Imperial College London

Enhanced bentonites for sustainable chemical containment

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Venue: SKEM 207
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Time: 16:00

Synopsis:

Bentonites are naturally occurring, high swelling clays that are mined, processed, and used for a variety of practical applications (e.g., drilling mud, groundwater well seal) and as an ingredient in industrial and commercial products. The ability of bentonites to swell when exposed to water and form a tight porous medium with low hydraulic conductivity also makes bentonites attractive for use as engineered, low-permeability hydraulic and chemical containment barriers, such as geosynthetic clay liners, compacted sand-bentonite liners, soil-bentonite vertical cutoff walls, and bentonite buffers for high level radioactive waste disposal. However, exposure of natural (traditional) bentonites to chemical solutions results in reduced swell that can lead to substantial (orders of magnitude) increases in the permeability of bentonites. For this reason, enhanced bentonites comprising traditional bentonites that are treated chemically to improve the resistance to adverse chemical interactions are being considered for use in engineered chemical containment barriers. This presentation will provide background on the fundamental behavior of traditional bentonites, discuss the issue of the compatibility of traditional bentonites permeated with chemical solutions, introduce the concept of chemical sustainability in terms of hydraulic conductivity, and describe the use of enhanced bentonites for engineered chemical containment barriers. The properties of four commonly evaluated enhanced bentonites, viz., bentonite polymer composite, dense prehydrated GCL, hyper clay, and multiswellable bentonite, as well as proprietary contaminant resistant clays, will be presented and compared with those for traditional bentonites, and potential issues related to long-term stability will be discussed.

Presenter's Bio:

Charles D. Shackelford is Professor and Head of the Department of Civil and Environmental Engineering, Colorado State University, Fort Collins, Colorado, USA. He has 35 years of experience pertaining to the geoenvironmental engineering aspects of waste management and environmental remediation, and has served as an expert on waste disposal issues on numerous occasions for private companies and federal and international agencies (e.g., International Atomic Energy Agency). He was recognized by the ISSMGE in 2013 for his career contributions to the field of environmental geotechnics with the receipt of the inaugural R. Kerry Rowe Honorary Lecture, and he was selected by the Canadian Geotechnical Society to deliver the 103rd Cross Canada Lecture Tour in 2019. He has served as an editor for both the ASCE Journal of Geotechnical and Geoenvironmental Engineering and the Journal of Hazardous Materials published by Elsevier, Amsterdam, and he currently serves as an editorial board member of Elsevier's Geotextiles and Geomembranes and as an associate editor of the Canadian Geotechnical Journal. He also was past chair of the Geoenvironmental Engineering Committee of ASCE's Geo-Institute, and past co-chair for the Environmental Geotechnics Committee TC215 of the ISSMGE, and currently serves as a member of both of these committees. His M.S. and Ph.D. degrees in civil (geotechnical) engineering are from the University of Texas at Austin in 1983 and 1988, respectively.
URL: https://www.engr.colostate.edu/ce/charles-shackelford/