

Short Course:

Introduction to Waste Containment

Craig H. Benson, *University of Wisconsin-Madison*

Charles D. Shackelford, *Colorado State University*

Jorge G. Zornberg, *University of Texas at Austin*

- AGENDA -

INTRODUCTION (Chuck Shackelford)

- **Types of Waste Containment Systems** (e.g., solid waste vs. liquid waste)
- **Liners, Covers, and Barriers, Oh my!** (types of materials, scenarios and configurations)
- **Regulatory Considerations** (Subtitle C & D, alternatives)
- **Technical Considerations** (flow, transport, stability, compressibility, gas collection etc.)

LINERS (Craig Benson)

- **Clay & Composite Liners** (relative performance, intimate contact, synergistic effects)
- **Suitable Clay Material** (particle size characteristics, Atterberg limits, mineralogy)
- **Compaction Control** (defining acceptable zones, measuring water content & density)
- **Hydraulic Conductivity Assessment** (laboratory methods, field methods)

LIQUID COLLECTION SYSTEMS (Jorge Zornberg)

- **Properties and Materials** (transmissivity and conductivity, testing of geonets and geocomposites).
- **Design of Liquid Collection Systems** (calculations used in design, review of typical mistakes, equivalency between geocomposite and granular drains).
- **Design Examples**

CHEMICAL CONSIDERATIONS (Chuck Shackelford)

- **Contaminant Transport** (advection and diffusion, examples analyses for contaminant transport through single and composite liners)
- **Chemical Compatibility** (effect of chemicals on hydraulic conductivity, testing considerations, results).

COVER SYSTEMS (Craig Benson)

- **Conventional Final Covers** (clay barriers, composite barriers, drainage layers)
- **Alternative Water Balance Covers** (water balance principle, unsaturated properties)
- **Field Performance Data**

STABILITY CONSIDERATIONS (Jorge Zornberg)

- **Properties and Materials** (shear strength of soils and waste, internal and interface shear strength involving GCLs and geomembranes, geosynthetic reinforcements).
- **Stability Evaluation** (vener stability analysis, global stability, use of geosynthetic reinforcements).
- **Case Histories**

QUESTIONS AND ANSWERS

When:	Sunday January 23, 2005	Registration fee:	\$300.00 per person
Where:	Hilton Austin 500 East 4th Street Austin, TX 78701	Special registration fee for <u>full-Conference registrants:</u>	\$ 50.00 per person
http://www.asce.org/conferences/geofrontiers05/		<ul style="list-style-type: none"> • Registration includes refreshments, lunch, handouts • Participants receive 7 PDHs 	

ABOUT THE COURSE

This short course will provide the basic concepts required for the design and construction of waste containment facilities. The course will expose the attendees to the wide range of considerations involved in waste containment design. Important considerations will include the types and properties of materials used for liner and cover systems, conventional and alternative types of liner and cover systems, seepage through liners and covers, contaminant transport through single and composite liners, strength and stability of components of waste containment facilities, systems for collection and removal of liquids, compressibility and settlement of solid waste, and use of reinforcements in cover and base liner systems. Course notes will be provided, as well as a CD containing additional course reference material.

ABOUT THE INSTRUCTORS

Craig H. Benson, Ph.D., P.E., is Professor of Civil & Environmental Engineering and Geological Engineering at the University of Wisconsin-Madison. Dr. Benson has a BSCE from Lehigh University and MS and PhD degrees from the University of Texas at Austin. For the last 15 years Dr. Benson has been conducting experimental and analytical research on barriers to flow and contaminant transport. Dr. Benson received the *Presidential Young Investigator Award* from the National Science Foundation and the *Distinguished Young Faculty Award* from the US Dept. of Energy. Dr. Benson has also received the *Huber Research Prize* and the *Croes, Middlebrooks, Collingwood, and Casagrande Awards* from the American Society of Civil Engineers. Dr. Benson currently is Editor-in-Chief of the *Journal of Geotechnical and Geoenvironmental Engineering*.

Charles D. Shackelford, Ph.D., P.E., is Professor in the Department of Civil Engineering at Colorado State University. Dr. Shackelford has a BSCE from the University of Missouri-Rolla and MS and PhD degrees from the University of Texas at Austin. He has 18 years of experience pertaining to the geoenvironmental aspects of waste management and environmental remediation. Dr. Shackelford received the *National Young Investigator Award* from the National Science Foundation and the *Walter L. Huber Civil Engineering Research Prize* from the American Society of Civil Engineers (ASCE). He served as an Editor for the *Journal of Geotechnical and Geoenvironmental Engineering*, past chair and current member of the *Environmental Geotechnics Committee* of ASCE's Geo-Institute, and currently serves as co-chair for the *Environmental Geotechnics Committee TC5* of ISSMGE.

Jorge G. Zornberg, Ph.D., P.E., is Assistant Professor at the University of Texas at Austin. He has a BS from the U. of Córdoba (Argentina), a MS from PUC-Rio (Rio de Janeiro, Brazil), and a Ph.D. from the U. of California at Berkeley. He has over 15 years experience in both research and practice in geotechnical, geoenvironmental and geosynthetics engineering. He has served as consultant for numerous private companies and federal agencies. Dr. Zornberg received the *Collingwood Prize* from the American Society of Civil Engineers, the *Young IGS Member Award* and the IGS Award from the International Geosynthetics Society, the *CAREER Award* from the National Science Foundation, and the *Presidential Early Career Award for Scientists and Engineers* (PECASE) from the president of the United States. He is a council member of the *International Geosynthetics Society*.

SPONSORS

This course is sponsored by the ASCE Geo-Institute's Geoenvironmental Engineering Committee and by the ISSMGE's TC5 Environmental Geotechnics Committee.