

NE224

Safety Assessment for Geological Disposal of Radioactive Wastes

TuTh, 2:00-3:30 pm, Spring 2014, 3 units

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Office Hours: 1-3 pm, Wednesday

Course Objectives: This course introduces mathematical analyses applied for safety assessment for geologic disposal of high-level radioactive waste. Mathematical analyses consist of radionuclide transport through heterogeneous natural geologic layers, and through a man-made barriers around radioactive waste solids, including waste solid dissolution by groundwater and subsequent release of radionuclides into the man-made barriers. These two types of models are coupled into a model for assessing overall repository performance.

Week	Day	Contents
1	1/21	0. Introduction; Class organization
	1/23	1. Multi-barrier Concept — Overview of geologic disposal —
2	1/28	2. Basics of groundwater hydrology
	1/30	2.1 Distribution of subsurface water
3	2/4	2.2 Representative Elementary Volume
	2/6	2.3 Continuity equation
		2.4 Darcy's law and hydraulic conductivity
		2.5 Unsaturated media
4	2/11	3. Far-field radionuclide transport
	2/13	3.1 Dispersion
5	2/18	3.2 Mathematical formulation
	2/20	3.3 Examples and analytical solutions
6	2/25	4. Near-field radionuclide transport
	2/27	4.1 Near-field environment
7	3/4	4.2 Dissolution of waste form
		4.3 Radionuclide release from solidified waste form
		4.4 Transport of radionuclide in the near field
		4.5 Effects of chemical reactions on transport of radionuclide
	3/6	4.6 Effects of heat on transport of radionuclides and near field environments
8	3/11	Mid-term exam
	3/13	4. continued
9	3/18	5. Integration transport models into overall performance assessment models
	3/20	5.1 Combining near-field and far-field models in a single canister configuration
		5.2 Effects of multiple canisters and transverse dispersion
	3/25	5.3 Effects of multiple canisters and water flow
	3/27	(Spring Recess)
10	4/1	6. Oklo Natural Reactor Phenomena
	4/3	
11	4/8	7. Biosphere models for dose evaluation
	4/10	
12	4/15	
	4/17	
13	4/22	8. Uncertainty and Sensitivity
	4/24	
14	4/29	
	5/1	
	5/6	Reading/Review/Recitation week
	5/8	

References: To be distributed in the class.

Grading: Final examination (or project report): 35%, Mid-term examination: 30%, Homework assignment: 35%