The Design and Monitoring of Geotextile Tube Use in CCR Impoundment Closure

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Lower Ash Pond
Layout of the Lower Ash Pond (LAP)

- Operational Pool
- Ash Management Operations
- Area 1
Dominion wanted to start the Intermediate Water Management Plan (IWMP) for the Lower Ash Pond (LAP) while continuing to operate the pond.

- Initially, Dominion desired to implement the IWMP by December 2018.
- Chesterfield Power Station needed to continue sluicing CCRs to the Lower Ash Pond through December 2017 while the station was being converted from wet to dry ash handling.
  - Design Consideration - One of the VPDES limit for the operating pond was TSS.
  - The IWMP needed to control sediment runoff from the filling of Area 1.

Initial Approach – Use of Sheet Piles Walls
- Sheet piles required a platform for access, 50 ft.
- Concern with embedment depths including possible impacts to underlying natural soils.

How could the IWMP target date be met? Geotubes

Design Considerations for Using the Geotubes
- Safety during installation.
- Environmental compliance must be maintained during installation.
- Stability during and after installation.

Why the Use of Geotubes was Selected?
Layout of the Lower Ash Pond (LAP)

- Operational Pool
- Ash Management Operations
- Area 1

Google Earth

Dominion Energy
Field Investigations

SPT (2015)
CPT (2015)
FFP (2016)
Geotechnical Investigation

Coal Combustion Residuals

Alluvium

Stronger Cretaceous Sediments

Full flow penetrometer ball tip pressure (psf)

CPT cone tip pressure (tsf)

CPT sleeve friction (tsf)

Field SPT N-values (bpf)

Graphs showing data for different layers and tests.
Sheet Pile Wall Concept
Geotextile Tube Wall Concept

- Construct a geotextile tube wall between Area 1 and pool side
- Fill geotextile tubes with ash dredged from the operational pool
- Geotextile tubes will act as a gravity structure to improve stability while fill is placed on land side
- Geotextile tubes provide BMP for maintaining compliance with discharge permit during filling and grading in Area 1.
Polymer Laboratory Testing

- Bench-scale testing with multiple polymers and multiple dosages
- Goal: identify polymer that will most improve the dewatering process
Slope Stability Analysis
# Stability of Construction of Geotextile Tube Wall

<table>
<thead>
<tr>
<th>Critical Cross Section</th>
<th>Construction Condition</th>
<th>Cumulative Geotextile Tube Filling Height (ft)</th>
<th>Calculated FS (min. 1.3)</th>
<th>Target FS</th>
<th>Met Target FS?</th>
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<tbody>
<tr>
<td>C</td>
<td>First geotextile tube layer, first filling</td>
<td>2</td>
<td>1.30</td>
<td>1.3</td>
<td>Yes</td>
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<tr>
<td>C</td>
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<td>1.32</td>
<td>1.3</td>
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<td>1.31</td>
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<tr>
<td>B</td>
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<td>1.36</td>
<td>1.3</td>
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<tr>
<td>B</td>
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<td>1.74</td>
<td>1.5</td>
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</tbody>
</table>
Construction of Geotextile Tube Wall

Lesson Learned

• Provide additional positive slope, anticipating settlement and construction impacts, for liner to reduce ponding at tubes while filling.
Lesson Learned

• Provide additional grading behind the geotubes for stormwater control under varying conditions, keeping in mind the tubes act as a dam.
Lessons Learned

- Polymer dosing can be highly variable during the dredging operations, so a thorough monitoring plan that provides the ability to adjust dosing is necessary.
Pore Pressure Monitoring

Lessons Learned

• Provide adequate space for piezometer readouts so they are not too close to the geotubes for future monitoring

• Strong communication of monitoring program and expectations.
Aerial View of Post Construction Condition of Geotextile Tube Wall Construction
Post Construction Gradation of Ash in Tubes
Post Construction %Moisture of Ash in Tubes
Lessons Learned / Effectiveness

- A thorough monitoring plan is needed to track the dosing rate.
- Stormwater controls should be considered under varying conditions.
- On this project, pore pressures dissipated quicker than expected.
- The geotubes provided effective separation between construction and operations.
- The structural fill was placed successfully within Area 1 without any compliance or stability issues.
- The condition of the ash in the geotubes may or may not vary, depending on the variable of dosing, runoff control, filling sequence, and time.
- Geotubes were more cost-effective than sheet pile wall installation.