6th Annual Web Conferences 2020
Technical Committees

Live Streaming Daily – Technical Case Studies

December 6 – 10, 2021

The Geo-Institute Geoenvironmental Engineering Technical Committee will live-stream on Monday, December 6 at 2 PM EST. The topics include:

"Impact of Electromagnetic Waves on Clay Properties," **Arvin Farid**, Ph.D., P.E., M.ASCE., **Sahba Azad**, M.ASCE., **Jim Browning**, M.ASCE, and **Elisa Barney Smith**, M.ASCE

Electromagnetic (EM) waves are used for various technologies from geophysical nondestructive testing and characterization to telecommunication. The impact of soil and its properties (e.g., moisture content, charged particles) are better understood. However, the reverse impact is not well understood. Hence, like any other measurement tool, soil properties to be measured can be impacted by the measurement too, i.e., EM waves. Because of the dipole properties of water molecules, any electric field can alter the alignment of water dipole molecules and affect the properties of water and, in turn, the soils (e.g., hydraulic conductivity). The effect of radiofrequency (RF) electromagnetic (EM) waves on the hydraulic conductivity of clay are discussed here.

Falling-head permeability tests were performed using a rigid-wall, cylindrical permeameter housed within an RF resonant cavity. The permeability measurement was then measured in the absence and presence of RF waves launched via a CPVC-cased monopole antenna, vertically centered in the permeameter.

The experimental and numerical results showed a correlation between the change in the hydraulic conductivity and the frequency and power characteristics of the RF stimulation. The results revealed that the change in the hydraulic conductivity varies with RF frequency and power levels. The relation among these properties was then investigated.

"*Surficial stabilization of wildfire-burnt hillslopes using xanthan gum and polyacrylamide*," **Idil D. Akin**, Ph.D., A.M.ASCE

Post-wildfire erosion has become an increasingly severe problem due to climate change and associated increase in wildfire occurrence and severity, creating economic and environmental problems in addition to threatening human life. Mulch treatments are commonly used to reduce erosion; however, mulch, especially agricultural straw mulch, can pose environmental concerns related to invasive plants. This talk presents the use of two alternative additives, polyacrylamide (PAM) and xanthan gum on silty soil burnt by 2018 Mesa Fire in central Idaho to reduce runoff-dominated erosion. Indoor rainfall experiments were conducted to simulate three wet-dry cycles. Runoff and infiltration measured after each wetting event indicate that both PAM and xanthan gum decrease soil loss and infiltration, but that neither seals the soil surface completely. The soil loss results are discussed in relation to water retention behavior of soil and xanthan gum or PAM. Additionally, both xanthan gum and PAM showed the potential to be transported with runoff or to infiltrate into soil over time. Therefore, the effects of surficial xanthan gum or PAM application on downstream water quality (e.g., pH, turbidity, dissolved solids, total nitrogen) are discussed.

"Effective Reduction of Landfill Gas Emission through Intermediate Covers with Innovative Geomembranes," **Jongwan Eun**, Ph.D., P.E., M.ASCE

Landfill gas (LFG) is not only the third-largest source of methane gas in the U.S., but also includes odorous gas to often upset landfill neighbors, resulting in strained relationships with the community, regulatory actions, and, in some cases, costly litigation. As a solution, innovative co-extruded geomembranes (GMs) with an Ethylene Vinyl-alcohol (EVOH) layer sandwiched between two polyethylene layers have been introduced to reduce the flux of organic contaminants in barrier systems. However, there are still latent and critical issues such as the applicability and validation of the effectiveness of using co-extruded EVOH GM for an interim cover at field site and the impact related to multiple stakeholders and regional community. In this study, the transmitted LFG was evalauted by using laboratory diffusion tests and field gas flux chamber tests through three different composite interim covers. The resistance of the different cover systems for selected LFGs were comparably analyzed. In addition, gas dispersion modeling near a regional

landfill was performed to evaluate environmental impact of LFG on the residence. From this study, the effectiveness of installation of interim covers with the co-extruded EVOH GM was assessed.

"*Internet of Things Monitoring of Biogeochemical Conditions Within an Oleophilic Bio-Barrier*," **Joe Scalia**, Ph.D., M.ASCE

Petroleum hydrocarbons discharged to surface water at a groundwater-surface water interface resulting in violations of the Clean Water Act often spark costly cleanup efforts. The oleophilic bio-barrier (OBB) has been shown to be effective in catching and retaining oils via an oleophilic (oil-loving) geocomposite and facilitating biodegradation through cyclic delivery of oxygen and nutrients via tidally driven water level fluctuations. Conventional resistive (e.g., geomembrane) or absorptive-only (e.g., organoclay) barriers for oil at GSIs limit oxygen diffusion into underlying sediments and are susceptible to overloading and bypass. Conversely, OBBs are designed to function as sustainable oil-degrading bioreactors. However, for an OBB to be effective, the barrier must maintain aerobic conditions created by tidally driven oxygen delivery. Oxidation reduction potential (ORP) sensors were installed within an OBB in the eastern US with an internet of things (IoT) monitoring system to evaluate the effectiveness of OBBs in maintaining aerobic conditions. Lessons learned from implementing the IoT monitoring system also are discussed.