

University of California at Berkeley
 College of Engineering
 Department of Nuclear Engineering

NE290E
Uncertainty Analysis for Geologic Disposal

Fall 2006
 2 units

Instructor: Prof. Joonhong Ahn, 4157 Etcheverry Hall,
 ahn@nuc.berkeley.edu
Time: M 2:00-4:00 pm
Office Hours: W 1:00-3:00 pm
Place: 1110C Etcheverry Hall

Course Description

This course is intended for graduate students interested in acquiring a foundation in uncertainties associated with safety assessment for geologic disposal of high-level radioactive wastes and spent nuclear fuels. The safety assessment for the geologic disposal system for high-level radioactive wastes needs to cover a time period of 10,000 years or longer, and to take into account heterogeneities observed in geologic formations. Understanding the nature of uncertainties in the assessment results is a key to make right decisions in radioactive waste management. The goal is for graduate engineering students to gain sufficient understanding in how the uncertainties can be quantitatively evaluated.

The lecture will consist of two parts. The first half includes overview for uncertainties observed in the safety assessment for geologic disposal, deterministic models for radionuclide mass transfer and transport, and sensitivity and uncertainties analyses. In the second half, applications of sensitivity and uncertainty analyses for repository performance assessment models are discussed. Implications and interpretations for results of sensitivity and uncertainty analyses are discussed as part of confidence building for safety assessment of geologic disposal.

Class Schedule

Day	Content	
8/28	0. Organizational matters; 1. Introduction – Role of uncertainty analysis in repository performance assessments	
9/4	(Labor day)	
9/11	2. Nature of uncertainties in repository performance assessment	
9/18	3. Summary of probability theory	
9/25	4. Uncertainty analysis for linear systems	
10/2	5. Sensitivity analysis	
10/9	6. Latin Hypercube Sampling method	
10/16	Mid-term exam	
10/23	7. Case Studies: Application of Laplace transform	
10/30	8. Discussions on Mini-Project Topic: Environmental impact of Yucca Mountain Repository (1) Deterministic Models, PDFs for parameter uncertainties	
11/6	9. Discussions on Mini-Project Topic: Environmental impact of Yucca Mountain Repository (2) Formulation of Uncertainty Analysis, (3) Task Allocation	
11/13	10. Discussions on Mini-Project Topic: Environmental impact of Yucca Mountain Repository (4) Interim Report & Discussions	
11/20	(No class)	

11/27	11. Discussions on Mini-Project Topic: Environmental impact of Yucca Mountain Repository (5) Model uncertainty; Regulatory uncertainty	
12/4	12. Building confidence; Natural analog; Final thought	

Required Texts:

- D. G. Cacuci, "Sensitivity and Uncertainty Analysis" Volume 1, Theory, Chapman & Hall/CRC, 2003.
- D. Savage (ed.), "The Scientific and Regulatory Basis for the Geological Disposal of Radioactive Waste," Wiley, 1995.

Homework:

Total 3 sets of homework problems will be given.

Grading:

25%: Homework, 25%: Midterm exam, and 50%: Final project (20% presentation and 30% report).