Mel and Enid Zuckerman College of Public Health
University of Arizona

SYLLABUS
Modeling Exposures to Environmental Hazards

Time: Thursday 1-4pm

Location: Drachman 319

Instructor: Miranda Loh, Sc.D., mloh@email.arizona.edu, Drachman Hall A-229

Office Hours: By appointment

Teaching Assistant: N/A

TA Office Hours: N/A

Other course instructors: N/A

Catalog Description: Introduction to modeling principles and methods used in environmental health sciences. Concepts covered include basic environmental fate-and-transport modeling commonly used in exposure modeling and human exposure and intake modeling.

Course Prerequisites: CPH 584 and CPH576A or equivalents; or instructor's approval.

Course Learning Objectives: After completion of this course, students should be able to:

1. Understand, develop, and use various commonly used types of environmental fate-and-transport models in exposure assessment.
2. Understand the differences between deterministic and stochastic models and the advantages/disadvantages to their application in various situations.
3. Understand the difference between variability and uncertainty and how to account for these in models.
4. Fit distributions to data and develop approaches to dealing with data poor situations.
5. Develop and use stochastic exposure models.
6. Understand how to conduct sensitivity and uncertainty analyses.
7. Interpret modeled data in a risk assessment context.

Core Public Health Competencies:

- Defines a problem

- Determines appropriate uses and limitations of data
- Selects and defines variables relevant to defined public health problems
- Evaluates the integrity and comparability of data and identifies gaps in data sources
- Understands how the data illuminates ethical, political, scientific, economic, and overall public health issues
- Understanding basic research designs used in public health
- Makes relevant inferences from data

Course Notes: Lecture notes will be provided on d2l (http://d2l.arizona.edu).

Texts/Readings:

Cullen, AC and Frey, HC. *Probabilistic Techniques in Exposure Assessment: A Handbook for Dealing with Variability and Uncertainty in Models and Inputs*., New York: Plenum, 1999.

Masters, GM and Ela, WP. *Introduction to Environmental Engineering and Science*. Third Edition. Upper Saddle River, NJ: Pearson, 2008.

Additional readings not listed above on D2L.

Course Requirements: Student will attend lectures, do readings, complete in-class exercises and complete all homework assignments. Attendance is vital as the in-class exercises will provide you with help for the homework. You are responsible for learning the material that we go over in class. If you cannot attend class you should make arrangements with a classmate to obtain notes from the lecture. The course will use Microsoft Excel and R. While you are not expected to be proficient at these software packages beforehand, a working knowledge of at least Excel and another statistical package would be helpful. Directions on setting up and coding spreadsheet and R models will be provided so that the student may complete the assignments. It is recommended that you read "An Introduction to R" if you have never used R before. In class work may include running other models.

Grading/Student Evaluation:
The grading system for this course is based on the following items.

Graduates:	
In-class assignments:	(80)
Homework:	(300)
Point total =	380

Final grades will be based on the following relative point system:

A = 90-100%
B = 75-89%
C = 65-74%
E = < 65

- Assignments will be marked down 10% per day it is late (beginning at the end of class on the day the assignment is due, e.g. if an assignment is due Monday, it will

be marked down 10% if it is turned in at 5:30pm). It is the student's responsibility to make sure his/her assignments are turned in on time. If you know you will be absent from class the day an assignment is due, please contact Dr. Loh in advance to arrange for an alternative time to turn it in.

Class Attendance/Participation: You are expected to attend class and participate by responding to rhetorical questions, submit the assignments on time, take exams on the specified dates.
All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee will be honored.)

Communications: You are responsible for reading emails sent to your UA account from your professor and the announcements that are placed on the course web site. Information about readings, news events, your grades, assignments and other course related topics will be communicated to you with these electronic methods. The official policy can be found at: http://www.registrar.arizona.edu/emailpolicy.htm

Disability Accommodation: If you anticipate issues related to the format or requirements of this course, please meet with me**.** I would like us to discuss ways to ensure your full participation in the course. If you determine that formal, disability-related accommodations are necessary, it is very important that you be registered with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations. The official policy can be found at: http://catalog.arizona.edu/2011%2D12/policies/disability.htm

Academic Integrity: All UA students are responsible for upholding the University of Arizona Code of Academic Integrity, available through the office of the Dean of Students and online. The official policy found at:
http://deanofstudents.arizona.edu/codeofacademicintegrity. If caught cheating or plagiarizing student will automatically fail the class.

Classroom Behavior:
The Dean of Students has set up expected standards for student behaviors and has defined and identified what is disruptive and threatening behavior. This information is available at: http://deanofstudents.arizona.edu/disruptiveandthreateningstudentguidelines

Students are expected to be familiar with the UA Policy on Disruptive Behavior in an Instructional Setting found at http://web.arizona.edu/~policy/distuptive.pdf
and the Policy on Threatening Behavior by Students found at
http://web.arizona.edu/~policy/threatening.pdf

Grievance Policy: Should a student feel he or she has been treated unfairly, there are a number of resources available. With few exceptions, students should first attempt to resolve difficulties informally by bringing those concerns directly to the person responsible for the action, or with the student's graduate advisor, Assistant Dean for Student and Alumni Affairs, department head, or the immediate supervisor of the person responsible for the action. If the problem cannot be resolved informally, the student may file a formal grievance using the Graduate College Grievance Policy found at
http://grad.arizona.edu/academics/policies/academic-policies/grievance-policy

Grade Appeal Policy: http://catalog.arizona.edu/2011-12/policies/gradappeal.htm

Syllabus Changes: Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate.

Telephone and Computer Use: Turn your cell phones to silent or vibrate in order to not disrupt the class and disturb your fellow students and professor.

Plagiarism: What counts as plagiarism?

- Copying and pasting information from a web site or another source, and then revising it so that it sounds like your original idea.
- Doing an assignment/essay/take home test with a friend and then handing in separate assignments that contain the same ideas, language, phrases, etc.
- Quoting a passage without quotation marks or citations, so that it looks like your own.
- Paraphrasing a passage without citing it, so that it looks like your own.
- Hiring another person to do your work for you, or purchasing a paper through any of the on- or off-line sources.

Course Schedule: (Dates of classes, topics, assignments, readings, examinations)

Date	Course topic	Readings	Assignments due
1/10	Introduction to course a. What is a model? b. Why do we do modeling? c. How does modeling help us in evaluating the source-impact pathway of environmental health? d. Examples. e. General strengths and limitations of modeling.	Chapter 4, Risk assessment, Masters and Ela, Introduction to Environmental Engineering	
1/17	General modeling concepts a. Model categories according to WHO/IPCS Harmonization Project. b. How do you choose or develop your model? c. Model evaluation and quality assurance. d. Concepts of uncertainty and variability and sensitivity. e. Exercise: Explore an example of different model types for various applications (students will choose from a set of scenarios and describe the type of model that they think would serve the scenario purpose – ties in with model WHO/IPCS categories	WHO, Principles of Characterizing and Applying Human Exposure Models, p. 7-28.	
1/24	Fate and transport I Some basic model types used in environmental health: a. Mass balance b. Growth/decay models c. Basic principles of contaminant transport (Flux, advection, diffusion)	Chapter 1: Materials balance and Chapter 3: Mathematics of Growth, Masters and Ela, Introduction to Environmental Engineering	

Date	Course topic	Readings	Assignments due
2/7	Fate and transport II More basic types of models in environmental health: a. Dispersion modeling b. Gaussian plume	Chapter 7.10 and 7.11: Air Pollution, Masters and Ela, Introduction to Environmental Engineering	HW1
2/14	Fate and transport III Inter-media transfer, partitioning and fugacity	Chapter 1.8: Chemical distribution among phases, Hemond and Fechner-Levy, Chemical Fate and Transport in the environment. Mackay, D. and Peterson, S. 1981. *Calculating fugacity.* Environmental Science and Technology, 15(1):1006-1222 Diamond, ML, et al. *Models of Multi-media partitioning of multi-species chemicals: the fugacity/equivalence approach.*	HW2
2/21	Environment→Exposure modeling Review of fate and transport modeling and link to exposure		HW3
2/28	Exposure modeling Exposure and intake models		
3/7	Probabilistic analysis I Intro to concept of probabilistic analysis a. Random walk	Chapter 1, 2, 4 (4.1-4.3): Cullen and Frey	

Date	Course topic	Readings	Assignments due
	b. Types of distributions and measures of central tendency, spread, shape c. Probability distribution functions and cumulative distribution functions and how they help describe data		
3/21	Probabilistic analysis II a. Determining what type of distribution to use b. Fitting distributions to data c. What if you have no data or very little?	Chapter 4 (4.3) 5: Cullen and Frey	
3/28	Probabilistic analysis III a. Simulation methods – Monte Carlo, Latin Hypercube b. Variability and uncertainty in probabilistic models c. Propagation of error d. One- and two- stage simulation	Chapter 7: Cullen and Frey	HW4
4/4	Probabilistic analysis IV a. Combining data b. Correlations c. Sensitivity analysis	Chapters 4, 8: Cullen and Frey	
4/11	Model validation and application of exposure models to risk assessment		HW5
4/18	Decision analysis a. Probability rules b. Bayes Theorum c. Decision tree	Gold et al. Cost-effectiveness in Health and Medicine. Appendix B	

Date	Course topic	Readings	Assignments due
4/25	Decision analysis II a. Other types of decision models (e.g. Markov, value-of-information)		
5/2	Final class		HW6