ESM 222 Pollutant Risk Management (formerly Fate & Transport of Pollutants)

Syllabus

Course Objective

The course is designed to provide an understanding of the physical, chemical and biological processes that govern the distribution of contaminants through the environment, as well as the processes that are involved in the transformation or degradation of a contaminant. Knowledge of these processes is essential for designing pollution prevention, control, monitoring and remediation strategies, estimating exposure, and for risk assessment. We will cover the distribution of pollutants in air, water, soil and biological tissues, with particular emphasis on toxic organic pollutants.

Textbooks and other readings

The textbook for the class is:

Hazardous Wastes: Sources, Pathways, Receptors. By Richard Watts. John Wiley & Sons (1998). ISBN 0-471-00238-0.

To supplement the material in the textbook, I have provided additional readings, available in the ESM 222 section of the Bren School Library. Some of the readings will be provided as class handouts. Some of the reading material may be too detailed for the purposes of this course; it is provided for students who are interested in going further in a particular subject (e.g. toxicology, bioaccumulation, bioavailability).

For exams and homeworks, we will in general use material presented in lecture and the textbook. Since this is a graduate level course, it is up to you to decide what level of knowledge you are interested in, and how much extra reading you want to do.

There will be 5 problem sets, one midterm and NO final exam. The final grade will be weighed based on 50% homework, 20% lab work, and 30% midterm. You should do your homeworks individually to get the most out of the course and prepare for the exam and your future career.

Presentation counts (remember that you are preparing to be professionals); poor presentation will be marked down. You don't have to type your calculations, but your answer should be easily readable. In terms of numerical answers, I give partial credit for using the right method, but answers that are incorrect by orders of magnitude will be marked down significantly.

Lectures

	Title	Reading (See Bren Library for Readings)
1	Introduction	Watts 1-41
2	Classification of pollutants	Watts 48-139
3	Physicochemical Properties	Watts 155-204 Schwarzenbach 56-58, 63-66, 76, 82-83, 90-97, 130-134
4	Equilibrium distribution of pollutants	Watts 254-328 Schwarzenbach 109-123, 157-163, 255-328
5	Mass balances at equilibrium	Watts 212-215, Schwarzenbach 547-554
6	Structure of environmental media #1	D Mackay (Multimedia Modeling Ch 4)
7	Structure of environmental media #2	Ramaswami et al. (Integrated Environmental Modeling, Ch. 3)
8	Movement of pollutants (advection & dispersion)	Watts 405-437
9	Movement of pollutants (retardation)	Fetter 400-415 (copy available in Bren lib)
10	Fate and Transport of Oil Spills in Ocean	
	Midterm	
11	Multiphase flow	Fetter 202-243; Mercer & Cohen, 1990 (copies available in Bren lib)
12	Colloid transport	Keller & Auset (2005)
13	Rate limited distribution of pollutants #1	Schwarzenbach 215-227, 241-242, 328-341
14	Rate limited distribution of pollutants #2	Ramaswami et al. (Integrated Environmental Modeling, Ch. 4)
15	Transformation of pollutants #1	Watts 333-392, Schwarzenbach 342-344, 377-383, 399-403, 451-453, Mackay 133-138
16	Transformation of pollutants #2	Watts 333-392, Schwarzenbach 342-344, 377-383, 399-403, 451-453, Mackay 133-138
17	Biological degradation	Watts 366-392
18	Fate & transport: putting the pieces together	
19	Assessing The Risk	
20	Addressing Pollution & Final Review	

Lab Sessions

Week	Topic
Lab 1	Safety Video, tour of lab, lab group assignments
Lab 2	Physicochemical Properties
Lab 3	Equilibrium distribution of pollutants - experimental
Lab 4	Equilibrium distribution of pollutants – modeling Info for PCBs in San Francisco Bay exercise
Lab 5	Midterm review - no lab
Lab 6	Experiments on advection & dispersion
Lab 7	Modeling Rate limited distribution of pollutants Water Quality info for SF Bay SF Bay Watershed
Lab 8	Modeling fate and transport with reactions Biochlor model (Manual)
Lab 9	ChemFate modeling
Lab 10	No lab