The Geo-Institute Geoenvironmental Engineering Technical Committee will live-stream on Tuesday, December 6 at 11 AM EST. The topics include:

"Subsidence Risk Mitigation in a Low-level Radioactive Waste (LLW) Landfill Final Cover: A Case History,"
***Kevin Foye**, Ph.D., P.E., M. ASCE*

Typical waste packaging and disposal practices at low-level radioactive waste (LLW) disposal facilities introduce significant subsidence risk for the facilities' final cover systems. Subsidence is often caused by the collapse of voids in the waste packaging and surrounding cover soils that eventually propagate to the ground surface. This subsidence could result in the loss of final cover system integrity, stormwater ponding, the concentrated flow of surface water and/or gas, increased leachate generation, transport of contaminants from the landfill, and potential adverse chemical reactions within the waste mass. A case history of a 60-acre LLW final cover system design and construction project illustrates an innovative approach to this problem. This approach combines engineering simulations of the projected final cover mechanical performance, specific probabilistic performance targets, and targeted cover system improvements to manage the subsidence risk in the final design.

"*Heat Generation in MSW Landfills: Effect of Climate and Landfill Size*," ***Milind V. Khire**, Ph.D., PE, D.GE, BCEE, M.ASCE*

Municipal solid waste landfills (MSW) generate heat primarily due to the anaerobic decomposition of waste. While a majority of closed and operational landfills maintain peak temperatures that are less than 170°F, a relatively small number of landfills have reported temperatures greater than 200°F. In order to estimate heat generation rates for MSW, numerical modeling of landfills located in humid and semi-arid regions ranging in size from medium to large was carried out. The numerical modeling also evaluated the key mechanisms that drive heat accumulation and heat loss in landfills. This presentation will provide a broader perspective on the effect of climate, the age of the waste, and the size of the landfill on the overall temperature of landfills.

"*Design and Modeling of Shallow GeoEnergy Systems in Low-Temperature Subsurface,*" ***Tugce Baser**, Ph.D., P.E., M.ASCE*

Climate change poses serious risks to natural and built systems worldwide. Multiphysics phenomenon can be an essential tool supporting the three major endeavors necessary to deal with climate change: mitigation, prediction, and adaptation. In this presentation, emerging applications in geotechnical engineering that involve multiphysics processes that can assist each of these endeavors are discussed. In-situ and numerical modeling and design of various renewable geoenergy systems in the Illinois basin are presented. This presentation will provide the audience with essential tools needed for understanding the potential of energy below us and approaches to utilize it to mitigate the impacts of climate change.

"Electrokinetic Remediation of Polluted Heterogeneous Subsurface Environments," ***Krishna Reddy**, Ph.D., P.E., F.ASCE*
A wide range of toxic organic and heavy metal contaminants exist at numerous sites and pose an unacceptable risk to public health and the environment. Electrokinetic remediation technology has the potential to treat these contaminated

sites, but the effect of subsurface heterogeneities such as layers, lenses, and mixtures of different soils on the electrokinetic process has not been adequately studied. This study evaluates surfactant-enhanced electrokinetic remediation under heterogeneous subsurface conditions. A series of bench-scale experiments were conducted using two soils (sand and kaolin) spiked with a representative PAH compound (phenanthrene) in a two-dimensional electrokinetic test apparatus under various layered, lens, or mixed soil configurations. In addition, the homogeneous sand and kaolin soils were each tested alone for comparison purposes. All the experiments employed the same nonionic surfactant (5% Igepal CA-720) flushing solution and a low (0.05) hydraulic gradient. The results showed that the surfactant flushing under the low hydraulic gradient alone was sufficient for the complete removal of the contaminant from the homogeneous sand profile, whereas the electroosmotic flow generated by the application of a DC 2.0 V/cm electric potential in a periodic mode considerably enhanced the removal efficiency for the homogeneous and heterogeneous soil profiles containing kaolin. The voltage gradient varied spatially and temporally through the soil profiles and affected the electroosmotic flow and contaminant removal.

"*A Landfill Sliding Case History*,"

***Tuncer B. Edil**, Ph.D., P.E., D.GE, Dist. M.ASCE, and **Craig H. Benson**, Ph.D., P.E., NAE, D.GE., F. ASCE*

Mass movement of waste (300,000 m3) occurred during filling of a nearly filled cell in a zone-of-saturation landfill in the upper Midwestern US. The cell contained a composite liner consisting of 1.2-m of compacted clay overlain by a 1.5-mm-thick smooth high-density polyethylene (HDPE) geomembrane (GM). A nonwoven polypropylene geotextile (406 g/m2) was placed on top of the GM for protection and was overlain by 0.3-m of gravel for leachate collection. The surface of the liner in the base of the cell was 19.2 m below the surrounding groundwater table. The compacted clay liner was exposed where the waste moved, suggesting that the failure surface was between the clay liner and smooth GM (later confirmed when waste was removed). Interface shear tests were conducted on all interfaces, and large-scale direct shear tests were conducted on the waste. Porewater pressures were measured at the geomembrane-clay interface so that effective stresses could be computed and effective stress strength parameters determined. Porewater pressures were also monitored in the clay liner directly below the geomembrane liner prior to and during excavation and during filling of an adjacent cell constructed to receive the waste being exhumed. Slope stability analyses conducted in 2D and 3D indicate that interface strength and waste mass geometry (height/width ratio) were the primary factors contributing to the waste movement, and that the interface shear strength was likely influenced by build up of pore water pressure.