engineering Technician	9
5.3 Qualification of Field Engineer	9
5.4 Testing Requirements	9
5.5 Inspection Requirements	11
5.6 Documentation and Review of Submittals	12

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1.0 GENERAL INFORMATION

1.1 Scope

This specification provides the technical requirements for installation, construction and quality control testing of a low-permeability clay liner to be placed in conjunction with the Possum Point Ash Pond "D" Expansion Project.

1.2 Location

FIELD CONSTRUCTED TO ELEV. 144 AROUND THE ENTIRE IMPOUNDMENT.
JAC 7/20/15

The liner shall be located as shown on Drawing 715932-C-132. It will extend from the top of the proposed slurry cut-off wall (Elevation 55) to the level of the first dredge (Elevation 100±), around the entire perimeter of the impoundment. In addition, the liner will be constructed to elevation 150 along the northern boundaries of the impoundment as shown on Drawing 715932-C-132. Specifications for the cut-off are included in Performance Specification No. CES-2328.

1.3 Definitions

1.3.1 Owner - Virginia Power

1.3.2 Engineer - The Design Authority for Virginia Power who is responsible for engineering design and the interpretation of drawings and specifications.

1.3.3 Independent Testing Agency - Firm retained by the Owner to provide testing, inspection, and related field engineering under the direction of the Engineer to fulfill requirements of this specification.

1.3.4 Field Engineer - Engineer specializing in geotechnical or soils engineering, experienced in testing, inspection and earthwork construction, provided by the Independent Testing Agency.

1.3.5 Lift Thickness - Lift thickness specified herein shall mean loose thickness of fill unless specified otherwise.

1.3.6 Fill - Soil to be utilized to construct the liner. This material shall be deposited in layers (lifts) and compacted as specified herein.

1.4 Codes and Standards

To the extent specified herein, the version and full identity of all codes and standards applicable to this specification are shown below. If there is a conflict between this specification and a reference document, the matter shall be referred to the Owner who will clarify the matter in writing.

1.4.1 American Society for Testing and Materials (ASTM) standard test methods as follows:

ASTM D421-58 (reapproved 1978), Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.

ASTM D422-63 (reapproved 1972), Particle-Size Analysis of Soils.

ASTM D1140-54 (reapproved 1971), Amount of Material in Soils Finer than the No. 200 Sieve.

ASTM D4318-84, Liquid Limit, Plastic Limit, and Plasticity Index of Soil.

ASTM D2487-83, Classification of Soils for Engineering Purposes.

ASTM D2488-84, Description and Identification of Soils (Visual-Manual Procedure)

ASTM D698-78, Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 lb. (2.49 kg) Rammer and 12 in. (305-mm) Drop. (Standard Proctor).

ASTM D1556-82, Density of Soil in Place by the Sand Cone Method.

ASTM D2922-81, Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D3017-78, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D2216-80, Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil-Aggregate Mixtures.

ASTM E329-77 (reapproved 1983), Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.4.2 National Institute for Certification of Engineering Technicians (NICET).

1.4.3 Washington Area Council of Independent Laboratories (WACIL).

1.4.4 Virginia Soil and Water Conservation Commission, Virginia Erosion and Sediment Control Handbook.

1.5 Related Specifications

The following specifications are considered to be companion documents of this specification, as they refer to related work:
CES-2323 "Technical Specification for Construction of Ash Pond "D" Embankment"

CES-2324 "Technical Specification for Testing and Inspection"

CES-2325 "Technical Specification for Clearing and Grubbing"

CES-2328 "Performance Specification for Slurry Cut-Off-Wall" (1)

1.6 Engineering Drawings

Unless otherwise noted, the term "drawings", as used in this specification, shall refer to drawings provided by the Owner. Drawings in general are to scale, but written dimensions shall always be followed and drawings shall not be scaled. In case of errors or discrepancies, the Owner shall be consulted for the adjustment of all complications arising therefrom, and their decision shall be final.

1.7 Reference Document

The following document has been prepared as a partial fulfillment for the State Water Control Board Dam Safety Permit. This is considered a companion document to the Drawings and Specifications: "Final Design Report" Virginia Power-Civil Engineering, October, 1986. This design report includes the results of the geotechnical investigation performed for the project, including boring logs.

2.0 MATERIAL REQUIREMENTS

2.1 General

No material substitutions or deviations from this specification shall be allowed without the prior written approval of the Owner. Equipment specifications shall be submitted to the Owner for approval prior to use. (1)

Soil described herein shall be classified in accordance with the Unified Soil Classification System (USCS) as determined by ASTM D2487 or ASTM D2488 (Visual-Manual Procedure).

2.2 Clay Liner Material

Suitable liner material shall consist of clayey, low-permeability soils which classify in accordance with the Unified Soil Classification System (USCS) as CH, MH, CL, ML, or SC. The liner material shall have a coefficient of permeability of 1×10^{-7} cm/sec or less based on tests performed by the Owner as specified herein. (1)

Suitable material shall be free of organic or deleterious material including topsoil, peat, roots, leaves and wood. The material shall not contain particles having a maximum dimension greater than 3 inches.

2.3 General Fill Material

General fill material shall consist of any compactible soil except organic soils classified as OH in accordance with the USCS. General Fill Material shall be used to fill in holes, hollows, valleys etc.

to provide a relatively smooth base for placement of clay liner material.

3.0 EQUIPMENT REQUIREMENTS

3.1 Compaction Equipment

Compaction equipment shall consist of vibratory, sheepsfoot or tamping rollers, rubber tired rollers, three-wheel power rollers, walk-behind vibratory rollers, vibratory plate compactors or other equipment suited to the soil being compacted. Compaction by construction traffic alone shall not be allowed. In general, sheepsfoot or tamping rollers and rubber-tired rollers are best suited for compaction of predominantly fine grained clay liner material. It is the intent of this specification to allow flexibility in the selection of compaction equipment and methods, provided that the compaction and permeability requirements as specified herein are met. (1)

4.0 INSTALLATION AND CONSTRUCTION REQUIREMENTS

4.1 Borrow Areas

Clay liner material, as defined in Section 2.2, shall be obtained from designated borrow areas approved by the Engineer. All material obtained from designated borrow areas may not necessarily meet requirements for use as clay liner material. The borrow material will be subject to inspection and testing to determine its suitability for use as a clay liner. (1)

General fill material may be obtained from on-site areas approved by the Owner. (1)

Borrow areas shall be excavated, graded, sloped, and dressed to facilitate runoff and prevent ponding of water. Side slopes shall not be steeper than 2.5H:1V.

Waste or overburden from borrow areas shall be disposed of as designated by the Owner. Appropriate Erosion & Sedimentation Control techniques shall be utilized in accordance with the Drawings and Technical Specification CES-2326. (1)

4.2 Subgrade Preparation

All areas on which the compacted clay liner will bear, shall be cleared and grubbed in accordance with Specification CES-2325, stripped and/or overexcavated to the depth required to obtain firm material free of organic material, roots, topsoil, or soft areas as defined by the Field Engineer. The subgrade shall be firm as defined by the Field Engineer.

Where questionable subgrade exists, it shall be proof-rolled with a loaded tandem dump truck or other heavy construction equipment approved by the Field Engineer. The subgrade shall not deflect excessively or display excessive "pumping action" during proof-rolling, construction traffic or compaction.

The subgrade shall not be frozen, or overly wet. Frozen, soft, wet or "pumping" areas, if encountered, shall be scarified, aerated and dried, or overexcavated to firm material as directed by the Field Engineer.

Loose rock or cobbles having a dimension of 3 inches or greater shall be removed from slopes or subgrade prior to placement of clay liner material.

4.3 Drainage and Dewatering

Water will not be permitted to pond on the fill or subgrade. Temporary surface drainage shall be maintained on the fill to divert surface runoff at all times during construction. Following the completion of each day's work, the fill or subgrade shall be sloped and sealed to allow runoff and to prevent ponding of water. (1) (1)

4.4 Liner Fill Placement

4.4.1 General

Each successive lift of fill shall be placed on firm approved subgrade, or compacted fill. Where the previous lift is found to be unacceptable (excessively soft, wet, frozen, inadequately compacted or disturbed by construction traffic), the area shall be scarified, aerated or moistened, recompacted or removed and replaced as required by the Field Engineer.

Fill materials shall be spread in approximately flat layers (horizontal or sloped as required) in such a manner as to obtain layers of relatively uniform thickness. Placing and spreading shall be done in such manner as to prevent segregation. Lifts of clay liner material shall be free of lenses, pockets, streaks or layers of granular material as defined by the Field Engineer.

4.4.2 Lift Thickness

Lift thickness shall not exceed 8 inches unless specifically authorized by the Field Engineer based on results of field density tests.

4.4.3 Required Clay Liner Thickness

Minimum compacted clay liner thickness shall be one (1) foot for material having a coefficient of permeability of 1×10^{-7} cm/sec. Borrow material shall have a maximum coefficient of permeability of 1×10^{-7} cm/sec to qualify as suitable clay liner material. (1)

4.4.4 Preparation and Maintenance of Fill Surfaces

If the compacted surface of any layer of material is too smooth or too dry to bond properly with the succeeding layer,

it shall be roughened or loosened by scarifying, light discing, or by other means acceptable to the Field Engineer, and it shall be sprinkled before the succeeding layer is placed thereon. If the surface becomes rutted or uneven subsequent to compaction, it shall be flattened and leveled before placing the next layer of material. Hauling equipment shall be routed across the fill in such a way as to prevent the formation of ruts or lanes in the compacted fill.

If, after a prolonged rainfall, the top surface of the fill is too wet to work properly, the top material shall be aerated and recompacted or the unsuitable material shall be removed to expose suitable material. 1

4.5 Moisture Control

4.5.1 General

The moisture content of all fill materials shall be uniform throughout each lift. Water should be applied as required by sprinkling. Uniform moisture content shall be obtained by discing, blading, harrowing or other methods prior to compaction of the layer. Material that is too wet when spread shall be scarified, or disced and aerated or removed. Moisture shall not cause bogging down of equipment, rutting or pumping under construction traffic.

4.5.2 Moisture Requirements

Clay liner material shall be placed and compacted slightly wet of optimum moisture content. Clay liner material shall have a moisture content of -1 to +3 percent of its optimum moisture as defined by a standard compaction test performed in accordance with ASTM D698.

4.6 Compaction Requirements

4.6.1 General

Any deviations from the following compaction requirements shall only be allowed by the Engineer after a review of test results, construction procedures, and field conditions.

4.6.2 Degree of Compaction Required

Clay liner material shall be compacted to a minimum of 95 percent of its maximum dry density as defined by a standard compaction test performed in accordance with ASTM D 698.

5.0 QUALITY ASSURANCE AND TESTING REQUIREMENTS

5.1 General

Testing and inspection detailed herein shall be conducted under the direction of the Engineer to insure strict compliance with the drawings and specifications, and to fulfill the design requirements.

Testing and inspection shall be performed by an Independent Testing Agency equipped and staffed in compliance with ASTM E329. The Independent Testing Agency shall employ competent engineers and technicians experienced in geotechnical engineering, soil testing and field control of soils and materials placement.

The Independent Testing Agency shall report all test and inspection results to the Owner in a timely manner. Test reports shall document material source and location, as well as test methods and standards. Field test reports shall also document test location as to horizontal and vertical control. Where test results or inspections indicate that the material furnished or work performed does not meet the requirements of the drawings or specifications, the testing agency shall notify the Owner immediately.

The Independent Testing Agency is not authorized to change, revoke or alter any requirements of the drawings and specifications without direction of the Engineer. However, the Field Engineer may approve or accept material or work performed as per the requirements of the drawings and specifications.

5.2 Qualification of Engineering Technician - Technicians performing testing or inspection shall be certified as a Level II Engineering Technician in accordance with NICET or WACIL certification. The Independent Testing Agency shall submit a resume to the Owner detailing experience and educational background for the Engineering Technician and an alternate Technician to be assigned to the project.

5.3 Qualification of Field Engineer - The Field Engineer shall be a graduate civil engineer specializing in geotechnical or soil engineering with a minimum of five years experience in soils and material testing and earthwork construction. The Independent Testing Agency shall submit a resume to the Owner detailing experience and educational background.

5.4 Testing Requirements

5.4.1 General - Field density tests performed on the liner fill and related laboratory testing and inspection shall be conducted to determine performance of the work in compliance with this specification.

5.4.2 Prequalification Testing - The following tests, detailed in Table I, shall be performed on samples of the clay liner Borrow material by the Independent Testing Agency at the frequency listed prior to acceptance of material for use in construction.

TABLE I
PREQUALIFICATION TESTING OF LINER MATERIALS

ASTM TEST STANDARD	TESTING FREQUENCY
D1140 D4318	Minimum of 3 each of tests for each borrow source (pit) or off site source
D2487	One classification for each sample tested (series of tests)
D698	One on combined sample or as directed by the Engineer

ARMY CORPS OF ENGINEERS	TESTING FREQUENCY
"Permeability Tests with Back Pressure" - Laboratory Testing Manual EM-1110-2-1906, Appendix VII, Part 7	One on laboratory compacted combined sample or as directed by the Engineer

Note: Testing frequencies stated above are minimums. The Engineer may require additional prequalification testing to clarify or better define material properties.

5.4.3 Production Testing During Placement & Compaction - The test frequency required during construction of the clay liner is shown on Table II. It should be noted that these are minimum frequencies during the early stages of the work. Until placement operations have been established so that consistent results are being obtained, tests shall be made more frequently than indicated on Table II as directed by the Engineer. Furthermore, whenever there is doubt that the required results are being obtained, frequency of testing shall be increased.

TABLE II
PRODUCTION TESTING DURING PLACEMENT & COMPACTION

Test Standard	Frequency
D1140, D4318, D2487, and D698	A,C
D2216*	A,D,E,G,H,&I
D1556 or 2922**	B,C,D,E&F
Permeability (EM-1110-2-1906)	J

Note: *Moisture content may be performed by rapid methods such as ASTM D 3017 (Nuclear Method) or other methods approved by the Engineer. Results obtained by ASTM D 3017 or other rapid methods shall be correlated with moisture content performed by ASTM D 2216 to the satisfaction of the Engineer.

**ASTM D 2922 shall not be used in trenches, excavations, or pits.

TESTING FREQUENCY DESIGNATED AS FOLLOWS:

A. One per 10,000 yd^3 placed

B. One per 1,000 yd^3

C. When material change occurs from source as required by the Field Engineer

D. In area where compaction is doubtful

E. At least one per earthwork shift

F. One per lift in area fill

G. One per each field density test

H. Where soil appears too wet or too dry

I. Following rework to correct moisture content

J. One per three acres of liner placed on field secured undisturbed sample of clay liner (1)

5.5 Inspection Requirements

5.5.1 General - Inspection shall be performed on a full time basis during placement and compaction of the clay liner.

Close coordination between the Engineering Technician (Inspector), Field Engineer and the Engineer are essential for effective construction control. General activity, including instructions given, and action taken, in each area of work shall be documented on a daily basis by both the Inspector and Field Engineer. Information concerning the tests performed, sample location and date of sampling, results of tests, and the corrective action taken (if required) shall be effectively transmitted between the Inspector and Field Engineer. The Field Engineer shall immediately notify the Engineer of conditions which require modifications of the specifications or those that affect design.

Inspection requirements are briefly summarized as follows. However, inspection is not limited to the following:

5.5.1.1 Stripped or excavated subgrades shall be inspected to ensure they conform with specifications.

5.5.1.2 Borrow material shall be inspected and tested to ensure there suitability for use as liner fill.

5.5.1.3 Liner fill material shall be placed, compacted, and tested in accordance with the specifications.

5.6 Documentation and Review of Submittals

5.6.1 General - All inspection and test reports and submittals shall be reviewed by an engineer with the Independent Testing Agency. The Independent Testing Agency shall prepare and submit an Inspectors Daily Report and Daily Summary of Test Results weekly to the Owner. At the end of each month, a Monthly Report summarizing results of testing and inspection shall be submitted to the Owner. These reports shall contain a sketch or sketches which detail locations of field tests performed.

** END OF SECTION **