NEW DEWATERING INNOVATIONS AT AN ASH LANDFILL CLOSURE

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INTRODUCTION

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PROJECT OVERVIEW

At a power station located in the Coastal Virginia – Hampton Roads region, grading and capping of an existing ash landfill was required. During the course of construction, the earthmoving contractor encountered an area of the landfill that was exceptionally wet. Like many contractors have experienced at other coal ash projects, after several passes with a dozer or excavator, this area would become unstable for equipment traffic.

In an effort to drain the nested water, the contractor first constructed several deep sumps. However, due to the unstable nature of saturated ash the sump was not able to reach the bottom of the landfill. In addition, a 600+ foot long rim ditch was excavated. Initially the rim ditch produced several gallons per minute of water, but was not able to stabilize the work area as the ditch began to slough.

Noticeably saturated conditions were encountered during mobilization

At this time, Sequoia Services was consulted to review the construction documents and geotechnical data for developing a dewatering program. In this review, it was revealed that a two-foot thick layer of bottom ash drainage material was placed on top of the low permeability liner, during orginal landfill construction. This drainage layer was installed prior to ash deposition. Current grade elevations where shot and it was determined that the drainage material was approximately 16-to-18 feet beneath existing grade.

Based on the information provided, it was determined that vacuum wellpoints were the appropriate dewatering tool to extract as much water from the landfill as possible. The bottom ash drainage layer provided a lense of high permeability material that could create an underdrain effect. The potential drainage impacts of tapping this lense would mean far reaching dewatering effects, and highly productive wellpoints.

The initial dewatering program consisted of a single row of (50) wellpoints with 10-foot center-to-center spacing. An engineered filter pack was designed to match the gradation of the bottom ash layer, maximizing the drainage capability. A pump was selected that would provide large air handling capabilities, but operate well with low flow rates.

During the jetting process, great care was taken to assure that the low permeability soil liner was not compromised. The jetting tool utilized was specifically chosen to target the bottom ash layer, but not puncture the liner. In the event the liner grade did not match the as-built drawings, an operator with 20+ years' experience was chosen to run the tracked excavator and closely monitor jetting rate, refusal and crowd.

Pictured: wellpoints installed along an existing rim ditch to stabilize ash for fine grading and liner

The wellpoint system was installed with tuning valves at each wellpoint in order to maintain optimum vacuum. Prior to startup, wellpoints were yield tested to determine flow rate and water quality. It is important to note that the results of these tests varied significantly. While many wellpoints produced several gallons per minute of low turbidity water, others produced negligible amount of water. Several wellpoints indicated that high iron concentrations were present in some areas of the landfill. A flowmeter was installed downstream of the settling basin to accurately track wellpoint system yields.

After initial system startup, the success of the dewatering program was quickly realized. Within days, the sumps and rim ditches became noticeably drier and more stable. Prior to the start of dewatering and outside of the landfill, there was a slope failure at an existing toe drain. This toe drain steadily flowed water. After approximately one week of wellpoint system operation, the flow from the toe drain was reduced to a slight trickle.

After 21 days of pumping on the system and hundreds of thousands of gallons of water removed from the landfill, the contractor requested Sequoia remobilize and extend the row of wellpoints. The base system plus additional wellpoints were able to stabilize the work area for placement of fill and grading of the landfill.

Pictured: Significant flow and low turbidity water can be produced from properly constructed wellpoints in ash.

PILOT TEST PROCEDURE

During the initial jetting phase, at approximately the midpoint of the system, five piezometers were installed perpendicular to the header pipe. These wellpoints were utilized to monitor water levels in the pond and conduct additional testing. During system operation, weekly piezometer readings show that water levels in the ash landfill were steadily dropping. When plotted on a logarithmic scale, the shape of the curve of drawdown was very flat. This means that the drainage effects were far reaching and could extend over several hundred feet.

These piezometers were constructed utilizing a tailored media as the filter media, in lieu of conventional concrete or masonry sand. The purpose of this replacement was to perform a pilot test on the feasibility of using wellpoints for both water removal and water pre-treatment.

At many ash ponds, arsenic and selenium are contaminants of concern in leachate. Oftentimes, owners have spent several millions of dollars on dewatering systems, only to have to spend several million more dollars to treat the dewatering discharge for permit compliance. This pilot test would reveal whether a step in this process could be reduced, or even removed.

Piezometers were installed to the same depths as the wellpoints and a refined activated alumina was installed as the filter media. Activated Alumina is well regarded in the water treatment industry for its capability to removing arsenic and selenium.

To qualitatively evaluate tailored media filters vs sand filters, each piezometer was pumped on for several hours. At specific time intervals flow rate was measured and water samples were withdrawn. In the field, water samples were analyzed for turbidity using a HACH 2100Q portable turbidimeter. Water samples were also sent to an

offsite, accredited laboratory for analysis to answer one specific question: will arsenic concentrations be lower in tailored media filter wellpoints?

Pictured: test cart with 2" contractor pump, water level indicator and turbidmeter preparing for wellpoint pilot testing. In the picture you will notice remnants of activated alumina media utilized to construct the filter pack.

SUMMARY AND CONCLUSIONS

The dewatering program was proven successful by its ability to withdraw large quantities of clean water from the ash landfill. The drainage impact of targeting the bottom ash layer were proven to be far reaching, as improvement of ash stability was realized several hundred feet from the row of wellpoints. Coal ash is known to be nearly impossible to work in a saturated state, however this project has affirmed that properly constructed wellpoints are a very successful means of draining, and subsequently stabilizing, ash ponds and landfills.

A lesson learned from this project is the importance of thorough detective work before the start of construction. Many ash ponds and landfills were generally originally constructed in areas with undesirable field conditions for contractors. This means that construction documents may not necessary match as-built conditions. One of the most valuable tools during the initial phases of the project were talking to site representatives and employees that were involved in the landfill bottom construction. These individuals provided key insight as to what conditions could be expected. As a result, the optimal dewatering program was selected.

Laboratory analysis results from the activated alumina pilot test were not received and evaluated at the due date of this paper. However, field tests have provided positive results. The initial yields of conventional sanded wellpoints vs tailored media wellpoints are comparable. Of equal importance is the comparison of water quality measured by turbidity (NTU's). Field testing of grab samples shows that there is no statistical difference between results obtained.

In the absence of the test results, bench scale testing of ash-contact water provides the most definitive insight. Whereas contact water that has passed through sand has led to no reduction in arsenic concentrations, test results for activated alumina filter pack show 60-70% reduction in arsenic.

These results suggest that wellpoints constructed with a tailored media filter pack are a viable option for ash dewatering and contact water pre-treatment. This adaptation of a nearly 100 year old technology may be an effective means to tackle budget conscience projects where short-term dewatering is necessary and it will be too costly or time consuming to mobilize a temporary water treatment system. Variables such as tailored media type (activated alumina, activated carbon, ion exchange resins, etc.), gradation, borehole size and proportions can be adjusted for varying ground conditions and contaminants of concern.