DEPARTMENT: Environmental Health

COURSE NUMBER: EHS777R  SECTION NUMBER: 000  SEMESTER: Spring 2015

CREDIT HOURS: 2.0

COURSE TITLE: Problem Based Learning - Community Exposures to Mercury and Benzene

INSTRUCTOR NAME: P. Barry Ryan

INSTRUCTOR CONTACT INFORMATION

EMAIL: bryan@emory.edu
PHONE: 404.727.3826

SCHOOL ADDRESS OR MAILBOX LOCATION: CNR Rm 2041

OFFICE HOURS By Appointment

BRIEF COURSE DESCRIPTION

This class is a problem-based learning approach to environmental contamination. You will be presented with a problem and asked to pursue a solution to it. Given the number of individuals in the class, we will look at two problems: 1) the impact of historical mercury emissions from Plant Branch in Eatonton, GA; and, 2) The associations between releases of benzene for the DSM facility in Augusta, GA and the occurrence of lymphoma in the surrounding community. Students will evaluate the health impacts and expected latency periods and use modeling to investigate areas of greatest impact.

LIST SCHOOL LEVEL, DEPARTMENT, AND OR PROGRAM COMPETENCIES

Departmental/Program Level Competencies developed in this course:

1) Exposure Science- Students will be able to assess the presence and fate of chemical and microbiological contaminants in the environment and their impact on human exposures. This competency will include training in environmental chemistry, environmental microbiology, environmental exposure assessment and the use of exposure biomarkers.

2) Biological Mechanisms of Susceptibility and Disease- Students will be able to assess the impact of environmental insults on human health. This competency will be focused on mechanisms of toxic action and impacts on human physiology.

3) Environmental determinants of population health- Students will be able to assess the impact and risk of various environmental exposures on human populations. Students will be able to use a variety of risk assessment tools to describe the relative risk of various environmental exposures.

4) Students will be expected to be able to communicate their results and knowledge to scientific and public health audiences through a variety of approaches e.g., manuscripts, and oral presentations.
LIST LEARNING OBJECTIVES ASSOCIATED WITH THE COMPETENCIES

The primary learning objective of this course is to have students synthesize coursework from environmental health sciences and other disciplines in an effort to approach a real problem of environmental health significance. Students will draw upon material presented in Hazards, Human Toxicology, Biostatistics, Epidemiology, Biomarkers, and other classes to study the impact of suspected sources of environmental contamination on the health and welfare of individuals in a nearby community. Using tools commonly available in the environmental fate and transport and risk assessment communities, students will assess likely impacts of coal-burning power plants and chemical manufacturing facilities on the surrounding community. It is expected that by the end of the course, students will have a more complete understanding of the methods needed to perform environmental health evaluations associated with these types of facilities.

EVALUATION

Students will work in groups to attack the problems. Students will be evaluated through classroom discussion, individual group meetings, and a final presentations and papers (from each group) detailing their approach to the problem, results from their investigations, interpretation of their results, and suggestions for further work in the area. While students will work in groups as indicated, both a group grade and an individual grade based on group-contribution, classroom contribution, and discussions with the instructor, will be given.

ACADEMIC HONOR CODE

The RSPH requires that all material submitted by a student in fulfilling his or her academic course of study must be the original work of the student.
Schedule of Classes - EHS777R Spring 2015

This is a Problem-Based Learning class, which may be better classified as a “learn-by-doing” class. The role of the instructor will be to give some basic information, promote discussion from the students, and to describe certain modeling systems in detail. The rest will be done by the students, with appropriate instructor guidance. The lecture outline below indicates material to be covered. We will get through the material as quickly as possible; the dates are simply guidelines that describe the material to be covered. As we finish one topic, we will go onto the next. Any extra time in the schedule will be devoted to group meetings, direct inquiry of the instructor, and familiarization with the models to be used.

14 January 2015- Administrative and Introduction
The class will start with a presentation of administrative details including expectations for the class, definition of working groups, grading, and associated details. Since the class is to be taught as a seminar class, there will be a mixture of lecture material, primarily at the beginning, followed by student presentations of work, along with critical analysis from other class members.

21 January 2015- Mercury and Neurodevelopment. Benzene, VOCS, and Non-Hodgkin’s Lymphoma
We will focus on two problems in this class, both with a strong environmental health focus. The first will be the expected health legacy associated with emissions associated with the recently decommissioned Plant Branch in Eatonton, GA. Plant Branch was a coal-fired electricity-generating facility that was also one of the largest emitters of mercury (Hg) in the country. Mercury exposure has been associated with neurodevelopmental delays in young children. The second project focuses on the relationship between toxic VOC emissions, most notably benzene, and non-Hodgkin’s lymphoma (NHL). DSM Chemicals North America, is the largest emitter of benzene in Georgia. We will examine the likely exposures experienced by the surrounding community and explore the epidemiology of NHL to evaluate an association with these emissions.

28 January 2015- Toxic Release Inventory- http://www2.epa.gov/toxics-release-inventory-tri-program
The second lecture will be devoted to understanding the emission characteristics of the sites. This will require an introduction to the Toxic Release Inventory, an EPA database and website containing information on all regulated emissions of Hazardous Air Pollutants (HAPs) in the United States. The site contains historical data dating back until at least the 1990a.

We will spend time discussing poultry physiology, the structure of barns for large-scale poultry cultivations, and the contaminants that are likely emitted from them. Focus will be on actual operation and the likely air and water emissions in both quantity and substance. We will keep in mind throughout the discussion that we are evaluating siting criteria and effects of as-yet-to-be-built CAFOs so local impact must be model.

4 February 2015- Detailed Evaluation of Sites
Two different sites have been selected for analysis. We will examine them in detail and identify sources of contamination and discuss how the contamination might move through the environment.
11 February 2015- Air Modeling
Evaluation will indicate that air and water impacts are the ones most likely to lead to public health concerns in the community. In this lecture, we will address the types of modeling typically done to evaluate air impacts. The focus is on Gaussian dispersion modeling. We will develop the Gaussian dispersion model and begin discussion of the most commonly used air dispersion model AERMOD. We will use the interface program AERMOD-View (Lake Environmental), which affords a quick and more complete use of AERMOD than the DOS-based programs offered free-of-charge from EPA.

18 February 2015- Water Modeling
Modeling of contaminant movement in water is more complicated than air modeling in that three different modes are present: surface runoff, penetration through the unsaturated zone to ground water, and ground water movement. Because of this, modeling systems are, themselves, far more complicated. The standard model used, MODFLOW, is too complicated and is likely beyond the scope of this two-credit class. We will use a simpler modeling system (ACTS developed by Georgia Tech) that affords modeling at amore simplified, but still quantitative level. The discussion here will focus on the physics of the modeling system. We will discuss the details of model operation in a later lecture.

25 February 2015- Demonstration of Models
We have now completed the lecture component of the class and are on to a more “hands on” approach. This class will be dedicated to developing and understanding the input for both the AERMOD and ACTS models. The lecturer will project up on screen input files for test cases and explain the effects of modifying each.
Discussion of additional data sources and GIS software will occur a well, relying at least in part on the expertise of individuals within the class.

4 March 2015- Discussion of Proposals
As we reach the half-way pint in the class, groups should have a definite and complete plan of analysis in hand and well underway. During this class period, student groups will make their first presentation, describing their plan, the work they have done, and expected future analyses. These will be subject to criticism and suggestions from other members of the class and by the instructor. Groups should present their material in an organized fashion targeting 30m minutes for the presentation and an additional 20 minutes for discussion and comment.
Each group of students was asked to develop a working proposal for analysis of their particular test case to be turned in today. Students were also asked to prepare an oral presentation outlining their plan and defending it before the class and instructor. Presentations are to be no more than 30 minutes in duration and are expected to be defended by members of the group.

11 March 2015- NO CLASS Spring Break

18 March 2015- NO CLASS
This week is left open for students to take into account the critical evaluation of their proposed work and to begin modeling analysis. The Instructor is available for consultation during this week.

25 March 2015 - Details of Air Modeling
Students focusing primarily on air modeling present their work in progress in this class. Selection of modeling parameters including compounds of interest, emission factors, meteorological data, and impact concentration are to be considered and discussed. Again, the groups are to present the open forum, receive criticism, and organize their response accordingly.

1 April 2015 - Details of Water Modeling
Students focusing primarily on water modeling present their work in progress in this class. Selection of modeling parameters including soil types, depth to water table, scenarios to test for manure-pile runoff, and poultry burials sites are to be considered and discussed. Again, the groups are to present the open forum, receive criticism, and organize their response accordingly.

8 April - Details of Health Analysis and Policy Implications
Students focusing on Health analysis and Policy implications present their work in progress in this class. Selection of likely health impacts, control strategies, and outcomes should be considered and discussed. Again, the groups are to present the open forum, receive criticism, and organize their response accordingly.

15 April 2015 - Preliminary Results
At this point, student groups will have their first set of preliminary results available. Such results will be presented. Each group will be allocated 30 minutes to discuss preliminary results, suggest follow-on analyses, and revive critical evaluation of their results from the class and instructor.

22 April 2015 - Continued Analysis
Classroom time will be devoted to answering detailed model-run questions and organization of results into a coherent package.

24 April 2015 - Written final reports (10-20 pages) due from each group.