Editorial

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In spite of the gains that have been made on waste utilization as raw materials in industrial production and development of physical infrastructure, civil and industrial activities are bound to continue to generate huge quantities of wastes into the foreseeable future. Various toxicological categories of waste are generated in the gaseous, liquid and solid forms, as well as their intermediates such as slurries. Wastes are also prone to change of state, depending on the physico-chemical environment and the presence of other materials with which they can interact. The most common method of storage and disposal of wastes is burial in geomedia. In this edition of *Environmental Geotechnics*, all the six papers published, pertain to one or more of the following aspects of geoenvironmental engineering, a field that covers many aspects of environmental geotechnics: site characterization with respect to stability and interaction among media (soil, water, vegetation and the atmosphere); analyses and design of contaminated geomaterial management systems and structures; and contaminant release scenario assessment and transport modelling.

It is recognized that the dynamic processes that occur at the interfaces among surface soils, vegetation and the atmosphere, have significant impacts on the stability of exposed soils. This is particularly critical for slopes as addressed by Jamalnia *et al.* (2021) in the first paper of this issue of *Environmental Geotechnics*. Where vegetation has been luxuriant, the topsoil is usually rich in organic material, at least, within the depth of the root zone. The dynamic combination of roots, humus and microorganisms is bound to affect soil characteristics, especially, in the circumstance of fluctuating water content which is characteristic of the surficial soil environment. Dikes of the type modelled by Jamalnia *et al.* (2021), typically have prominent slopes, the stability of which can be significantly affected by changes in moisture content of the exposed soil. Such changes are due to evapotranspiration action of the plants that are usually grown on the dikes to reduce surface soil erosion. Then, the implication is that vegetation density on dikes which in this paper, is scaled by the authors as the leaf area index, can be used to rate the potential stability of dikes as a method that is less intrusive than ground-based monitoring.

In the second paper, experiments by Nong *et al.* (2021) on the effects of organic content on the soil-water characteristic curve and soil shrinkage curve indicate direct proportionality between soil organic content and suction at the corresponding residual water content. They attribute their result to the capacity of organic matter to store moisture tightly with the requirement of higher suction pressures to drain.

The third paper of this edition authored by Beier *et al.* (2021), focuses on the development of a multi-compartment analytical and design system for use in managing oil sand tailings. Their system has the main feature and hence, utility of integrating models that address just one or more of the stages, processes and materials that pertain to management of tailings from cradle to grave. Figure 1 of their paper is very instructive with respect to interlinkages among the input materials, processes and output materials throughout various stages of tailings management. The primary stages are extraction (a pre-stage), classification, dewatering, dredging and consolidation.

With this comprehensively interlinked management system described quantitatively, it is possible to evaluate the likely impacts of changes in design or operation of a component on the efficiency of any of the other components. Furthermore, the system (the mine tailings management system) developed and tested by Beier *et al.* (2021), enables quantitative linkages of system outputs to risk assessment models that address various risk-cost-efficiency scenarios. With the data input structure that they have created as Figure 13 of their paper, they have validated their system of models with a field scenario on some specific parameters: impoundment volume versus operational time; sediment height versus time; and other parameters.

In dry climates and regions that experience significant freeze-thaw cycles, compacted clayey soil barriers may desiccate or crack under alternating conditions, thereby, leading to excessive infiltration of water into the covered waste. In their paper included herein, Pique *et al.* (2021) have used anionic polyacrylamide as an amendment, to enhance the resilience of the clayey compacted barrier soil to volume change and cracking. Fundamentally, this amounts to increase in the viscosity of the soil pore fluid relative to water such that water movement to the barrier surface for evaporation is less rapid. The polymer interacts physically with the clayey barrier material and increases its plasticity, a state that is less amenable to the development of cracks. A few other examples of the utility of aqueous polymers in soil systems are the use of polymers as soil conditioners in agriculture (Ben-hur *et al.*, 1989); polymer impregnation of cohesionless soils to minimize disturbance in sampling them as practiced in geotechnical engineering; and reduction in shrinkage of clayey soils attained through amendment with several aqueous polymers (Inyang *et al.*, 2010).

Apart from attempting to appreciate the physico-chemical and biological processes that occur within a waste containment

system with implications on the transit of contaminants outside, functional performance of a containment system is dependent on how much of the targeted contaminants travel from the barrier into the surrounding media. Essentially, this implies the development and use of mathematical models to estimate the spread of contaminants from their sources to various reference points. This is precisely the focus of the fifth paper of this journal issue. In their paper, Dominijanni and Manassero (2021) have developed and demonstrated the use of a steady-state pollutant transport model for landfill liner performance assessment. The reader should note that with respect to a liner or any other waste containment system component, 'performance' can mean different things. Upon inspection of the mathematical formulations and utilities derived and presented by Dominijanni and Manassero (2021) in this journal issue, functional rather than design performance is desirably the focus of their model. Functional performance is of higher order in terms of utility, than design/structural performance.

Mathematical utilities for assessing contaminant transport in terms of concentrations at various locations outside the barrier versus time of release, best address function: the interest in assessing how effectively sensitive locations in the environs of the barrier are protected. Thus, the model presented, covers transport of contaminants through the liner, vadose zone, and in groundwater to various locations. Most often, liner performance assessments end at determination of contaminant transit rates in terms of volumetric flow rates and concentrations through the barrier to the exclusion of the underlying media. The model presented, is innovative and has many equations in the algebraic format, making them readily useable. As exemplified by Menezes and Inyang (2009) and Mazurek *et al.* (1996), many investigators have developed various models that integrate in-barrier contaminant transport with flow in the vadose and saturated zones below waste containment systems.

The sixth and final paper of this journal issue addresses the effects of air-injection pressure on airflow pattern of air sparging systems. Obviously, the effectiveness of this contaminated site remediation technique is critical because it is one of the common means of enhancing the volatilization of organic compounds from contaminated groundwater. In their work, Farid *et al.* (2021) modelled soil with glass beads to enable direct observation of airflow patterns to provide insight to possible effects of injection pressure in actual field circumstances. Their findings are useful

for assessing adjustments that need to be made when air sparging is performed under high overburden pressures.

In conclusion, all the papers that are published herein, are innovative in terms of the models, techniques, equipment configurations and data presented to provide insight to various geoenvironmental phenomena. They will aid the implementation of field projects and point to the need for further investigations in the areas of soil response to various types of gradients (contaminant concentration, force fields, temperature, etc); aqueous polymer effects on soil texture in the presence of other dissolved substances; multi-phase contaminant transport in fractured and porous media; and recovery systems of volatile organic compounds from contaminated geomeadia.

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