Wednesday, 3/15/2017

8–9:30 a.m.

Soil and Groundwater Remediation 1

Chairs: Arvin Farid, Boise State University; Krishna Reddy, University of Illinois at Chicago

Impact of Mix Water Quality on Bentonite-Water Slurry for Soil-Bentonite Cutoff Wall Applications

Melissa Replogle and Michael Malusis, Bucknell University

The influence of mix water hardness and salinity on bentonite-water slurry used in soil-bentonite cutoff walls was investigated. Slurries prepared by blending 5-12 % sodium bentonite with aqueous solutions containing CaCl2 and/or NaCl were tested for Marsh viscosity, filtrate loss, and bleed. Slurries containing 5 % bentonite exhibited acceptable bleed, filtrate loss (≤ 25 mL), and viscosity (32-45 s) when mixed with solutions containing ≤5 mM CaCl2 (hardness ≤ 500 mg/L) and ≤ 50 mM NaCl (salinity ≤ 2,900 mg/L). Increasing the CaCl2 concentration to 10 mM or the NaCl concentration to ≥ 100 mM yielded inadequate viscosity and excessive filtrate loss, but these properties were improved by increasing the bentonite content to 6 or 7 %. Slurries prepared with water containing 25 mM CaCl2 (hardness ≈ 2,500 mg/L) required 12 % bentonite to exhibit acceptable viscosity, filtrate loss, and bleed. Overall, hardness had a greater impact on the slurries relative to salinity.

Field Evaluation of Switchgrass (Panicum virgatur) to Phytoremediate Mixed Contaminants at Slag Fill Site

Gema Amaya Santos and Krishna Reddy, University of Illinois at Chicago

The present study investigates in the field the potential of switchgrass to survive in the harsh high pH slag disposal area at Big Marsh and phytoremediate existing Polycyclic Aromatic Hydrocarbons (PAHs) such as benzo(a)pyrene (BaP) and heavy metals such as Lead (Pb) and Arsenic (As). Test plots were prepared by adding compost and tilling the fill material. Switchgrass was planted and monitored. Soil was sampled before, after preparing the test plots, and after the second and third growing seasons, together with plant root and shoot samples. PAHs and total metals were analyzed, and the fractionation of metals in the soil was determined by sequential extraction. A decrease of PAHs concentrations in the soil was observed, while the concentration of heavy metals remained constant. Additionally, concentrations of PAHs and heavy metals in shoots were undetectable, demonstrating insignificant uptake of contaminants by the plants.

Use of Minitube Blanket for Horizontal Landfill Gas Collection and Control

Stephan Fourmont and Pascal Saunier, Afitex-Texel; Toraj Ghofrani, King County

Landfill gas (LFG) needs to be efficiently and effectively extracted from active and closed landfills to comply with air quality regulations as well as to fuel beneficial uses. LFG extraction is performed by applying a vacuum onto vertical wells or horizontal collection trenches. LFG collection trenches are commonly constructed by excavating into the waste mass and backfilling the trench with aggregate and a perforated high-density polyethylene (HDPE) pipe. While LFG collection trenches are an important component to a well-operated landfill, the costs associated with constructing trenches and relocating waste are significant. This paper presents a review of tubular drainage geocomposite used for more than 5 years in replacement of traditional pipes and aggregates LFG trenches. The use of this

geocomposite improves the zone of influence (ZOI) of the “trench” without reducing the collected flow, as well as reduces dramatically the costs and the Greenhouse gas (GHG) emissions.

Analysis of Workability of Soil-Bentonite Slurry-Trench Cutoff Walls

Ri-Dong Fan, Yan-Jun Du, Song-Yu Liu, and Yu-Ling Yang, Southeast University; Krishna R. Reddy, University of Illinois at Chicago

Soil-bentonite slurry-trench cutoff walls are used extensively as vertical engineered barriers for groundwater pollution control. The workability of soil-bentonite backfills used for these walls is an important design and construction consideration. In this study, a systematic analysis of extensive database reported in previous studies is made. It is found that bentonite content required to achieve workability in bentonite-water slurry decreases with increasing liquid limit of bentonite and then it remains constant at 5% for bentonite required to achieve target slump (-ΔH = 100 to 150 mm) can be estimated by an empirical equation established based on an apparent liquid limit of backfill calculated based on the proportions and liquid limits of individual constituents of the backfill. The results of this study are useful for preliminary estimation of the required bentonite content in the bentonite-water slurry and backfill water content to yield the target slump (workability).

Permeable Reactive Filter System for Treatment of Urban Stormwater Runoff with Mixed Pollutants

Krishna Reddy and Girish Kumar, University of Illinois at Chicago

This study investigated a new and practical approach to remediate urban stormwater runoff contaminated by mixed pollutants. The study consisted of evaluation of different permeable filter medium in terms of the removal efficiencies when addressing typical urban mixed pollutants; and development of a feasible design and recommendations for an effective in-ground filtration system. Mixed pollution indicators used to assess stormwater quality included: heavy metals (As, Cr, Cd, Cu, Ni, Pb, and Zn), nutrients (nitrates and phosphates), polycyclic aromatic hydrocarbons (PAHs) (naphthalene, phenanthrene and benzo(a)pyrene) and bacterial contamination (E. coli abundances), all of which are contaminants commonly found in urban stormwater runoff. To determine removal efficiencies of targeted contaminants in different permeable medium, synthetic stormwater (SSW) representative of urban stormwater runoff was applied to packed columns with different permeable filter medium, and the contaminant concentrations in the resulting effluents were analyzed. Batch tests were also conducted to determine the maximum removal efficiency of each filter medium. Based on the batch and column studies, it was found that a mixed media, consisting of calcite, zeolite, iron filings and sand was effective with high removal efficiencies for nutrients, TSS, E. coli, heavy metals and PAHs. Large-scale laboratory test and field pilot-scale demonstrations were conducted to evaluate the performance of this permeable mixed media filter system.