

UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

CIVE 6111 Graduate Seminar

Edward Matteo, PhD

Department of Nuclear Waste Disposal
Research and Analysis
Sandia National Laboratories (SNL)

Engineered Seals and Barriers in Subsurface Service Environments

Friday, April 7, 2017

2:45 pm - 3:45 pm

CBB 120

Abstract: Engineered seals and barriers provide critical containment in a variety of subsurface engineering application, ranging from disposal of nuclear waste to oil and gas development. For nuclear waste disposal, the durability of these seals may need to be demonstrably predictable for timescales on the order of 10^3 years! Subsurface seals, generally constructed from Portland cement and/or bentonite clay, are subject to the complex dynamics of multi-scale phenomenon and multi-process coupling -- specifically thermo-hydrologic-mechanical-chemical (THMC) coupling. While THMC models represent the "holy grail" for predicting fate and transport in subsurface engineering applications, robust and efficient THMC have proved elusive. Instead subsets of process models (e.g. T, M, TH, THM, THC) are utilized and have proved adequate in many instances. This talk will cover highlights of the functional requirements for seals in subsurface service environments, using case studies of problems from nuclear waste storage and geologic storage of carbon dioxide. Examples of research results from these applications will show current design and predictive methods, as well as illustrate how a combined experimental and computational approach can be implemented to better understand the multi-scale, coupled processes that are critical to the design and prediction of subsurface seal performance.

About the speaker:



Ed Matteo is a Senior Member of Technical Staff at Sandia National Laboratories (SNL) in the department of Nuclear Waste Disposal Research and Analysis. In 2011, he received his Ph.D. in Chemical Engineering from Princeton University, as a member of George Scherer's Materials Research Group. His PhD research focused on understanding the chemical reactivity of wellbore cement in the context of CO₂ sequestration. As a post-doc and staff member at SNL, his work has focused on fluid-mineral interactions and materials characterization for various subsurface engineering applications, including wellbore integrity and nuclear waste repository design. Ed is currently Work Package Manager and Technical Lead for the *Preliminary Design Concepts* work package from DOE's Spent Fuel and Waste Disposition (SWFD) Campaign. The *Preliminary Design Concepts* work package is focused on Engineered Barrier System (EBS) design, thermal analysis of emplaced waste packages, waste package and overpack design, and repository layout. Ed is also PI for *Monitoring and Repair of Damaged Cement-Geomaterial Interfaces in High Pressure High Temperature Repository and Borehole Scenario*, a project that aims to develop experimentally-validated computational methods to predict performance of cement-geomaterial interfaces over large timescales and large domains.

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