Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
Addenum to Ash Stacking Height in Processing Area Work Plan R1
Geosyntec concurrence with Work Plan and supporting documents

Date Submitted:
01/18/2010

Submitted to whom
Leo Francendese

Concurrence

Received	Not Applicable	TVA
☒	☐	Mike Scott
☐	☒	Steve McCracken
☒	☐	Kathryn Nash KAN
☒	☐	Dennis Yankee DHY
☒	☐	Michelle Cagley mc
☒	☐	Tom Spurlock TJS
☐	☐	_____

Received	Not Applicable	Jacobs
☐	☒	John Moebes
☐	☒	Julie Pfeffer
☒	☐	Jack Howard
☒	☐	Randy Denton
☐	☐	_____
☐	☐	_____

Approvals

TVA Michael T Scott Date 1/18/10

EPA Leo Francendese Date 1/18/10

Consulted w/ TDEC

cc:

- ☒ Anda Ray, TVA
- ☒ Barbara Scott, TDEC
- ☒ Leo Francendese, EPA
- ☒ Mike Scott, TVA
- ☒ Dennis Yankee, TVA
- ☒ Kathryn Nash, TVA
- ☒ Cynthia Anderson, TVA
- ☒ Steve McCracken, TVA
- ☒ EDM
- ☒ Julie Pfeffer, Jacobs
- ☒ David Stephenson, TVA
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- ☒ Greg Signer, TVA
- ☒ KIF Incident Document Control
- ☒ Katie Kline, TVA
- ☒ Gretchen Wahl, Jacobs
- ☒ Dannena Bowman, EPA
- ☒ Jeff Gary, Jacobs
- ☒ Robert Pullen, Jacobs
- ☒ John Moebes, Jacobs

WORK PLAN

ADDENDUM TO
ASH STACKING HEIGHT in PROCESSING AREA WORK PLAN (originally dated June 9, 2009)

1.0 Purpose of Work

This plan is to describe the work required to increase the height to which ash may be stored, i.e., from 15 feet to 30 feet above the demarcation layer of elevation 768 in the temporary ash storage area (Ball Field). This will provide additional storage capacity plus allow reconfiguration of the topography to enhance drainage and subsequent drying of the ash. This plan amends the currently approved work plan originally dated June 9, 2009 that addressed the operations within the Ball Field site.

2.0 Design Components

Under the currently approved work plan, the ash can be stacked to 15 feet above the 768 elevation demarcation layer without any special compaction or monitoring requirement. The attached sketch "Ball Field Reconfiguration" portrays the plan to stack ash up to an elevation of 798, or 30 feet above the 768 elevation. Attached is documentation from the "Engineer of Record", Geosyntec Consultants, and peer review by AECOM validating the proposed changes as well as concurring with this work plan. The recommendations identified by Geosyntec will be incorporated into the construction and/or operations. In summary, these recommendations are,

(1) Maintain a 4 horizontal to 1 vertical (4H:1V) slope at the working edge of any storage slopes.
(2) Maintain the existing instrumentation program, replace damaged settlement plates and piezometers.
(3) Incorporate ash elevation data into the instrumentation program.
(4) Construct the grading plan as shown on the attached Jacobs conceptual drawing entitled Ball Field Reconfiguration, dated 12-15-09.

3.0 Construction Management

The Ball Field drainage will be improved through a perimeter ditch system and sloping a base layer to promote surface runoff to the ditches. Ash will be stored or windrowed on top of the base. Stored ash, sufficiently dry to load, will be sloped for stability and worker protection. Windrowed ash, stacked to the angle of repose, requiring additional processing, will be constantly moving. In both cases, the height will not exceed an elevation of 798. Windrows will be placed approximately 200 feet west of the rim ditch, extending westward as required.

The proposed construction activities will be accomplished by conventional methods, utilizing excavators, dozers, trucks, and other associated equipment. The abundance of activity in the area will require close coordination among all contractors. Jacobs will provide construction management services for the project that will include: (i) coordination of all contractors to assure safe working operations in the area; (ii) daily review of construction and survey records to assure that maximum proposed grades are not exceeded; (iii) daily evaluation of the height to assure positive drainage to the perimeter drainage features; (iv) review, approval, and monitoring of contractor-proposed excavations in the area to minimize the potential for damage

to the instrumentation; and (v) implementing protocols for “sealing” the area in advance of inclement weather to minimize infiltration of precipitation into the stockpiled ash.
The protection of the instrumentation will be enhanced by the proposed grading changes. The working platform, or base layer of ash at an elevation of approximately 4 to 8 feet above the demarcation layer of stone (and instrumentation cable encased in conduit) provides a separation of 5+ feet between excavation activities and the instrumentation. In addition, concrete barriers, flagging etc will be placed and maintained around the instruments clusters. A task order is in place for maintenance of the instrumentation system, plus some long lead items are to be placed in stock. With the automated remote data collection system, any interruption in service will be known immediately. Accordingly, notifications to appropriate personnel and actions to put the system back into operation will start promptly.

Instruments will continue to be monitored as required in the initial Ash Stacking Height in Processing Area Work Plan approved June 9, 2009 and will follow the recommendations by Geosyntec and AECOM.

4.0 Schedule

The work outlined above will be started on or before 1-11-10 and be completed as space becomes available. Work on the Ball Field will have to be completed in sections in order to minimize the impact to the ongoing operations. Interim grades in these sections will be monitored to assure that stable slope conditions identified in this plan are not exceeded.

5.0 Waste Management

No waste other than miscellaneous construction debris will be generated as a result of the proposed activities.

6.0 Health and Safety

All construction activities will be done in accordance with site wide Health and Safety Plan.
As noted above, increase in activity throughout the Ball Field will require close coordination among the participants. Foot traffic in and around the area will increase significantly requiring a greater awareness on the part of the equipment operators. Personnel on foot must log in and out with the Job Safety Analysis (JSA) and check in with the Jacobs Construction Manager. This is a general site policy that personnel check in with the foreman or construction manager prior to entering a work area. Windrows, at a slope of 1:1 and with the potential to slough are to have a 30’ wide no trespass perimeter for personnel on foot and small vehicles. The windrows will not be placed at the edge of the area. Samples for moisture content will be collected from the piles by an excavator while samplers remain fifty feet from the toe of the slope. Equipment operators will be advised to watch for sloughing. These requirements will be incorporated into all JSAs relating to personnel on foot and in small vehicles.

Attachments

E Mail JJWang @Geosyntec to Jack Howard, 11-17-09 with Stability Analysis
Technical Review: William Walton to Barry Snider @ TVA 11-19-09
Review of Geosyntec's Technical Summary Slope Stability
with attachment April 4,2009 Letter to TVA
Response from Geosyntec to 19 November 2009 Comments from AECOM
Draft Letter AECOM to Barry Snider @ TVA- 12-3-09,
Geosyntec Analysis of Proposed Windrow Area, 12-23-09
Technical Review, William Walton to Barry Snider @TVA 12-30-09
Review of Geosyntec's Slope Stability for Windrow Area
E Mail RBachus @ Geosyntec to Randy Denton 1-6-10
Concurrence w/ Work Plan

KIF

RBachus@Geosyntec.com [RBachus@Geosyntec.com]

Sent: Tuesday, November 17, 2009 9:01 AM

To: Howard, Jack; Denton, Randy; McKamey, Shannon

Cc: JJWang@Geosyntec.com

Attachments: Technical Summary_Ball Fie~1.pdf (65 KB)

Jack, Randy, and Shannon: We have attached the requested stability analysis results. I would like to talk with you today about the operations in the Ball Field Area.

Jack, you suggested that we talk with Stantec about being a resource to them in their operations. I have done this with no response. I would like to offer similar services to Jacobs. We currently have several issues at the site that raise my concerns. This modified plan for site operations is a total change in the original plan of operations in the Processing Area. The ash that is being managed at the site is much wetter than we originally anticipated, suggesting the dipping and processing is not releasing as much water as originally anticipated. We have lost essentially all ability to monitor the site due to neglect by the contactor to maintain a safe working distance above the demarcation layer. I suspect that there are numerous problems with achieving the requisite dewatering in the processed ash. I just saw a request from Darrell Guinn regarding a technique to help dewater ash using polymers. My experience with this concept is that it is largely ineffective and expensive. In short, I think Geosyntec can significantly help the Jacobs team at the Site and I do not believe that we are adequately engaged. I want to be sure that we do not trigger even a local instability and I am concerned that the credibility of the team will be questioned if we are not able to meet the objectives we originally committed to.

Please call me at your earliest convenience to discuss.
Thanks
Bob

Robert C. Bachus, Ph.D., P.E.
Principal

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engineers | scientists | innovators

16 November 2009

Technical Summary
Slope Stability Analysis Results
Ball Field Temporary Ash Disposal Site – Operations Modification
Kingston Fossil Plant, Harriman, TN

Objective

The Tennessee Valley Authority (TVA), Jacobs Engineering (Jacobs), and Sevenson propose to modify the currently approved processing and storage activities at the Ball Field Site (Site) within the Kingston Fossil Plant (KIF) complex. The Site is used for the processing and temporary storage of dewatered fly ash that is excavated and collected from the Emory River, the Swan Pond Creek Embayment, and other areas in and around the KIF. The Site is triangular in plan view, comprises approximately 30 acres, and includes areas and provisions for loading ash onto railcars for off-site disposal. The proposed modifications within the Site are described in the November 2009 Jacobs document titled *Ball Field Process and Storage Improvement Work Plan* (Improvement Work Plan). Geosyntec Consultants (Geosyntec) prepared this Technical Summary at the request of Mr. Jack Howard, P.E., of Jacobs to report the results of slope stability analyses that were performed to recognize the proposed modifications to the current Site operations. Geosyntec understands that Jacobs intends to submit this Technical Summary to Mr. William Walton, P.E., of AECOM, Mr. David Paul, P.E., of the U.S. Bureau of Reclamation (USBR), and to the Tennessee Department of Environment and Conservation (TDEC) for their review, concurrence, and comments.

Anticipated Subsurface Conditions Beneath the Ball Field Site

The subsurface conditions considered for these analyses remain unchanged from the conditions considered in previous slope stability analyses. Based on review of several recently advanced subsurface borings and piezocone penetration test (CPTu) soundings, the subsurface conditions at the Site can be summarized as follows (from top to bottom):

- 1 to 2 ft thick layer of aggregate to serve as a demarcation and drainage layer;
- 8- to10-ft thick unsaturated crust layer of relatively strong fly ash and bottom ash;
- 30- to 50-ft thick layer of soft fly ash with local thin zones of bottom ash;
- 20- to 30-ft thick layer of relatively soft clayey foundation soils; and
- bedrock.

The groundwater surface is typically located within or near the base of the unsaturated crust layer. To date, the demarcation layer has seemed to be effective at providing a vertical seepage boundary to help drain water from the fly ash stored at the Site. As mentioned, the subsurface conditions at the Site were established based on numerous subsurface borings (by Mactec) and CPTu soundings (by Conetec) advanced within the Site footprint. In addition, laboratory testing results performed by several parties working at the KIF were used to establish the engineering properties considered in the subsequent analyses.

Proposed Modification to Operations of Temporary Ash Storage Area

As described and shown in the Improvement Work Plan, Jacobs proposes to utilize the entire Site for temporary ash storage and will work to develop a single contiguous fill area. The maximum height of the fill slope will be 30 feet at the far northwest corner of

the Site. The surface of the fill will be sloped to drain water back towards the Rim Ditch. Jacobs proposes to maintain a 4 horizontal to 1 vertical (4H:1V) slope at the working edge of the slope adjacent to railcar loading area.

Slope Stability Analysis Results

Based on the results of numerous stability analyses performed in the past by Geosyntec, the slope height and slope of the working face of the fill govern the calculated stability of the temporary ash fill slope. Therefore, the maximum slope fill height of 30 ft and a slope at the face of the working face is assumed to be 4H:1V. For these analyses, the water surface within the stored ash is assumed to be maintained at the level of the demarcation layer. As processed ash is place in the area water is anticipated to dominantly flow vertically through the ash into the demarcation layer and thereafter into the underlying ash. The results of these analyses are presented in the Attachment A. Results indicate that for both circular and block modes of failure, an adequate calculated factor of safety is provided

Proposed Performance Monitoring Program

As described in previous documents prepared by Geosyntec, piezometers and settlement plates are included at five locations across the site. These instruments will continue to be monitored as part of the proposed site modifications.

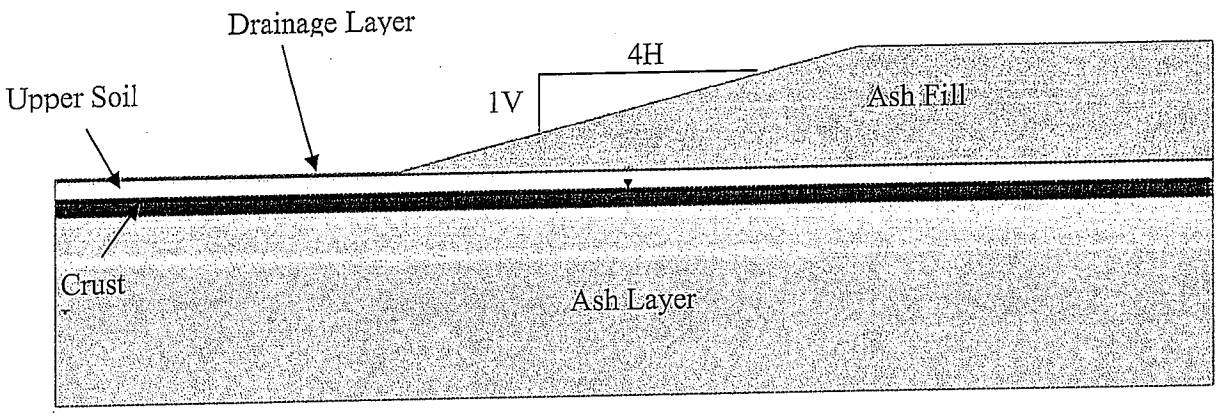
16 November 2009

Attachment A
Stability Analysis – Ball Field Reconfiguration

Material Properties:

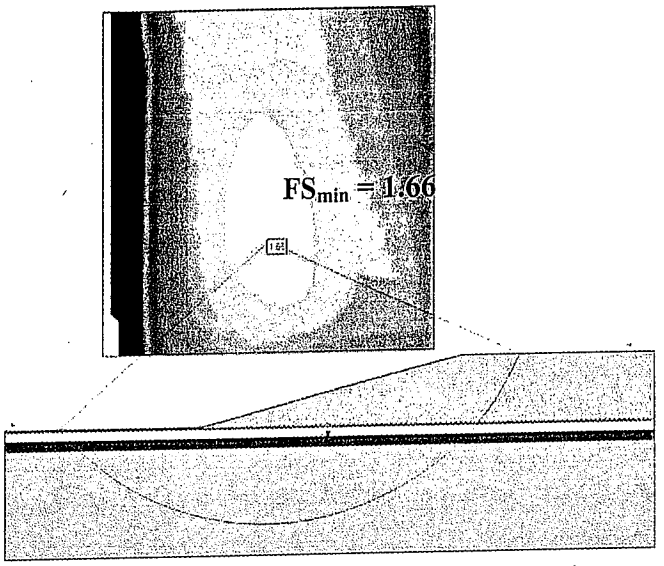
Material	Layer Thickness (ft)	Unit Weight (pcf)	Shear Strength
Ash Fill	30	100	c=0, $\phi = 25^\circ$
Drainage layer	1	135	c=0, $\phi = 35^\circ$
Upper Soil Layer	5	90	c=0, $\phi = 25^\circ$
Crust Layer	5	120	c=500 psf, $\phi = 10^\circ$
Ash Layer	50	75	c=0, $\phi = 20^\circ$
Clayey Foundation Soil	20	100	c=0, $\phi = 28^\circ$

Geometry:

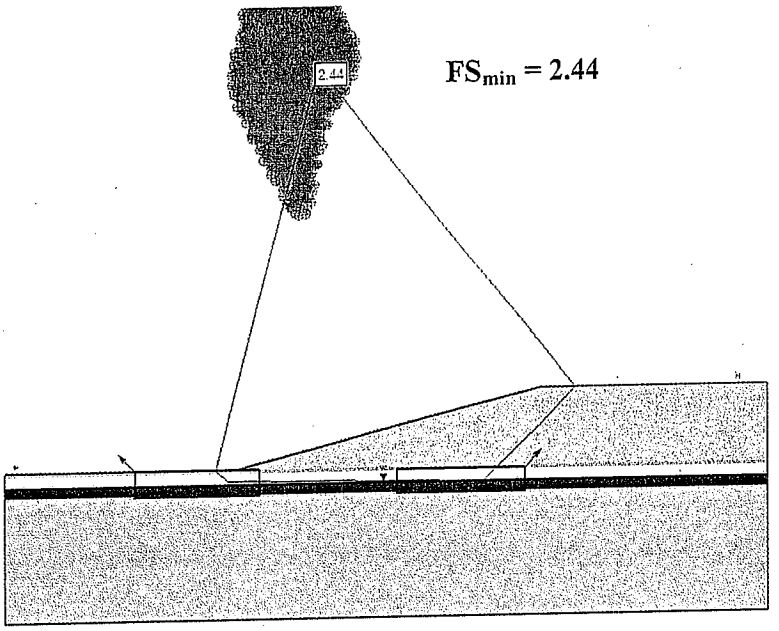


16 November 2009

Results of Slope Stability Analysis (Circular Type Critical Surface).



Results of Slope Stability Analysis (Block Type Critical Surface).



AECOM
750 Corporate Woods Parkway
Vernon Hills, Illinois 60061

847.279.2500 tel
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November 19, 2009

Mr. Barry Snider, P.E.
Tennessee Valley Authority
1101 Market Street, LP 5E-C
Chattanooga, TN 37402

sent via e-mail: bssnider@tva.gov

Re: Review of Geosyntec's Technical Summary Slope Stability Analysis Results Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN – AECOM Project No. 60140251

Dear Mr. Snider,

As requested by the Tennessee Valley Authority (TVA) and Jacobs Engineering (Jacobs), AECOM have Geosyntec's Technical Summary Report for the Slope Stability Analysis Results for the Ball Field Temporary Ash Disposal Site – Operations Modification at the Kingston Fossil Plant near Harriman, Tennessee and other supporting documents from Jacobs.

AECOM has conducted a review of the following documents forward to AECOM by Jacobs:

1. Technical Summary Slope Stability Analysis Results Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Harriman, Tennessee prepared by Geosyntec's dated November 16, 2009.
2. Ball Field Process and Storage Improvement Work Plan prepared by Jacobs, undated.
3. KIF Ball Field Site Instrumentation Results & Summary Reports from June 6, 2009 to October 10, 2009 prepared by Jacobs.

Previously during the RCA program, AECOM has reviewed the following documents provided by Geosyntec for this site.

1. Geosyntec Construction Quality Assurance (CQA) Plan, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN, 5 pages, dated April 1, 2009.
2. Geosyntec Test Pad Construction and Testing Program, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County TN, 4 pages, dated March 30, 2009.
3. Geosyntec Interpretation of Performance Monitoring System, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN, 6 pages, dated March 30, 2009.
4. Geosyntec Figure 3 Instrumentation Plan, TVA Kingston Fossil Plant, Revision 2, dated March 23, 2009.

Review Comments

Jacobs proposes to modify the currently approved dredge ash processing activities at the Ball Field Site (Site) at the Kingston Fossil Plant (KIF) to improve storage and ash dewatering. The triangular shaped site covers approximately 30 acres, and includes rim ditches, wet ash processing, and centralized ash storage areas to loading areas to load ash into railcars for off-site disposal. There is a primary need to direct storm water away from the day to day ash drying operations and to increase the volume on-site storage of wet ash. It is proposed that a base layer of ash will be graded to the same height as the loading excavator platform at elevation 778 feet. There will be ash berms constructed along the west and north legs of the site. The ash will then be placed so that the highest point along the stockpile is located at the northeast corner of the site at elevation 798 feet. The stockpile will then be slope to the east and south down to elevation 775 feet near the wet ash processing area and rim ditch. The proposed grading

plan is shown on Attachment A of the Jacob Work Plan. We understand from the Jacobs work plan and Geosyntec report that exterior slopes of the stockpile or base ash fill will have slopes no steeper than 4H:1V.

We have reviewed the Geosyntec Technical Summary report and have the following comments and recommendations.

1. The Jacobs Work Plan and/or Geosyntec Technical Summary should include a staging plan with time line and working elevations for the proposed site modifications. We assume no stocked ash will be placed above El. 798 feet, which is approximately 30 feet above the old Ball Field. All parties agreed stockpiles would not exceed 30 feet in height.
2. The Geosyntec Technical Summary does not address the results of instrumentation monitoring program which has been in-place under and along the perimeter of the Ball Field site. Data from this performance monitoring program is important to confirm the assumptions made by Geosyntec in the original site development stability analysis. We understand no new instrumentation is being recommended.
3. There is no discussion on the plan to construct the base ash layer, sand base area at the processing area, and active storage layer (height undefined) all in three to four weeks. We question if the west and north base ash perimeter berms will be filled up to elevation 798 feet in that three for four week time period. We recommend this question be answered prior to mass site regrading. There is no opinion offered on maximum rate of loading to achieve the geometry of the base ash perimeter fill. We understand they are needed to promote better gravity drainage and prevent ponding of water on the stockpiles.
4. There are no recommendations for alarm and action limits for increase in porewater pressure or horizontal movement to settlement of the foundation soils. These levels would trigger either the slowing rate of filling or stop filling. Within the AECOM letter to TVA's Ralph Rodgers dated April 4, 2009, (see attachment) alarm and action level were discussed for limits on the pore water pressure ratio (the change in positive pore water pressure in the foundation ash due stockpile filling which will increase the vertical stress). Our earlier suggestion that pore water pressure ratios not excced 10 to 15 percent for action and work stoppage, respectively. We assume performance monitoring will continue program of having alarm and action level be maintained to ensure there are limit for the allowable displacement ratio (ratio vertical movement [from settlement plate results] to horizontal movement [from perimeter inclinometer readings]).
5. After reviewing the weekly Instrumentation Results and Summary Reports provided by Jacobs the settlement plates have not been operational since June 25, 2009. With the exception there has been minor movements observed from the inclinometer readings. Why have they not been replaced? More importantly, the monitoring program has not recorded top of stockpile elevation over each or next to each instrument. This allows the geotechnical reviewer to quantify cause and effect. The data summary report should also list the height of fill over the instrumentation at the time of the pore water pressure readings were made and results presented as porewater pressure ratio. We understand that the porewater pressures transducers readings are recorded continuously, without fill reading. We suggest that at the end of day the height of fill reading be taken by surveyors at the five instrumentation stations. This is needed to compute the agreed upon pore water pressure ratio limits.
6. The Technical Summary by Geosyntec does not provide a discussion of the recommended rate of filling for the "base ash layer" during mass regrading of the site.
7. We encourage the construction of drainage ditches, access roads, sand base drainage layer, area and that the base ash layer can commence along the north side of the site as this is where the Initial North Dike was located. We understand that the North Dike was founded on the natural alluvial soils and will provide lateral resistance to movement of the foundation ash during base ash filling.

Recommendations

We recommend that the Technical Summary include a more detailed discussion of the following topics:

1. Provide a sequence of construction time line or schedule to show when and how the working grades will be achieved. We are concerned about rapid base ash filling up to the working grades in less than four weeks without performance monitoring and sign-off by Geosyntec, the engineer of record for this work area.
2. Provide a written summary and interpretation of the instrumentation performance monitoring program results to date.
3. Replace the damage settlement plates or install Boros anchors to restore the ability to measure settlement under the base ash and stockpile areas.
4. Confirm or establish updated alarm and action levels for both pore water pressure ratio and displacement ratio and describe what action should be taken at each warning level.
5. Update the stability analysis to include varying porewater pressure ratios.
6. Commence with the construction of drainage ditches, access roads, sand base layer and base ash filling over the north side of the site as this is in the area is protected by wick drains and the former North Dike foundation.

Summary

More information needs to be presented show that the proposed three to four week base ash regrading program will not trigger undrained behavior in the foundation ash. We suggest all of the instrumentation under the site be restored and that daily instrument measurements include survey of the top of ash placed over the five instrumentation stations. We assume Geosyntec is responsible for interpreting the collected instrumentation and fill survey readings. If filling causes excess pore water pressure buildup or excess later deformation, then actions should be taken to lower stockpiles or slow the filling rates to ensure stability under the ash stock piles is maintained.

We recommend that Geosyntec issue a daily instrumentation performance report and that information be communicated to Jacobs and TVA to make sure the regrading program is not triggering movement or excess pore water pressure development in the loose, wet foundation ash.

Please call us if you have any questions.

Very truly yours,

William H. Walton, P.E., S.E.
Vice President, Senior Principal Engineer

William Butler, P.E.
Senior Geotechnical Engineer

Attachments – April 4, 2009 AECOM Letter to TVA

cc: Jamie Dotson – TVA – vjdotson@tva.gov
Jack Howard – Jacobs – Jack.Howard@jacobs.com

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April 4, 2009

Mr. Ralph E. Rodgers
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1401

Re: Review of Geosyntec's CQA Plan and Performance Monitoring System at Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN – AECOM Project No. 60095742

Dear Mr. Rodgers,

As requested by TVA's Barry Snider and Chris Buttram, we have reviewed the following work in progress documents provided by Geosyntec in emails to AECOM dated April 1 and 2, 2009.

1. Geosyntec Construction Quality Assurance (CQA) Plan, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN, 5 pages, dated April 1, 2009, Revision 2.
2. Geosyntec Test Pad Construction and Testing Program, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County TN, 3 pages, dated March 30, 2009.
3. Geosyntec Interpretation of Performance Monitoring System, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN, 3 pages, dated March 30, 2009.
4. Geosyntec Figure 3 Instrumentation Plan, TVA Kingston Fossil Plant, Revision 2, dated March 23, 2009.

Per TDEC directive, the remedial design documents for temporary storage of ash on the former ball field over the Kingston Ash Pond and south of the Dredge Cells will be reviewed by AECOM and TVA in regards to promote short and long term structural stability and integrity of ash ponds. AECOM has been requested to review remedial designs as we are the Root Cause Analysis (RCA) of failure at this site. Both TVA and AECOM have been appointed to the TDEC structural integrity peer review for this structure.

Review Comments

A. AECOM Review Comments on the CQA Plan

We appreciate Geosyntec revising the text and accept the document with minor suggestions. We suggest the "Test Pad" be constructed under an instrumented area show to have piezometers (e.g., over an area having a PA, PC and SP) at one of the four areas shown on Figure 3, Rev. 2. We suggest the recovered and dewatered material be placed in maximum 2-foot thick lifts across the foot-print of the wick drain improved site and with initial slopes no steep than 10H:1V. The proposed fill side slope of 3H:1V could be flattened subject to performance monitoring. We offer information gained during our ongoing RCA evaluation that in regards to the undrained behavior of saturated loose ash at the site. We recommend that if nuclear density testing is used to measure in-place ash density, the nuclear density meter be calibrated routinely to corresponding sand cone density test.

We also suggest the wick drain blanket surrounding the ball field site be maintained open and visible for inspection to allow visual confirmation the stone drainage blanket is exposed and can drain freely.

B. AECOM Review Comments on Test Pad Construction and Testing Program

The document is well written and easy to understand. The plan can proceed without further review. We suggest the "Test Pad" be constructed under an instrumented area show to have piezometers and a settlement plate (e.g.,

over an area having a PA, PC and SP) at one of the four instrumentation stations or locations shown on Figure 3, Rev. 2.

C. AECOM Review Comments on the Performance Monitoring System at Ball Field

There are several issues that should be understood by all parties involved with the instrumented Temporary Stockpile of recovered ash at the Ball Field:

1. Geosynstec Stability Analyses – The computed factors of safety focus on effective stress strength (ESA) parameters and assumed excess positive pore water pressures due to rapid filling and wick drain promoted drainage. The analysis did not evaluate the undrained behavior (TSA) or used the undrained strength of the loose, wet ash. We agree with Geosyntec's suggestion to use of performance monitoring to evaluate the increase in positive pore water pressures, settlement, and lateral movement to detect shear strains under the stockpile during material placement. There is a risk that too rapid of a loading over the old pond ash footprint could trigger undrained behavior resulting in undrained strength as low as 100 to 500 psf. Upon further review of our on going ash testing in the laboratory, we recommend Geosyntec reduce the threshold "action" and "alarm" levels, on the excess pore water pressure measured in the saturated flyash be reduced to 10 percent and 15 percent of the pore water pressure ratio (the ratio of excess pore water pressure divided by the total stress of the new fill placed over the wick drain system), due to the contractive behavior of the ash. Based on these recently completed laboratory testing; the Geosyntec defined pore pressure ratios of 115%, 33% and 27% limits for 10, 20 and 30 foot high fills, respectively, described in Attachment 1 submitted several weeks ago, pose too much risk for another flow slide from AECOM's perspective. We have attached our computations for fill stability if full undrained conditions were to occur in the ash for a wedge block type sliding plane. For final stockpile geometry, the computed safety factor is less than unity for undrained ash strength. This shows the importance of loading the ash in a slow manner to ensure drained behavior during the ash placement operation.
2. High Void Ratio Ash Under Crust – The failed, saturated flyash existing beneath the dredge cells have high void ratios (ranging from 0.8 to 1.2). We could not find any water content measurements on Standard Penetration Test (SPT) samples taken by Mactec to estimate void ratio, assuming a specific gravity of 2.3. If this data is available, we suggest Geosyntec review this information with the TVA to know the void ratio of ash beneath the former ball field. Furthermore, the void ratios under non-failed portions of the Dredge Cell 1 increase with depth; this is contrary to what is expected for normally consolidated materials deposited hydraulically. Normally sluiced dredged fill material become denser with depth due to higher vertical stress, resulting increasing normal consolidation of a particulate media by increased overburden stresses.
3. Measure Excess Pore Pressures – We concur with Geosyntec's selection to use real-time, continuous readout, vibrating wire piezometers with alarms located in within the saturated ash to detect fill induced excess pore water pressure that could develop due to rapid placement of fill over saturated high void flyash. For normal soft soils there should be excess pore water pressure generated when fill is placed over it until upward seepage occurs into the wick drains and upward into the drainage blanket or sideways to lesser hydraulic head locations under or around the Stockpile.
4. Ash Placement Rates – We expect the ash will be placed in uniform 2-foot thick lifts across the entire footprint of the Test Area A and B. Once the first lift is complete a second lift can be placed. Time should be provided to ensure that all of the piezometers and inclinometers are read before the next lift is placed. Our goal should be to make sure filling rates are slow enough to allow drained behavior in the ash during the stockpiling.
5. Settlement Plates - Settlement plates placed over the wick drain system at the base of the temporary stockpile will measure actual vertical compression of the failed ash to complement the concept that with increasing more surcharge pore water is forced out of the ash resulting in a denser material, therefore resulting in settlement or consolidation.
6. Clay Strengths – We have run vane shears in AECOM Boring 09-402 in silty clay under ash, at the toe of Cell 1 next to Swan Pond Road, and measured peak strengths ranging from 500 to 1,825 psf. We also measured vane shear strengths in AECOM Boring B 09-604 located at the southeast corner of Dredge Cell No. 1. It had measured vane peak undrained shear strengths ranging from 2,025 to 3,575 psf. We checked sliding at elevation 720 feet using an assumed undrained shear strength of 1,200 psf computed using an assumed

$S_u/\sigma v'$ ratio of 0.3 for clay at elevation 772.0 feet and mid height fill slope at elevation 780 feet (1/2 of the excepted height of the 30 –foot high stockpile). Our wedge block analysis is attached. We did not receive any Mactec or Geosyntec measurements or recommendations regarding the undrained shear strength of the foundation clay under the proposed stockpile. However, the presence of the wick drains approximately 5 feet into clay should allow drained behavior and clay sliding should not be a problem. Inclinometers and piezometers will be used to monitor the clay draining so that there are no slide planes developing in the clay.

7. Vertical Inclinometers – The inclinometers are used to monitor fill induced lateral shear strains created by the presence of the adjacent slope or driving forces created by the construction of the temporary Ash stockpile. The purpose of these instruments is to measure lateral movements and to determine if lateral movements are substantially less than measured vertical movements (determined from the settlement plate readings).
8. Rate of Filling – The contractor should be flexible in fill placement rates to ensure the footprint can allow full lift coverage before the next lift is placed. Should measured pore water pressures the above suggested trigger limits, alternate filling should be done in Area A or over the former North Dike under the Ball Field area. The goal should be to fill at a rate that allows ash drainage with little pore water pressure buildup.
9. Construction Oversight – It is very important that Geosyntec have skilled personnel on site that can will take daily readings and have the authority to stop filling if the ash exhibit undrained behavior.

The temporary stockpile fill will confirm whether ash deposition will cause excess pore water pressures in the ash and evaluate the dissipation of excess pore into the wick drain and the overlying drainage blanket system constructed under the base of the stockpile fill.

If there is little excess pore water pressure generated and minimal settlement, the ash is carrying the load on particle edges, like an uniformly graded fine sand or silt deposit. The concern here is that the loose sand or silt particles can suddenly shift under load from an edge to edge orientation to attempt to nest into a more stable denser structure, thus causing a rapid rise in excess pore water pressure and loss of the ash shear strength. This could lead to a sudden flow slide or static liquefaction. Since there is level ground beyond the test fill, the consequences of a flow slide or shift is minor. Furthermore, the existing 3H:1V cut slope from the north crest of Cell No. 1 is from elevation 817 feet down to the failed ash plain at elevation 757 feet.

As further confidence to move forward with the Temporary Stockpile, the initial test embankment over failed ash next to AECOM boring 09-404 constructed of excavated ash from the Cell No. 1 test trench did not result in excessive settlement or lateral displacement. For 6 feet of fill placed over failed ash over a two week period, the settlement plates on ash settled less than 1 to 2.5 inches and the inclinometer showed lateral outward movement down 20 feet but limited to a maximum of ¼ inch at grade. There was no increase in pressure in the Boring 09-404 multi-level piezometers as they were situated just outside the footprint of the test fill and experienced minimal shear strains at depth from the construction of the test fill. We have observed the stockpiling of failed ash in the sloughs over failed wet ash. Several of these stockpiles exceed 15 feet in height but were built slowly.

The importance of the test pad and temporary stockpile fill is to demonstrate whether loading creates excess pore water pressures within the failed ash and underlying clay soils. If problems with excess pore water pressure occur, the fill slopes of the temporary stockpile could be flattened to 4H:1V or 5H:1V to reduce driving stresses.

D. AECOM Review Comments on the Instrumentation Plan

The updated instrumentation plan looks good. We suggest the test pad be located over the PA-3, Pc-3 and SP-3 instruments.

Summary

We are in favor of this engineered temporary stockpile at the Ball Field with performance monitoring based on drained conditions. We can learn much about the foundation clay and failed flyash under monitored loading for relocated flyash built in stages up to 30 feet high above a wick drained improved foundation. AECOM supports the premise that this engineered test fill solution based on analysis, design assumptions and testing be verified by daily monitoring and surveys.

It would be very useful to run SPT test borings and/or CPTu after the fill has reached 10 and 20 feet high to measure if there has been an increase in fill strength or consolidation of the failed loose and submerged flyash. We suggest their plan include some post-fill testing and CPTu probes to see if there have been ground improvements due to surcharge loading.

We suggest TVA and AECOM be copied on this daily instrumentation performance data to assist in site remediation design and review. Please call us if you have any questions.

Very truly yours,

William H. Walton, P.E., S.E.
Vice President, Senior Principal Engineer

William Butler, P.E.
Senior Geotechnical Engineer

Attachments – Staged Stability Check of Temporary Stockpile at Ball Field

cc: Barry Snider – TVA – bssnider@tva.gov
Gonzalo Castro – Consultant – gv.castro@verizon.net

Calculation Sheet

Project	Originated By	Date	Checked By	Date	STS Job No.	Subject	Scale	Sheet No.
KINGSTON	MHW	4/3/09	PC	4-3-09	0095744	TEMPORARY STORAGE AT BALL FIELD	1" = 20'	1 of 2

SECTION: BALL FIELD TEMPORARY STORAGE

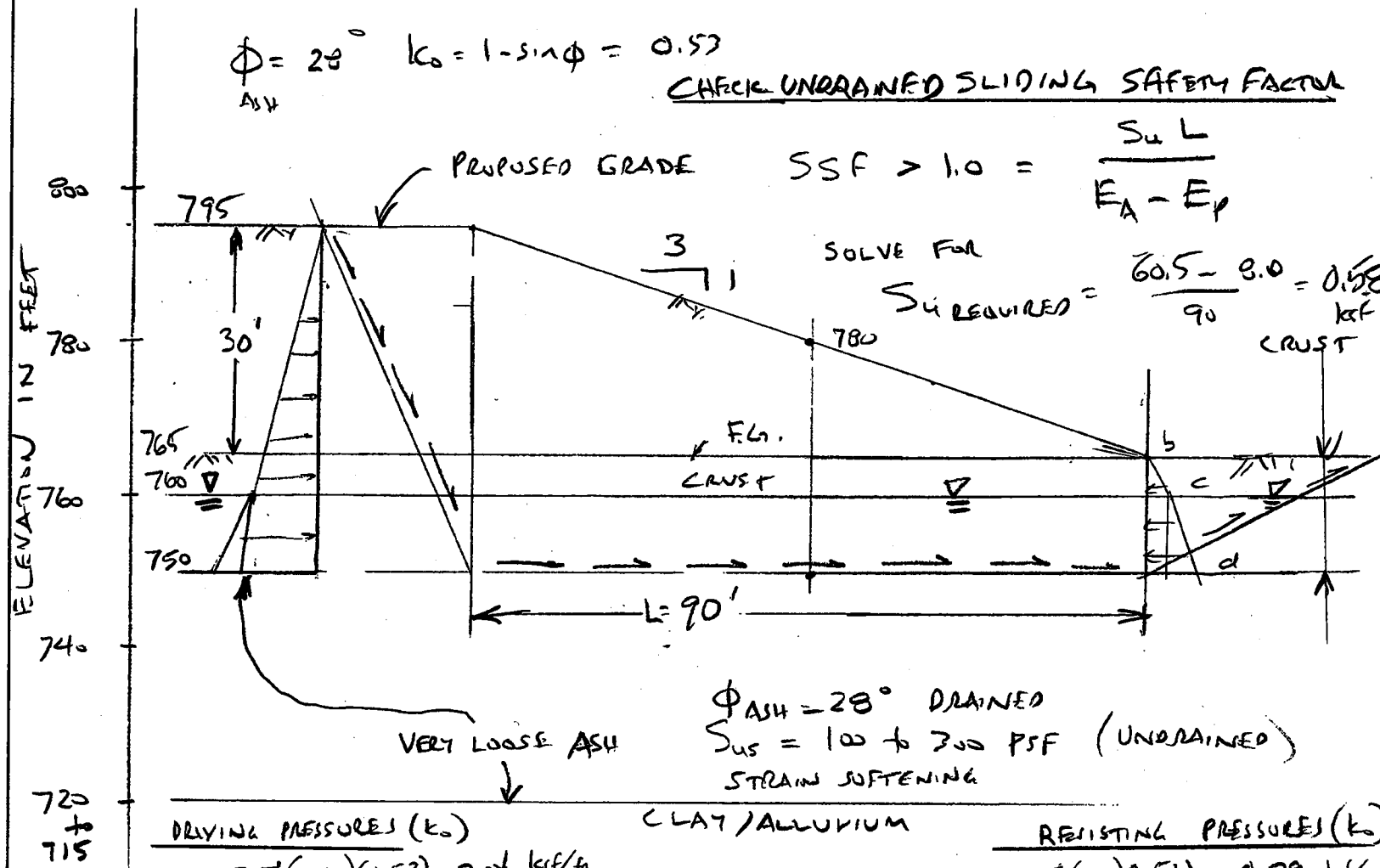
SCALE: 1" = 20' H & V

$\phi_{ASH} = 28°$ $K_o = 1 - \sin\phi = 0.53$

CHECK UNDRAINED SLIDING SAFETY FACTOR

$$SSF > 1.0 = \frac{S_u L}{E_A - E_p}$$

SOLVE FOR S_u REQUIRED $= \frac{60.5 - 8.0}{90} = 0.58$ ksf



$\phi_{ASH} = 28°$ DRAINED

$S_{us} = 100$ to 300 PSF (UNDRAINED) STRAIN SOFTENING

DRIVING PRESSURES (k_o)

a. $35'(0.11)(0.53) - 2.04 = 0.25$ ksf/ft

b. $2.04 + 10(0.0476)0.53 + 10(0.0624) = 2.91$ ksf/ft (0.624)

$E_A = \frac{2.04(35)}{2} + \frac{2.04 + 2.91}{2}(10) = 35.7 + 24.75 = 60.5$

RESISTING PRESSURES (k_o)

c. $5(0.11)0.53) = 0.29$ ksf/ft

d. $0.29 + 0.25 + 0.624 = 1.16$ (0.29, 7.25)

$E_p = \frac{0.29(5)}{2} + \frac{0.29 + 1.16}{2}(10) = 8.0$

STS | AECOM

Calculation Sheet

Project	KINGSTON			Subject	TEMPORARY STORAGE AT BALL FIELD		
Originated By	Date 4/3/09	Checked By PC	Date 4-3-09	STS Job No. 60095742	Scale NTS	Sheet No. 2	Of 5

STRESS RATIO ~ σ_c/σ_p

TRY: $S_{us} = SR\,\bar{\sigma}_v$ @ EL 780 MID FILL HEIGHT

SR FROM AFRICAN ASH TEST = 0.12 (see Attached)

$S_{us} = 0.12\left(20(0.11) + 10(0.0473)\right)$

$S_{us} = 0.12\,(2.20 + 0.47)$

$S_u = 0.32$ ksf $<$ S_u required $= 0.58$ ksf

fn 3H:1V

THEREFORE, MUST MAINTAIN DRAINED CONDITIONS DURING FILL PLACEMENT OVER WICK DRAIN IMPROVED AREA BY KEEPING EXCESS PORE WATER PRESSURES LOW IN ASH; OR COULD GO WITH 4.5H:1V SLOPES TO REDUCE DRIVING STRESSES.

- TRY: L = 135' 4.5H:1V

$$S_{u\,\text{required}} = \frac{60.5^{k/ft} - 8.0^{k/ft}}{135\ ft} = 0.39\ \text{ksf} > S_{us} = 0.32\ \text{ksf}$$

- TRY L = 150' 5.0H:1V

$$S_{u\,\text{required}} = \frac{60.5 - 8.0}{150'} = 0.35\ \text{ksf} \sim 0.32\ \text{ksf}$$

SEE ATTACHED ASH TEST FROM DREDGE CELL AREA TO DEMONSTRATE CONTRACTIVE BEHAVIOR OF ASH

Calculation Sheet

Project				Subject			
KINGSTON				TEMPORARY STORAGE AT BALL FIELD			
Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No.	
MW	4/3/09	PC	4-3-09	60095742	NTS	3 of 5	

DURING ASH PLACEMENT WE RECOMMEND PORE PRESSURES DEVELOPED DURING FILLING DUE NO RISE ABOVE THE FOLLOWING CRITERIA

$$r_u = \frac{\Delta u}{\Delta \sigma_v} \leq 0.1 \quad \text{ALARM LEVEL}$$

$$r_u = \frac{\Delta u}{\Delta \sigma_v} \leq 0.15 \quad \text{ACTION LEVEL}$$

FOR COMPARISON THE GEOSYNTEC CHART SHOWS

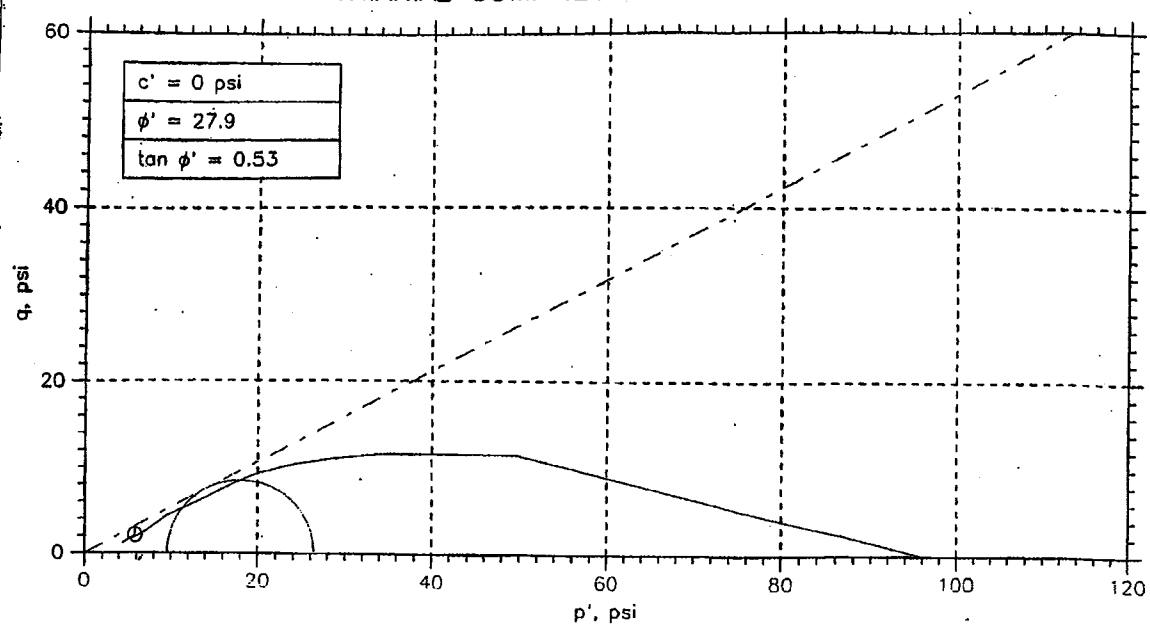
H HEIGHT OF FILL	ALLOWED PRESSURE	$\sigma_v (\gamma \cdot H)$	r_u
10'	1150 PSF	1000	1.15
20'	1000 PSF	2000	0.5
30'	800 PSF	3000	0.27

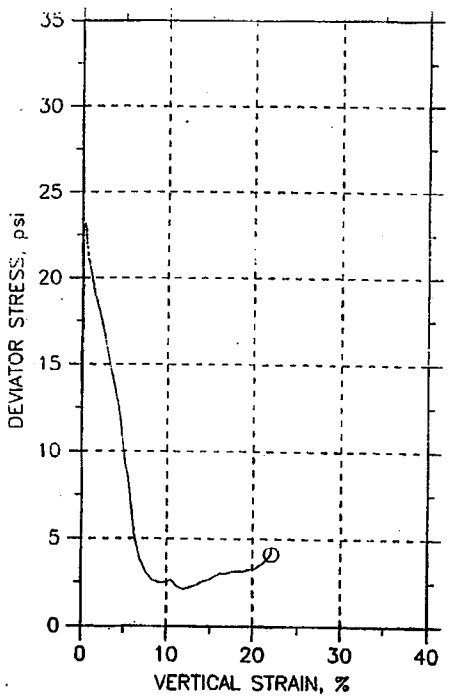
$\gamma = 100$ pcf

WE SHOULD AVOID UNDRAINED CONDITIONS. THE WICK DRAINS WITH ENCOURAGE RAPID DRAINAGE AND UNIFORM LIFTS OVER ENTIRE FOOTPRINT WILL ANY TIME FOR PORE PRESSURE REDUCTION.

4/5

TRIAXIAL COMPRESSION TEST REPORT





Symbol		○			
Test No.		5742200B T2			
Initial	Diameter, mm	71.37			
	Height, mm.	165.36			
	Water Content, %	70.21			
	Dry Density, pcf	63.73			
	Saturation, %	128.87			
	Void Ratio	1.2531			
Before Shear	Water Content, %	43.24			
	Dry Density, pcf	71.99			
	Saturation, %	100.00			
	Void Ratio	0.99452			
	Back Press., psi	70			
Minor Prin. Stress, psi		96			
Max. Dev. Stress, psi		23.177			
Time to Failure, min		4.0005			
Strain Rate, %/min		0.15			
B-Value		---			
Estimated Specific Gravity		2.30			
Liquid Limit		NP			
Plastic Limit		NP			
Plasticity Index		NP			
Failure Sketch					

Project: KINGSTON COAL TVA
Location: TN
Project No.: 60095742
Boring No.: 09-200 SET
Sample Type: RECONST
Description: COAL ASH - DARK GRAY SPECIMEN RECONSTITUTED BY DRAINED SLURRY TECHNIQUE (B=0.99)
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

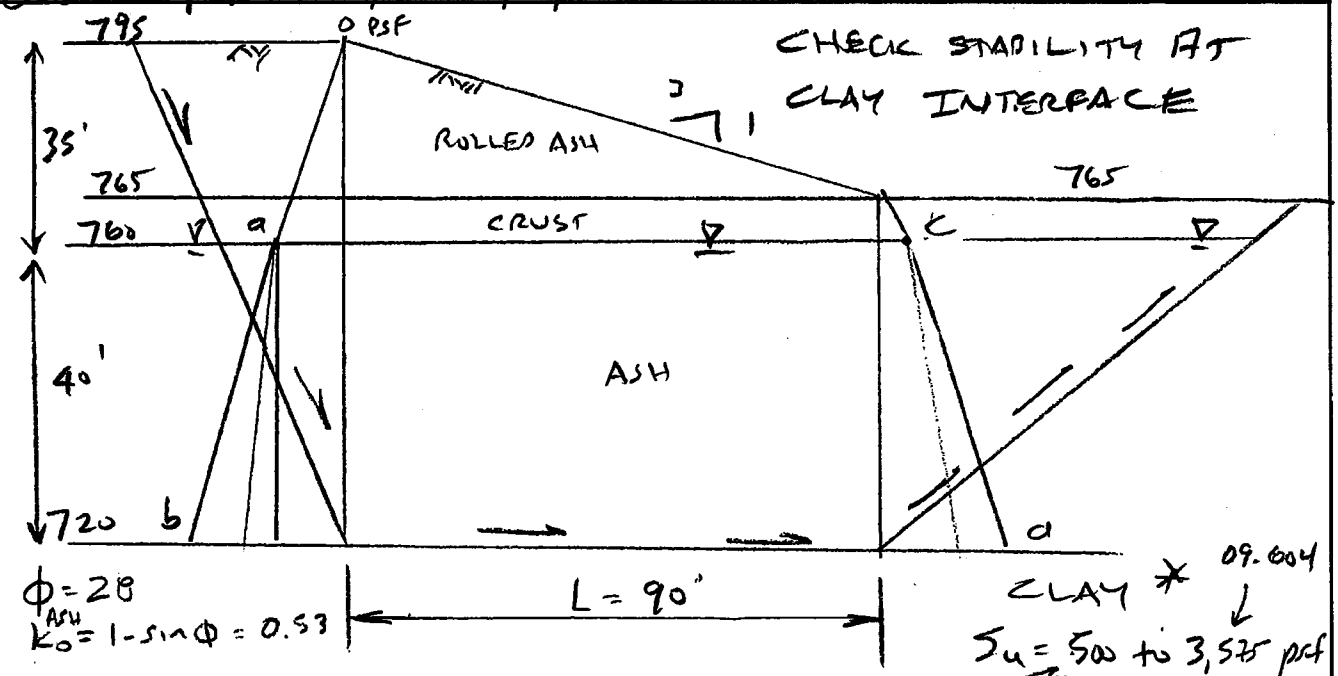
Tue, 31-MAR-2009 12:50:16

WORK-IN-PROGRESS

STS | AECOM

Calculation Sheet

Project	KINGSTON			Subject	TEMPORARY STORAGE AT BALL FIELD		
Originated By	Date 4/4/09	Checked By LWB	Date 4/04/9	STS Job No. 60095742	Scale NTS	Sheet No. 5 Of 5	



$P_a = 2.04$ ksf/ft

$P_b = 2.04 + (0.11 - 0.0624)0.53(40) + 40(0.0624)$ (1.01, 2.5)

$P_b = 5.55$ ksf/ft

$P_c = 0.29$ ksf/ft

$P_d = 0.29 + 1.01 + 2.50$

$P_d = 3.80$ ksf/ft

$E_d = \frac{2.04(35)}{2} + \frac{2.04 + 5.55}{2}(40)$

$E_d = 35.7 + 151.8 = 187.5$ k/ft

$E_p = \frac{0.29(2)}{2} + \frac{(0.29 + 3.80)40}{2}$

$E_p = 0.29 + 81.80 = 82.1$ k/ft

$S_{u\,req'd} = \frac{187.5 - 82.1\ k/ft}{90} = \frac{105.4\ k/ft}{90\ ft} = 1.17$ ksf

$S_{u\,CLAY} = 0.30\,\bar{\sigma}_V = 0.30\left[(780' - 760')0.11\ ksf + 40'(0.0476\ ksf)\right]$

$= 0.30[2.2 + 1.90]$

$= 1.23$ ksf > 1.17 ksf

* HAT WICKS INSTALLED TO AVOID EXCESS PORE WATER PRESSURE

From: Howard, Jack [Jack.Howard@jacobs.com]
Sent: Thursday, November 19, 2009 2:13 PM
To: rbachus@geosyntec.com
Cc: GEOSYNTEC CONSULTANTS INC; Denton, Randy; McKamey, Shannon K; Snider, Barry S; Dotson, Vernon J Jr
Subject: FW: AECOM Peer Review Geosyntec final draft
Attachments: R60140251-Peer_Rev_Geosyntec-lwb-whw-final draft-111909-w-attachm.pdf

Bob: Attached are the comments and recommendations from Bill Walton and Bill Butler, AECOM on the Peer Review of the Geosyntec Technical Summary Ball Field Site Modification Stability Analysis 16 November 2009. We must resolve these comments as quickly as possible to get many of our current problems on the KIF Ball Field corrected. We cannot proceed with the work until we have acceptance from you and AECOM. Randy Denton will work with our contractors to develop a work sequence and time line for building the Base Layer in response to recommendation No.1, and we will supply that to you early next week. I will be sending you an e-mail today outlining our plans to address the Ball Field Issues raised in your November 17 e-mail. Please call Randy Denton or me with any questions. Thanks.

Jack Howard, Jacobs
Engineering Manager

Geosyntec consultants

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Kennesaw, Georgia 30144
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Response to 19 November 2009 Comments from AECOM
Ball Field Temporary Ash Disposal Site – Operations Modification
Kingston Fossil Plant, Harriman, TN

Introduction

Geosyntec recently provided Jacobs Engineering (Jacobs) with a 16 November 2009 document titled *Technical Summary, Slope Stability Analysis Results, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN* (Technical Summary). The Technical Summary provided slope stability analysis results regarding a Jacobs-proposed modification to the current processing and dewatering operations at the Ball Field Site (Site) at the Tennessee Valley Authority (TVA) Kingston Fossil Plant (KIF). The Technical Summary was provided to AECOM for review. TVA received a 19 November 2009 letter from AECOM titled *Review of Geosyntec's – Technical Summary Slope Stability Analysis Results Ball Field Temporary Ash Disposal Site Kingston Fossil Plant, Harriman, Roane County, TN, AECOM Project No. 60140251* (Review Letter). Mr. Jack Howard, P.E., of Jacobs requested that Geosyntec provide a response to AECOM's Review Letter.

Response to Comments

In the Review Letter, AECOM provided seven (7) comments and made six (6) recommendations related to these comments. The AECOM comments and recommendations are provided below in italic font, followed immediately by Geosyntec's response in regular font. Geosyntec will provide these responses to Jacobs and TVA, with the understanding that the responses will be provided to AECOM.

Comment No. 1 *The Jacobs Work Plan and/or Geosyntec Technical Summary should include a staging plan with time line and working elevations for the proposed site modifications. We assume no stocked ash will be placed above El. 798 feet, which is approximately 30 feet above the old Ball Field. All parties agreed stockpiles would not exceed 30 feet in height.*

Recommendation No. 1 *Provide a sequence of construction time line or schedule to show when and how the working grades will be achieved. We are concerned about rapid base ash filling up to the working grades in less than four weeks without performance monitoring and sign-off by Geosyntec, the engineer of record for this work area.*

Geosyntec Response: AECOM is correct regarding the height of the proposed stockpiles. In the Jacobs proposal, no stockpile will exceed 30 feet in height above the demarcation layer, as shown in the Jacobs plan drawing of the proposed modification presented in Attachment A. In discussions with Jacobs personnel, Geosyntec understands that over the course of the past several months, numerous small and local stockpiles have been placed across the Site, but that in general, almost all portions of the Site (and certainly the center portions of the Site) have experienced temporary stockpiles of at least 15 to 30 feet in height. There is currently 5 to 15 ft of ash over the majority of the Site. During the ongoing ash placement activities, the existing instrumentation network has been monitored to assess the response of the underlying foundation ash to the imposed loading from the temporary stockpiles. There has been little indication of excess pore pressure response, implying that the filling rate has been sufficiently slow such that the imposed excess pore pressures have rapidly dissipated. Additional discussion of instrumentation follows. The proposed Jacobs plan essentially calls for a regrading of the existing layer of ash (i.e., the base layer) over the demarcation layer to construct the "base layer." Much of this material is currently in place and the proposed plan is to prepare a relatively smooth lift of ash above the demarcation layer, not bring in significant quantities of new ash. Therefore, there is likely to not be significant "rapid base ash filling" over the next few weeks. Rather, the base filling will be primarily to establish and incrementally add and/or relocate ash to construct a relatively uniform working platform over the demarcation layer to facilitate drainage and to provide protection for the instrumentation network.

Comment No. 2 *The Geosyntec Technical Summary does not address the results of the instrumentation monitoring program which has been in place under and along the perimeter of the Ball Field site. Data from this performance monitoring program is important to confirm the assumptions made by Geosyntec in the original site development stability analysis. We understand no new instrumentation is being recommended.*

Recommendation No. 2 *Provide a written summary and interpretation of the instrumentation performance monitoring program results to date.*

Geosyntec Response: To date, Geosyntec has not prepared a formal written summary of the instrumentation response. Mr. Shannon McKammey, P.E., of Jacobs provides a weekly summary assessment of the instrumentation network response for internal review. A copy of the Jacobs summary is provided to Geosyntec. In general, as stated above, there is little indication of excess pore pressure development as a result of loading from the ash. The ability to continuously monitor pore pressures using these piezometers provides definitive information that the piezometers respond to changes in ground water levels across the Site that may be more regional in origin. This ability to continuously monitor the instrumentation network also provides confirmation that there is very little indication of excess pore water pressure development. Given the broad distribution of

instrumentation across the Site and the fact that these instruments essentially confirm Geosyntec's model for the Site, we see little advantage of adding additional instruments to effectively monitor response during implementation of the Jacobs proposed modification.

Comment No. 3 *There is no discussion on the plan to construct the base ash layer, sand base area at the processing area, and active storage layer (height undefined), all in three to four weeks. We question if the west and north base ash perimeter berms will be filled up to elevation 798 feet in that three or four week time period. We recommend this question be answered prior to mass site regrading. There is no opinion offered on maximum rate of loading to achieve the geometry of the base ash perimeter fill. We understand they are needed to promote better gravity drainage and prevent ponding of water on the stockpiles*

Geosyntec Response: This comment was addressed in the first response. The base layer is anticipated to help facilitate drainage, but is also anticipated to help provide the needed protection to the instrumentation network.

Comment No. 4 *There are no recommendations for alarm and action limits for increase in porewater pressure of horizontal movement to settlement of the foundation soils. These levels would trigger either the slowing rate of filling or stop filling. Within the AECOM letter to TVA's Ralph Rodgers dated April 4, 2009, (see attachment) alarm and action level were discussed for limits on the pre water pressure ratio (the change in positive pore water pressure in the foundation ask due stockpile filling which will increase the vertical stress). Our earlier suggestion that porewater pressure ratios not exceed 10 to 15 percent for action and work stoppage, respectively. We assume performance monitoring will continue program of having alarm and action level be maintained to ensure there are limit for the allowable displacement ratio (ratio vertical movement [from settlement plate results] to horizontal movement [from perimeter inclinometer readings]).*

Recommendation No. 4 *Confirm or establish updated alarm and action levels for both porewater pressure ratio and displacement ratio and describe what action should be taken at each warning level.*

Geosyntec Response: AECOM is correct regarding previous discussions regarding the need, use, and value of appropriate alarm or trigger levels. Geosyntec has maintained the alarm levels referenced in the AECOM comment (i.e., 10 percent for action and 15 percent for work stoppage) throughout the project. Furthermore, Geosyntec will continue to maintain these alarm levels as the project moves forward. To date, there has been virtually no indication that the pore pressure ratio exceeds even 1 percent.

Comment No. 5 *After reviewing the weekly Instrumentation Results and Summary Reports provided by Jacobs, the settlement plates have not been operational since June 25, 2009 with the exception there have been minor movements observed from the inclinometer readings. Why have they not been replaced? More importantly, the monitoring program has not recorded top of stockpile elevation over each or next to each instrument. This allows the geotechnical reviewer to quantify cause and effect. The data summary report should also list the height of fill over the instrumentation at the time of the pore water pressure readings were made and results presented as porewater pressure ratio. We understand that the porewater pressures and transducer readings are recorded continuously, without fill reading. We suggest that at the end of day the height of fill reading be taken by surveyors at the five instrumentation stations. This is needed to compute the agreed upon pore water pressure ratio limits.*

Recommendation No. 3 *Replace the damaged settlement plates or install Boros anchors to restore the ability to measure settlement under the base ash and stockpile areas.*

Geosyntec Response: One of the reasons for the construction of the proposed base layer is to provide additional protection to the buried conduit and water lines that comprise the instrumentation network. Geosyntec has made several trips to the Site and met with Jacobs personnel to develop a plan for initiating and completing repairs. Unfortunately, the ongoing operations, the thickness of the existing "base" layer of ash, and the recent heavy precipitation has prevented the team from completing the repairs. We have recently developed plans to allow access to the instrumentation and to complete the repairs. We hope to have the repairs complete by mid-December. With regards to the recommendation to perform field surveys at the end of each day, Geosyntec does not feel that this is necessary for the following two reasons: (i) it is anticipated that the "stockpile height" above each instrument cluster will change continuously and that achieving a representative correlation between fill height and instrument response will be extremely variable and potentially unreliable; and (ii) the fact that much of the Site has experienced stockpile heights of >20

ft over the past several months, implies that much of the future instrument response will reflect "unload/reload" characteristics. Geosyntec believes that careful ongoing monitoring of the current network and adherence to the proposed alarm levels will provide sufficient information to allow a timely cause/effect relationship should we see any tendency for increasing pore pressures or settlements.

Comment No. 6 *The Technical Summary by Geosyntec does not provide a discussion of the recommended rate of filling for the "base ash layer" during mass regrading of the site.*

Recommendation No. 5 *Update the stability analysis to include varying porewater pressure ratios.*

Geosyntec Response: Please see the response to previous comments regarding the filling rate. As part of this response, however, Geosyntec has performed supplemental slope stability analyses to assess the sensitivity of the calculated slope stability to increasing pore pressure ratios. Results are provided in Attachment B. These results indicate that even with pore pressure ratios as high as 25 percent, an adequate calculated factor of safety is provided. Geosyntec notes that the conditions at the Site (i.e., the Ball Field Site) have been confirmed to be much more favorable than conditions in the Dredge Cell area that does not exhibit the relatively stiff crust layer. While Geosyntec concurs with AECOM that slope stability is and should be a major concern, the combination of the installed prefabricated vertical drains and the stiff crust explain why the Ball Field Site shows a much more "subdued" response to loading, compared to other portions of the KIF site being studied by AECOM.

Comment No. 7 *We encourage the construction of drainage ditches, access roads, sand base drainage layer, area and that the base ash layer can commence along the north side of the site as this is where the Initial North Dike was located. We understand that the North Dike was founded on the natural alluvial would and will provide lateral resistance to movement of the foundation ash during base ash filling.*

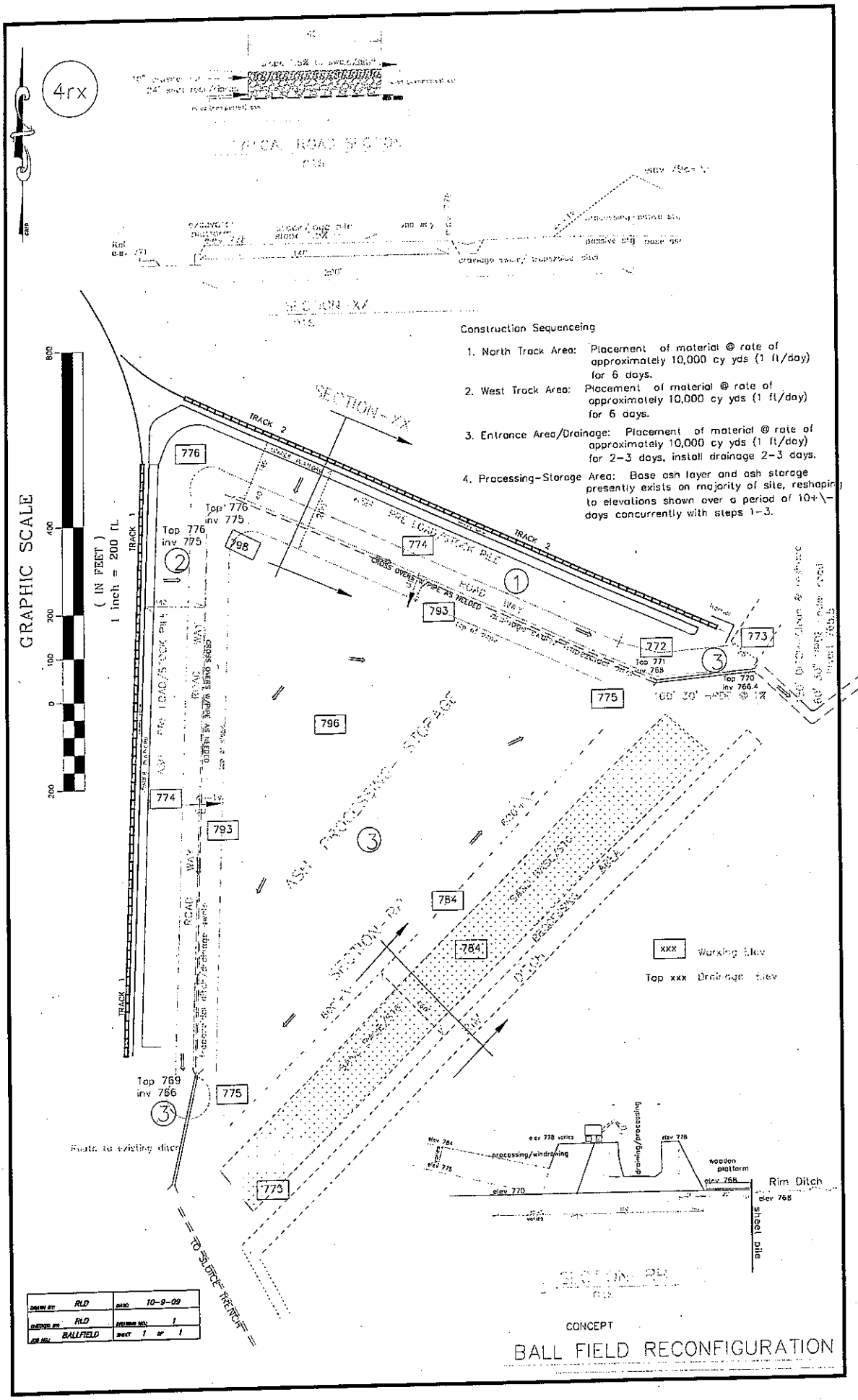
Recommendation No. 6 *Commence with the construction of drainage ditches, access roads, sand base layer, and bas ash filling over the north side of the site as this is in the area is protected by wick drains and the former North Dike foundation.*

Geosyntec Response: Geosyntec concurs with this recommendation and believes that any and all efforts to control and divert surface water to perimeter ditches will be beneficial. Therefore, we believe that implementation of the Jacobs proposed modification should be approved, including ditches, access roads, etc on the west side of the Site.

Closure

Geosyntec believes that these responses address the AECOM concerns and comments. Should TVA, Jacobs, and/or AECOM have any question, please do not hesitate to contact Geosyntec. We appreciate the opportunity to work with TVA and Jacobs on this project.

ATTACHMENT A


4rx
GRAPHIC SCALE
(IN FEET)
1 inch = 200 ft.
Construction Sequencing
1. North Track Area: Placement of material @ rate of approximately 10,000 cy yds (1 ft/day) for 6 days.
2. West Track Area: Placement of material @ rate of approximately 10,000 cy yds (1 ft/day) for 6 days.
3. Entrance Area/Drainage: Placement of material @ rate of approximately 10,000 cy yds (1 ft/day) for 2-3 days, install drainage 2-3 days.
4. Processing-Storage Area: Base ash layer and ash storage presently exists on majority of site, reshaping to elevations shown over a period of 10+\- days concurrently with steps 1-3.
SECTION-XX
SECTION-YY
SECTION-ZZ
TRACK 1
TRACK 2
ROAD WAY
ASH PROCESSING-STORAGE
ASH PROCESSING-STORAGE AREA
DITCH
CROSS OVER WAPHE AS NEEDED
Top 776 inv 775
Top 771 inv 768
Top 770 inv 766.4
Top 769 inv 766
Route to existing ditch
xxx Working Elev
Top xxx Drainage Elev
processing/windrowing
draining/processing
wooden platform
Rim Ditch
sheet pile
elev 770
elev 768
elev 775
elev 776
elev 784
TO BRIDGE TRENCH
RLD
10-9-09
BALLFIELD
CONCEPT
BALL FIELD RECONFIGURATION

ATTACHMENT B

Attachment B

Stability Analysis for Ball Field Reconfiguration (Excess Pore Pressure Condition)

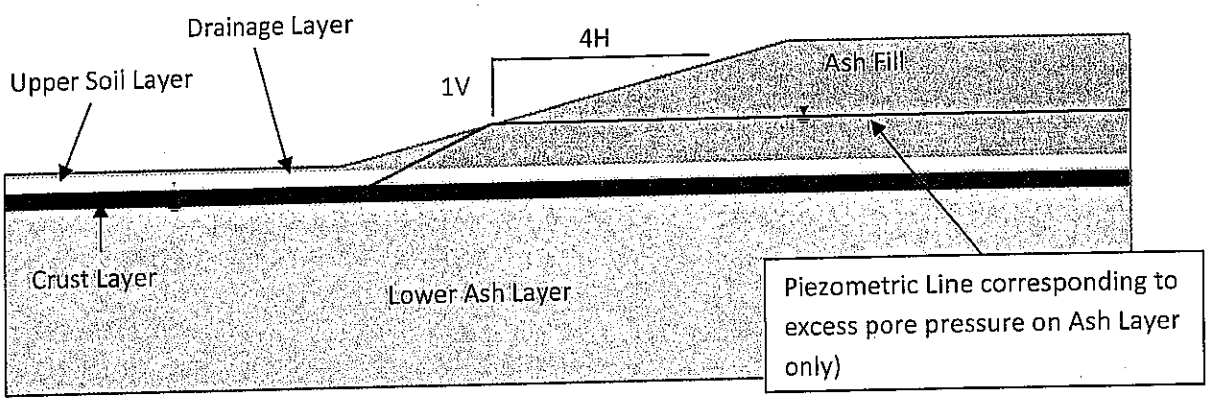
Assumptions

A piezometric line was assigned only to the lower ash layer to simulate the excess pore pressure condition in the lower ash.

Material Properties

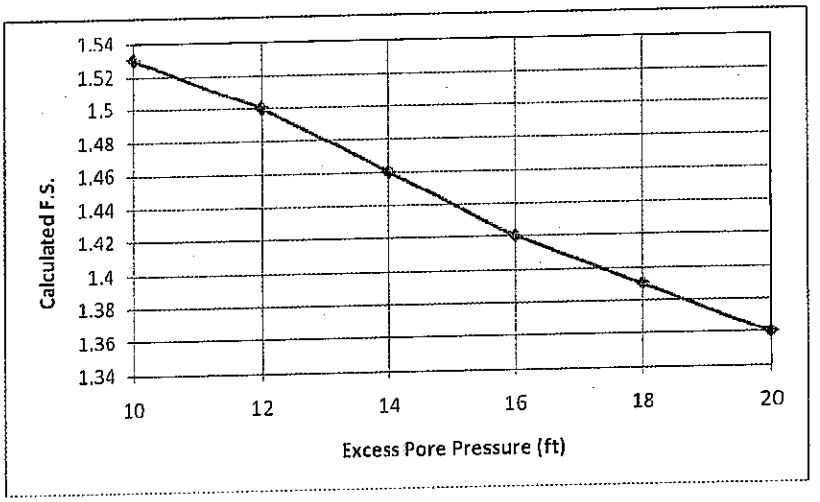
Material	Layer Thickness (ft)	Unit Weight (pcf)	Shear Strength
Ash Fill	30	100	c=0, $\phi = 25^{\circ}$
Drainage layer	1	135	c=0, $\phi = 35^{\circ}$
Upper Soil Layer	5	90	c=0, $\phi = 25^{\circ}$
Crust Layer	5	120	c=500 psf, $\phi = 10^{\circ}$
Ash Layer	50	75	c=0, $\phi = 20^{\circ}$
Clayey Foundation Soil	20	100	c=0, $\phi = 28^{\circ}$

Geometry:

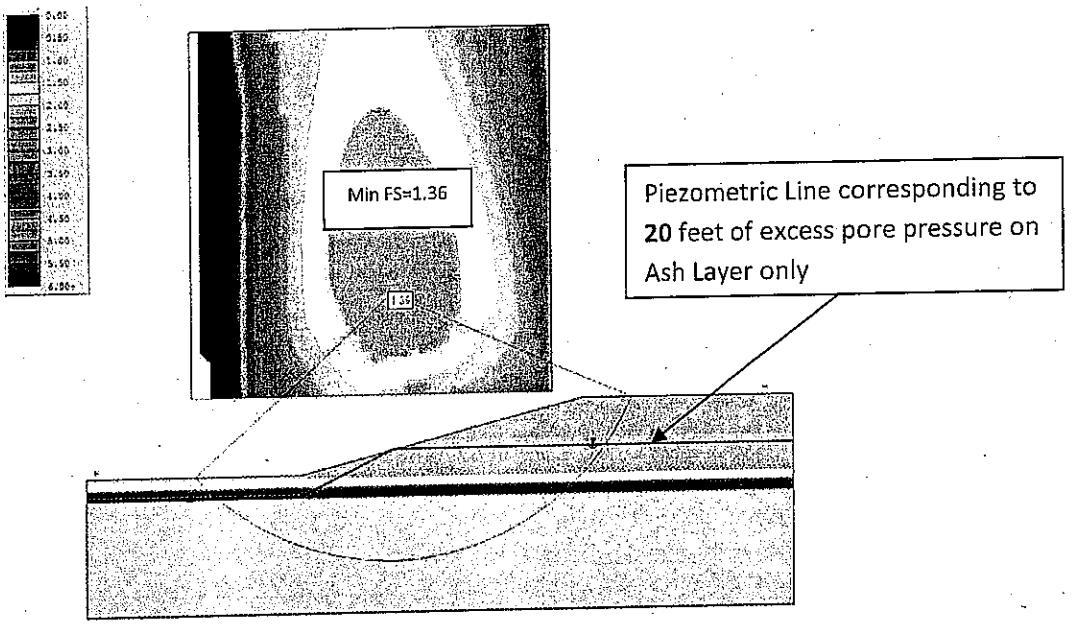


Summary of Results

Excess Pore Pressure in the Lower Ash (ft)	Excess Pore Pressure Ratio	Calculated FS
10	0.21	1.53
12	0.25	1.50
14	0.29	1.46
16	0.33	1.42
18	0.37	1.39
20	0.42	1.36



Graphic Result for an Example Case (Excess Pore Pressure in the Lower Ash = 20 feet)



Input file for the Example Case(Excess Pore Pressure in the Lower Ash = 20 feet)

Document Name

File Name: 4H to 1V 20' excess pp.sli

Project Settings

Project Title: TVA Kingston Ball Field - Case No.8
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: 3

Material Properties

Material: Upper Soil Layer
Strength Type: Mohr-Coulomb
Unit Weight: 90 lb/ft3
Cohesion: 0 psf
Friction Angle: 25 degrees
Water Surface: None

Material: Ash Layer (Consolidated)
Strength Type: Mohr-Coulomb
Unit Weight: 75 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Piezometric Line 1
Custom Hu value: 1

Material: Ash Fill
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 0 psf
Friction Angle: 25 degrees
Water Surface: None

Material: Gravel Layer
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Crust
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 500 psf
Friction Angle: 10 degrees
Water Surface: None

List of All Coordinates

Material Boundary

0.000	758.000
300.000	758.000

Material Boundary

90.000	768.000
300.000	768.000

Material Boundary

0.000	767.000
300.000	767.000

Material Boundary

0.000	763.000
300.000	763.000

External Boundary

90.000	768.000
0.000	768.000
0.000	767.000
0.000	763.000
0.000	758.000
0.000	710.000
300.000	710.000
300.000	758.000
300.000	763.000
300.000	767.000
300.000	768.000

300.000	798.000
210.000	798.000
Piezo Line	
0.000	759.000
90.000	759.000
130.000	778.000
300.000	778.000
Search Grid	
45.884	800.595
197.990	800.595
197.990	954.232
45.884	954.232

AECOM
1035 Kepler Drive
Green Bay, Wisconsin 54311

920.468.1978 tel
920.468.3312 fax

December 3, 2009

Mr. Barry Snider, P.E.
Tennessee Valley Authority
1101 Market Street, LP 5E-C
Chattanooga, Tennessee 37402

Subject: Geosyntec's November 30, 2009, Response to 19 November Comments from AECOM Ball Field Temporary Ash Disposal Site – Operations Modification, Kingston Fossil Plant, Harriman, Tennessee -- AECOM Project No. 60140251 Task 500.1

Dear Mr. Snider,

As requested by Jack Howard of Jacobs Engineering (Jacobs), on December 2, 2009, we reviewed the following documentation from Geosyntec in response to AECOM's review letter dated November 19, 2009.

Document Reviewed

AECOM has conducted a review of the following document:

1. Geosyntec's November 30, 2009, Response to 19 November 2009 Comments from AECOM Ball Field Temporary Ash Disposal Site – Operations Modification Kingston Fossil Plant, Harriman, Tennessee.

Review Comments

AECOM has read, and now has a better understanding of the Ball Field re-grading plan, construction sequence and timing of work efforts. We are pleased to know that the instrumentation program will be maintained and damaged equipment replaced. We are also pleased to know that Geosyntec will continue to review Jacobs instrumentation monitoring program on a weekly basis. Geosyntec's conclusion is that the wick drains, blanket drain and ash crust have limited the development of excess pore water pressure in the submerged ash. It is understood that shear strains and excess positive pore water pressure has been minimal to date.

Recommendations

Construct the grading plan as shown on the Jacobs Plan titled Ball Field Reconfiguration, dated October 9, 2009. We understand Jacobs will limit fill heights to El. +798 feet.

Maintain the existing instrumentation program, replace damaged settlement plates or install Boros Anchors or equal. Survey the top of the fill over each of the five instrumentation stations on a daily basis. Perhaps a remote survey of the fill can be done from a dozer instrumented with GPS.

Continue the warning and action triggers for excess pore water pressure ratios of 0.1 and 0.15, respectively. This requires that top of fill readings be taken to compute the change in vertical stress. Continue the deformation ratio check which compares settlement plate (volumetric compression strain) to inclinometer movements (shear strain). Geosyntec should provide trigger and alarm levels for acceptable deformation ratio in general accordance with Ladd (1991) or Stantec criteria for Test Area A. Both of these quantitative trigger measurements require settlement readings.

Jacobs should continue to share instrumentation and fill settlement reports with Geosyntec on a weekly basis. Geosyntec should comment in writing that the fill is performing in accordance with the design assumptions.

Summary

AECOM recommends that Jacobs proceed with Ball Field re-grading while maintaining and repairing/replacing instrumentation to maintain the five settlement plate and piezometer stations and six inclinometer locations. We assume the recommendations above will be acceptable and construction need not be delayed to allow a response to our comments.

Please call us if you have any questions.

Sincerely,

William H. Walton, P.E., S.E.
Vice President, Senior Principal Engineer

William Butler, P.E.
Senior Geotechnical Engineer

Cc : Jamie Dotson – TVA – vjdotson@tva.gov
Jack Howard – Jacobs – Jack.Howard@jacobs.com

AECOM
750 Corporate Woods Parkway
Vernon Hills, Illinois 60061

847.279.2500 tel
847.279.2510 fax

December 30, 2009

Mr. Barry Snider, P.E.
Tennessee Valley Authority
1101 Market Street, LP 5E-C
Chattanooga, TN 37402

Sent via e-mail: bssnider@tva.gov

Re: Review of Geosyntec's Slope Stability for Proposed Windrow Area, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN – AECOM Project No. 60140251, Task 600.1

Dear Mr. Snider,

As requested by the Tennessee Valley Authority (TVA) and Jacobs Engineering (Jacobs), AECOM has reviewed the latest Geosyntec's Slope Stability Analysis for the Proposed Windrow Area at the Ball Field Temporary Ash Disposal Site at the Kingston Fossil Plant near Harriman, Tennessee.

Documents Reviewed

AECOM conducted a review of the following document forward to AECOM on December 28, 2009 by Jacobs:

1. Stability Analysis for Proposed Windrow Area, 22 pages, prepared by Geosyntec dated December 23, 2009.

Previously, AECOM reviewed the following documents provided by Jacobs and Geosyntec for this site.

1. Technical Summary Slope Stability Analysis Results Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Harriman, Tennessee prepared by Geosyntec dated November 16, 2009.
2. Ball Field Process and Storage Improvement Work Plan prepared by Jacobs, undated.
3. KIF Ball Field Site Instrumentation Results & Summary Reports from June 6, 2009 to October 10, 2009 prepared by Jacobs.
4. Geosyntec Construction Quality Assurance (CQA) Plan, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN, 5 pages, dated April 1, 2009.
5. Geosyntec Test Pad Construction and Testing Program, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County TN, 4 pages, dated March 30, 2009.
6. Geosyntec Interpretation of Performance Monitoring System, Ball Field Temporary Ash Disposal Site, Kingston Fossil Plant, Harriman, Roane County, TN, 6 pages, dated March 30, 2009.
7. Geosyntec Figure 3 Instrumentation Plan, TVA Kingston Fossil Plant, Revision 2, dated March 23, 2009.

Review Comments

Jacobs proposes a windrow fill technique to assist in the processing of drying flyash and sediments dredged from the Emory River at the Ball Field site. The windrow area will be located 200 feet northwest of the east side rim ditch. Site drainage will be improved by construction of a perimeter ditch system and

a sloping base ash layer. This base preparation program was reviewed and accepted by AECOM during out last review dated December 3, 2009. Flyash dredged from the rim ditch will be placed in a windrow fill to facilitate the drying the flyash. This ash handling process will be marshaled westward in a series of windrows until the ash is dry enough to be placed in railcars for offsite disposal or in stockpile at the far west side of the Ball Field site.

The maximum crest elevation the windrow will be +798 feet and we understand that the top of the ash base layer will be at elevation +780, therefore the maximum height of the windrows will be 18 feet. There will be 30 feet spacing between windrows. We also understand that side slopes for the windrows will be constructed at 1H:1V.

The purpose of the stability analysis was to determine the global stability of the foundation soils beneath the windrows and the internal stability of the flyash constructed windrow stacks. We have reviewed the Geosyntec Technical Summary report and have the following comments and recommendations.

1. We agree with using a minimum Factor of Safety (FS) of 1.3 for the static short term global condition at the Ball Field area. We concur with Geosyntec that the computed local shallow stability of wet ash side slopes seeping water will have computed FS less than unity. This can be managed using mechanical equipment, but personnel on foot should be restricted from being along toe of the windrows to avoid burial by sloughing.
2. We have seen flyash placed in temporary stockpiles at the site with side slopes of 1H:1V to 2H:1V. However, there will sloughing of the sides of the windrows especially after rains or if the ash is overly wet. We concur with the setting up of protocols for controlling equipment operations and limiting personnel access to the area between windrows.
3. We agree with Geosyntec that no windrows of flyash should be placed above elevation 798 feet, which is approximately 30 feet above the Ball Field base subgrade system of a blanket drain and wicks into loose wet flyash and clay.
4. We suggest all of the instrumentation under the site be restored and that daily instrument measurements include survey of the top of ash placed over the five instrumentation stations. We assume Geosyntec and Jacobs are responsible for interpreting the collected instrumentation and fill survey readings and reporting their findings to TVA. If filling causes excessive pore water pressure buildup or excess lateral deformation, then actions should be taken to lower stockpiles or slow the filling rates to ensure stability under the ash stock piles is maintained. We understand no new instrumentation is being recommended.
5. There are no recommendations for alarm and action limits for increase in porewater pressure or horizontal movement to settlement of the foundation soils. These levels would trigger either the slowing rate of filling or stop filling. We suggest Geosyntec and Jacobs adopt earlier protocols outlined in Geosyntec's March 31 and April 1, 2009 reports.

Recommendations

We recommend that the final work plan addressing Ball Field regrading and windrow activity include a more detailed discussion of the following topics:

1. Written commitment to protect instrumentation in the windrow areas and replace damage instrumentation
2. Provide a written summary and interpretation of the instrumentation performance monitoring program results on a weekly basis with reporting to TVA.
3. Confirm or re-establish updated alarm and action levels for both pore water pressure ratio and displacement ratio and describe what action should be taken at each warning level.
4. Establish written protocols for equipment operations and personnel access to the area between active windrows.

Summary

We support the use of windrows to promote drying of the ash in the processing area. We recommend that Jacobs issue a weekly instrumentation performance report and that information be communicated to Geosyntec and TVA to make sure the ash regarding windrow program is not triggering movement or excess pore water pressure development in the loose, wet foundation ash under the wick drain protected Ball Field. This review is limited to ash fills placed on the Ball Field and does not apply to filling in the dredge cell area.

Please call us if you have any questions.

Very truly yours,

William H. Walton, P.E., S.E.
Vice President, Senior Principal Engineer

William Butler, P.E.
Senior Geotechnical Engineer

cc: Jamie Dotson – TVA – vjdotson@tva.gov
Jack Howard – Jacobs – Jack.Howard@jacobs.com

From: RBachus@Geosyntec.com
Sent: Wednesday, January 06, 2010 11:53 AM
To: Denton, Randy
Cc: Howard, Jack L.
Subject: RE: Modirfied Work Plan-inc. comments
Attachments: WORK PLAN-BALLFIELD-Jan4RV_rcb.pdf

Randy: Geosyntec concurs with the recommendations provided in the revised Work Plan. Two small comments:

1. I thought we had five instrumentation locations, not four.
2. Why the difference between samplers staying 50 ft away, while other people are allowed within 30 ft?

All other aspects are fine.
Bob

From: Denton, Randy [mailto:rdenton@tva.gov]
Sent: Monday, January 04, 2010 9:46 AM
To: Robert Bachus
Cc: Howard, Jack L.
Subject: Modirfied Work Plan-inc. comments

Final Draft-Work plan on ball field, for your review and concurrence.
Thanks, Randy

From: Howard, Jack [mailto:Jack.Howard@jacobs.com]
Sent: Monday, January 04, 2010 7:14 AM
To: RBachus@Geosyntec.com
Cc: McKamey, Shannon; JJWang@Geosyntec.com; Denton, Randy
Subject: RE: Draft comments to Geosyntec Letter dated November 30, 2009 for the Ball Field Temporary Ash Disposal Operation Modification Plan.

Bob: We don't need anything else from you on this. Randy will modify the Ballfield Work Plan to incorporate these changes and send to you for concurrence. We will need your concurrence notification as quickly as possible, once Randy sends that to you. Thanks.

Jack Howard, Jacobs

From: RBachus@Geosyntec.com [RBachus@Geosyntec.com]
Sent: Monday, January 04, 2010 6:27 AM
To: Howard, Jack
Cc: McKamey, Shannon; JJWang@Geosyntec.com
Subject: RE: Draft comments to Geosyntec Letter dated November 30, 2009 for the Ball Field Temporary Ash Disposal Operation Modification Plan.

Jack: I am sorry for the delay in getting back to you. I went back and found this letter from AECOM and I believe that this is the one you were referencing during our call. I do not see any actions that we need except to get the instrumentation system working and to develop a protocol for receiving data from Shannon. I note that they were requesting the daily surveys. Have these been obtained?
What other actions do you need form us?
Bob and Justin

From: Howard, Jack [mailto:Jack.Howard@jacobs.com]
Sent: Thursday, December 03, 2009 5:29 PM
To: Robert Bachus; Justin Wang

Cc: vjdotson@tva.gov
Subject: FW: Draft comments to Geosyntec Letter dated November 30, 2009 for the Ball Field Temporary Ash Disposal Operation Modification Plan.

Bob & Justin: Attached are AECOM's response to your latest submittal on the Ball Field. I think this will work for us, even though the daily survey of fill levels on the instruments will be a burden. You argued against this in your response, but is there anything we can do about this? Please let me know your position this evaluation as soon as possible. Thanks.

Jack Howard, Jacobs

-----Original Message-----
From: Butler, Bill W. [mailto:bill.butler@aecom.com]
Sent: Thu 12/3/2009 5:07 PM
To: bssnider@tva.gov; Dotson, Vernon J Jr; Howard, Jack
Cc: Walton, Bill
Subject: Draft comments to Geosyntec Letter dated November 30, 2009 for the Ball Field Temporary Ash Disposal Operation Modification Plan.

Good Afternoon Barry, Jamie and Jack:
Attached is our draft comments to Geosyntec Letter dated November 30, 2009 for the Ball Field Temporary Ash Disposal Operation Modification Plan.
Please review and forward any comments to either Bill Walton or me.
Have a great day.
Bill

William Butler, P.E.
Senior Geotechnical Engineer
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