Monday 3/13/2017

12:15–1:45 p.m.

Alternative Final Covers

Chairs: Tarek Abichou, Florida State University; Bernardo Castellanos, Virginia Tech

The Critical Role of Lateral Drainage Capacity in Limiting Leakage through a Low Permeability Geomembrane Cover

Greg Meiers and Cody Bradley, O'Kane Consultants Inc.; Tarek Abichou; Bernardo Castellanos

Waste storage facilities located near Sydney, Nova Scotia, Canada were reclaimed with engineered cover systems. Similar alternative cover systems were utilized, each comprised of a geomembrane and overlying growth medium layer; however, a drainage layer above the geomembrane was not included in all instances. The monitored field performance of the alternate cover systems highlighted the detrimental impact that ponding of water above the geomembrane will have on performance. Empirical relationships for leakage through the geomembrane as a function of ponding pressure heads highlights that the performance of a low permeable layer is enhanced if adequate lateral drainage capacity is provided to eliminate sustained periods of water ponding.

The field performance of the Hamburg-Georgswerder Landfill in Germany and the Monterey Peninsula Landfill in the United States are re-evaluated based on this finding. These case studies support the finding that the inclusion of a drainage layer mitigates risk associated with leakage attributed to geomembrane defects. However; the relative value of including lateral drainage capacity is also a function of site specific climatic conditions. Of particular importance in this regard is the intrannual and interannual variability in precipitation relative to evapotranspiration which will control the transient nature of the ponded conditions.

The Durability of Exposed Geomembrane Covers

George Koerner, Geosynthetic Institute

A most frequently asked question regarding all types of geomembranes is, “How long will they last?” This paper answers the question for exposed geomembranes assuming that they were properly designed and installed. Ultraviolet radiation, elevated temperature and full oxygen are available which shortens the service lifetime of a geomembrane. Ultraviolet fluorescent tube weathering devices per ASTM D7238 were used for incubation purposes. Five different geomembranes were evaluated. Each material was incubated at 80, 70 and 60°C until 50% reduction of strength and elongation occurred. The data was then extrapolated down to 20°C for laboratory halflife values and for comparison with the nonexposed condition. Results for geomembranes vary from 47 to 97 years with High Density Polyethylene (HDPE) being the highest.

Liner Performance: Interesting Observations and Test Results

Ian D. Peggs, I-Corp International Inc.

Three different lining systems are reviewed for their interesting performances and test results: 1) an High Density Polyethylene pond liner that suffered random groups of stress cracks in two spring times only 6 and 18 months after installation and for which cross roll direction elongation at break did not meet the manufacturer’s specification, 2) an internal Polypropylene liner in a 100 mm steel pipe containing 35% hydrochloric acid that failed and when heated for butt fusion repairs generated bubbles

in the weld zone, and 3) a 5 mm High Density Polyethylene sump box with flanges around the tops of three sides that leaked at the two top corners as a result of poor welding. While the causes of the failures vary from complex to simple all show the importance of manufacturing and construction quality control and quality assurance.

The Viability of Using Mixtures of Mine Tailings and Waste Rock in Water Balance Covers

Mohammad R. H. Gorakhki and Christopher Bareither, Colorado State University

The focus of this study was to evaluate hydrologic performance of mixed mine tailings and waste rock in water balance cover systems via one-dimensional numerical modeling. Comparisons were developed between an actual water balance cover and the following theoretical scenarios: (1) cover systems with storage layers composed of (i) copper, (ii) gold, (iii) coal, and (iv) oil sand tailings; (2) constant thickness mine tailings storage layers with waste rock inclusions; and (3) re-designed storage layer thickness composed of tailings and waste rock to yield comparable percolation rate to covers with no waste rock. Percolation rates ranged between 0.0 and 3.2 mm/yr for pure tailings water balance covers, which was comparable to predictions for the actual earthen cover. Addition of waste rock increased percolation in all cases due to reduced storage capacity. Re-designed covers composed of tailings and waste rock yielded thicker storage layers, but comparable percolation rates to water balance covers with no waste rock inclusions.

Combined Seepage and Slope Stability Analysis of Landfill Cover System

Sid Nadukuru, Ming Zhu, Cuneyt Gokmen, and Rudolph Bonaparte, Geosyntec Consultants

Composite landfill cover systems can have a variety of components and configurations. One common configuration consists of a cover soil layer, a geocomposite drainage layer (GDL), and a geosynthetic barrier layer. When properly designed and constructed, the GDL is expected to provide sufficient drainage to limit water build-up above the geosynthetic barrier layer and therefore, protect the cover system from a potential seepage-induced veneer slope failure. However, the field performance of the cover system may be impacted by changed drainage conditions, such as clogging, construction-induced wrinkling, and inadequate daylighting of the GDL. This paper presents a study in which a combined transient seepage and slope stability analysis has been performed to numerically evaluate the impact of GDL drainage conditions on veneer slope stability. The analysis results indicated that the factor of safety varies with time and can decrease significantly under certain drainage conditions. The numerical modeling framework presented in this paper can be used to improve engineering design approaches and to perform forensic evaluations of the post construction system performance.