PRINCIPLES AND METHODS OF RISK ANALYSIS
Nuclear Engineering 175/275
Tuesday and Thursday 8:00a to 10:00a
Online Course

Revision B 8/23/20

FACULTY:
Per F. Peterson, Professor of Nuclear Engineering
4167 Etcheverry Hall
Office Hours: Thursdays 10a-11a and by appointment
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COURSE WEBSITE:
https://bcourses.berkeley.edu

COURSE SUMMARY:
Principles and methods for assessing and managing the risks of human activities, complex technologies and natural phenomena. Probabilistic safety assessment and environmental, ecological and public health risk assessment. Risk-based decision making and risk-based versus risk-informed regulation. Introduction to complexity and its application to biological, ecological, technical and social systems. Fault and event trees, environmental transport and fate, exposure assessment, dose/response, decision trees and influence diagrams, and uncertainty. Utilitarian and alternative approaches to cost/benefit analysis and multi-attribute utility theory. Risk communication. Application to aerospace, biotechnical, chemical, energy, environmental, information, manufacturing, mechanical, national security, nanoscale and nuclear systems.

COURSE FORMAT:
Two 1.5-hour lectures per week plus 1-hour discussion section (for NE 275 students)

PREREQUISITES:
None.

LECTURES

What is Risk Analysis and How Does it Work?

8/27 An Introduction to Risk Analysis, Overview of the Course, and Discussion of Course Goals (01)

9/1 Risk Assessment for Engineered Systems (02) (Hwk 1 assigned)

9/3 Risk Analysis and Nuclear Regulation—Why Do It? (Bill Kastenberg) (03)

Risk Characterization

9/8 Risk-Based Decision Making (04) (Hwk 1 due)

9/10 Hazard Characterization: Transportation System Emissions Example (Tom McKone) (05)

Discuss goals for NE 275 term projects in discussion section

9/15 Probabilistic Risk Assessment (PRA): Intro to Fault and Event Trees (06) (Hwk 2 assigned)

9/17 Probabilistic Risk Assessment (PRA): How it is Applied In Advanced Reactor Development (Jordan Hagaman, Kairos Power)

9/22 PRA Applied to Light Water Reactors: Level I, Level II and Level III PRAs (07) (Hwk 2 due)

9/24 Initiating Event Identification (08)

9/29 Equipment Reliability (09) (Hwk 3 assigned)

10/1 Best Estimate Methods for System Response (10)
NE 275 project abstracts due, discuss in class

10/6 Review (Hwk 3 due)
Mid-term exam handed out

10/8 Mid-term exam workday

10/13 Dose-Response Assessment (11)
Mid-term exam due today

10/15 Environmental and Ecological Risk: From Complicated to Complex Systems (Bill Kastenberg) (12)

Regulation and Decision Making

10/20 Nuclear Security Risks (13)

10/22 Hazardous Chemical Risk Regulation and Management (14) (Hwk 4 assigned)

10/27 Sustainability and Life Cycle Assessment (15) (Hwk 4 due)

10/29 Energy risks in perspective (16) (Hwk 5 assigned)

11/3 Decision Trees/Influence Diagrams (17).

11/5 Utility Theory (18)
Draft for Comment Risk Assessment Report Due

Advances in Risk-Based and Risk-Informed Decision Making

11/10 Variability, Vulnerability, & Uncertainty (20) (Hwk 5 due)

11/12 Utilitarianism and Alternate Approaches, Multi-Stakeholder Issues (21) (Hwk 6 assigned)

11/19 Risk Management for Contaminated Sites (22)

11/17 Risk Informed Regulation (23) (Hwk 6 due)

11/24 Advanced Reactor Licensing Modernization Project (24)

11/26 - UCB Holiday (Thanksgiving)

12/1 Innovation in Regulated Technologies (25) (con't)

12/3 Review

12/8 Reading/Review/Recitation
Draft for Comment Risk Management Report Due

12/10 Reading/Review/Recitation

12/?? (Date?, 9:00a-12:00n) NE 275 Student Presentations

12/14 Final Report (275) or Take Home Exam (175) Due by 5:00PM