Tuesday 3/14/2017

3–4:30 p.m.

Geosynthetics in Waste Containment Facilities 2

Chairs: Krishna Reddy, University of Illinois at Chicago; Nazli Yesiller, Global Waste Research Institute / Cal Poly

Protection Geotextiles for Geomembranes in Landfill Applications

Henning Ehrenberg and Kent P. von Maubeuge, NAUE GmbH & Co. KG

Geomembranes are often used in civil engineering applications to create a hydraulic barrier. With nearly all protection-layer systems, deformations occur in the geomembrane which need to be quantitatively assessed by reference to the indentations. The geomembranes basic function is to remain impervious over the entire design life of the project. However, mechanical stresses induced by confined materials could produce a deformation of the membrane and in critical situations, could ultimately puncture it. A protection geosynthetic needs to be designed in consideration of the specified geomembrane and its thickness as well as in consideration of the soil material (typically mineral drainage layer) and the surcharge placed above. Inappropriate selection of the protection geotextile can result in a failure, e.g. puncture of the lining material. Several methods of determining puncture protection are described in different standards. This paper will describe the design-related approach for protection layers and explain the concept of one specific test. Overall this paper will give a closer insight of this design-oriented test method.

Capping a Waste Sludge Lagoon In-Place without Solidification

David Farber, O'Brien & Gere

To develop an economically viable method to close a large industrial wastewater sludge lagoon and reduce the amount of leachate generation, one of the following approaches is typically taken:

- Solidify the sludge and install a low permeability cap system
- Solidification and offsite disposal of the sludge

If a sludge cannot be solidified, using a reasonable amendment mix ratio, then capping or offsite disposal may become difficult and costly for lagoon closures. A floating geosynthetic cover system may be an economic alternative for lagoon closure and leachate minimization. A floating geosynthetic cover consisting of geogrids, a floating modular layer, and a low permeability geomembrane was utilized to close a 4.86-hectare lagoon. This system allowed crews and equipment access to the lagoon surface for installation of the cover system. This design can be applied to hazardous and non-hazardous lagoons where in-situ solidification/sludge handling is not the preferred remedy.

Sorption and Transport of Benzene Through Organoclay Amended Geosynthetic Clay Liner (GCL)

Sadra Javadi, Mohammad Ghavami, and Qian Zhao, University of Louisville

Geosynthetic Clay Liners (GCLs) have been used as a composite barrier material for almost three decades, and the design and practices of GCLs were advanced with our enhanced understanding of their physical and hydraulic performance. Although the primary application of GCLs is to serve as a hydraulic barrier, recently their applications in geo-engineering has been expanded as they were also applied to barriers, capping systems and transportation facilities targeted for different permeant fluids. This paper

focused on understanding the behavior of GCL with organobentonite amendment: specifically, the goals are (1) to quantify the impact of organobentonite amendment on the conductivity for water and other permeants. The conductivity/permittivity for variable fluids in conventional GCL, GCL with organobentonite amendment was conducted in 1D permeameter (2) to investigate the chemical sorption of organic contaminants onto the organobentonite amendment and retarded transport of organic contaminants due to sorption. Obtained results suggests that a small fraction of organobentonite amendment can slightly decrease the permeability for low polarity fluids and enhance the contaminants retention capacity of GCL.

Geomembrane Cracking and Final Cover Performance

Kevin Foye and Te-Yang Soong, CTI and Associates Inc.

Past estimates of geomembrane longevity have typically focused on the degradation of the polymer tensile properties with time, demonstrating that these materials exceed expectations for typical municipal solid waste (MSW) facilities. However, interest in the performance of geomembranes for the disposal of low-level (LLW) and intermediate-level (ILW) radioactive waste landfills poses additional challenges. Many of these facilities use probabilistic models of long-term performance in terms of contaminant transport and exposure to make design decisions. However, current models have relatively little information quantifying the potential for leakage through the geomembrane that directly consider the change in material properties with time. Studies of the various mechanical modes of deformation and rupture for polyethylene sheet allow for this quantification. An example of this approach illustrates how the consideration of crack development in final cover geomembranes can be adapted for use in simulations of long-term landfill system performance suitable for LLW/ILW facility performance assessments.

Study of the Parameters Controlling Nanoparticle Dispersion for Nanocomposite Geomembrane Applications

Patricia Dolez, CTT Group; Marek Weltrowski, Cegep de St-Hyacinthe; Eric David, Ecole de technologie superieure

Nanocomposites give an innovative method to increase the mechanical, thermal, and barrier performance of geomembranes. However, all this can only be achieved if the nanoparticles are properly dispersed in the polymer matrix. For that purpose, nanoclay particles are functionalized with organic groups for instance. Polar compatibilizing agents are also often included in the nanocomposite formulation to improve the dispersion. Still, the optimal conditions for a perfect dispersion of nanoparticles in the polymer matrix that will lead to maximal performance of the nanocomposite geomembrane are yet to be identified. To help answer this question, this paper analyses the relative importance of different parameters that affect the dispersion of nanoparticles in a polymer matrix. The effectiveness of the approach is tested with data involving high density and linear low density polyethylene, various percentages of organically-modified nanoclay, and different compatibilizing agents.

Comparing Testing of Geosynthetic Clay Liners (GCLs) with Bentonite Powder and Granular Cores

Antje Mueller-Kirchenbauer, MKP Geotechnical Engineering; Kent P. von Maubeuge, NAUE GmbH & Co. KG; Carsten Schloetzer, Hochschule Ostwestfalen-Lippe, University of Applied Sciences, Germany

Geosynthetic clay liners (also called GCLs or Geosynthetic Clay Barriers - GBR-C according to ASTM, resp. ISO terminology) can be a replacement element for the mineral sealing layer in many sealing

applications, such as landfill capping systems. Due to the thin thickness and the high sensitivity of bentonite to changes in the water content, GCLs are a sensitive structural geo-engineering element. To investigate the long-term sealing behavior of GCLs, six lysimeters were built in Lemfoerde, Germany, and were equipped with different cover systems in order to obtain further knowledge of the GCLs performance. GCLs with granular and powder bentonite filling have been investigated since 1998 and were rebuilt in the year 2010. After the first 10 years of performance, the GCL with the granular core showed an increase of the permeation through the GCL. This paper will show the results of the field study and the differences in sealing behavior of powder and granular filled GCLs.