



Vancouver Geotechnical Society

A Local Section of the
Canadian Geotechnical
Society

www.v-g-s.ca

2018-2019 Executive Committee:

Chair	- Marc Bossé, Thurber	604-684-4384
Past-Chair	- Shane Magnusson, BGC	604-684-5900
Program Director	- Aran Thurairajah, Golder	604-296-4200
Treasurer	- Yoshi Tanaka, Kontur	778-730-1747
Secretary	- Tim Morton, GHD	604-248-3925
Registrar	- Ali Ghandeharioon, KCB	604-669-3800
Web Manager	- Chris Longley, Tetra Tech	604-685-0275
CGS Director	- Andrea Loughheed, BGC	604-684-5900
Student Representative	- Intisar Ahmed, UBC	778-712-1996
Member-at-Large	Kumar Sriskandakumar (BGC), Olga Kosarewicz (BCIT), Carlie Tollifson (Stantec), Deyab Gamal El-Dean (Metro Vancouver), John Lee (BCIT)	

NOTICE OF UPCOMING TECHNICAL PRESENTATION

Thursday, 6 June 2019

TOPIC: **Membrane Behavior and Chemico-Osmosis in Clays**
Canadian Geotechnical Society Cross Canada Lecture Tour (CCLT) – Spring 2019

SPEAKER: **Prof. Charles D. Shackelford, Ph.D., P.E., F.ASCE – Colorado State University.**

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, is a licensed professional (civil) engineer (P.E.) in California and Colorado, 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). Dr. Shackelford's research is focused primarily on evaluating flow (seepage) and transport of liquids and contaminants through engineered soil and geosynthetic containment barriers used for liquid and solid waste containment. His research contributions pertaining to the role of diffusion in containment barrier design were recognized in 1995 with the receipt of the Walter L. Huber Civil Engineering Research Prize from the American Society of Civil Engineers (ASCE), and he was recognized in 2013 for his career contributions to the field of environmental geotechnics with the receipt of the inaugural R. Kerry Rowe Honorary Lecture from the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE). 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 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 (GEC) 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 the GEC and TC215. His M.S. and Ph.D. degrees in civil (geotechnical) engineering are from the University of Texas at Austin in 1983 and 1988, respectively.

CONTENT: Semipermeable membrane behavior refers to the ability of a porous medium to restrict the migration of dissolved, aqueous-phase chemicals (solutes). Solute restriction occurs in a porous medium when the sizes of the pores available for solute migration are smaller than the sizes of the migrating solutes. The existence of membrane behavior in porous media also results in chemico-osmosis, or the flow of water from a region of lower solute concentration to a region of higher solute concentration. In Geotechnical Engineering, chemico-osmosis resulting from membrane behavior in clays has been shown to influence volume change behavior, cause apparent deviations from Darcy's law, and generate anomalous pore-water pressures in low-permeability geologic formations (e.g., shales). The existence of membrane behavior in high activity clays, such as sodium bentonites, also has been studied extensively from the viewpoint that solute restriction in bentonites can improve the containment function of such bentonites used for chemical containment barriers (e.g., geosynthetic clay liners, compacted sand-bentonite liners, soil-bentonite vertical cutoff walls, and bentonite buffers for high level radioactive waste disposal). This presentation will (1) illustrate the fundamental concepts of membrane behavior and chemico-osmosis in porous media, (2) describe the basis for membrane behavior in clays, (3) review the historical relevance of membrane behavior in clays with respect to consolidation, non-Darcian flow, and anomalous pore-water pressures in geologic formations, and (4) summarize the presenter's 20 years of experience in determining the existence



Vancouver Geotechnical Society

A Local Section of the
Canadian Geotechnical
Society

www.v-g-s.ca

2018-2019 Executive Committee:

Chair	- Marc Bossé, Thurber	604-684-4384
Past-Chair	- Shane Magnusson, BGC	604-684-5900
Program Director	- Aran Thurairajah, Golder	604-296-4200
Treasurer	- Yoshi Tanaka, Kontur	778-730-1747
Secretary	- Tim Morton, GHD	604-248-3925
Registrar	- Ali Ghandeharioon, KCB	604-669-3800
Web Manager	- Chris Longley, Tetra Tech	604-685-0275
CGS Director	- Andrea Lougheed, BGC	604-684-5900
Student Representative	- Intisar Ahmed, UBC	778-712-1996
Member-at-Large	Kumar Sriskandakumar (BGC), Olga Kosarewicz (BCIT), Carlie Tollifson (Stantec), Deyab Gamal El-Dean (Metro Vancouver), John Lee (BCIT)	

and magnitude of membrane behavior in bentonites used as engineered barriers for chemical containment applications (e.g., municipal and hazardous waste landfills, tailings impoundments, lagoons, low and high level radioactive wastes, etc.). ty geologic formations (e.g., shales). The existence of membrane behavior in high activity clays, such as sodium bentonites, also has been studied extensively from the viewpoint that solute restriction in bentonites can improve the containment function of such bentonites used for chemical containment barriers (e.g., geosynthetic clay liners, compacted sand-bentonite liners, soil-bentonite vertical cutoff walls, and bentonite buffers for high level radioactive waste disposal). This presentation will (1) illustrate the fundamental concepts of membrane behavior and chemico-osmosis in porous media, (2) describe the basis for membrane behavior in clays, (3) review the historical relevance of membrane behavior in clays with respect to consolidation, non-Darcian flow, and anomalous pore-water pressures in geologic formations, and (4) summarize the presenter's 20 years of experience in determining the existence and magnitude of membrane behavior in bentonites used as engineered barriers for chemical containment applications (e.g., municipal and hazardous waste landfills, tailings impoundments, lagoons, low and high level radioactive wastes, etc.).

DETAILS:

Location: Centennial Room, Executive Inn, 4201 Lougheed Highway, Burnaby, BC V5C 3Y6

Social Hour: 5:30 to 6:30 pm (drinks available at the hotel bar)

Technical Presentation: 6:30 to 7:30 pm (No need to RSVP)

Dinner: 8:00 pm (\$20 will be charged for dinner). If you would like to stay for dinner, please RSVP to Ali Ghandeharioon via email (aghandeharioon@klohn.com) or at the door.

The VGS would like to thank the following companies (in alphabetical order) for sponsoring the Cross Canada Lecture Tour:

- BGC Engineering Inc.
- Clifton Associates Ltd.
- Klohn Crippen Berger
- Thurber Engineering Ltd.

The Cross Canada Lecture Tour is organized by Canadian Geotechnical Society and its various local sections, and funding is provided by the Canadian Foundation for Geotechnique.