BRIEF COURSE DESCRIPTION
Integrates aspects of environmental science, environmental management, and industrial hygiene through exploration of the underlying principles common to both environmental and occupations hazard evaluation. Students will be exposed to units on environmental and industrial contamination, health and safety, and the interface between the industrial environment and the community environment. Class structure will include lecture materials, a special-topics paper, and classroom discussion. EH 510 is required for EH MPH, GEH MPH, EH/EPI MSPH and BS/MPH Dual Degree students.

LIST SCHOOL LEVEL, DEPARTMENT, AND/ OR PROGRAM COMPETENCIES
Upon completion of the EH510, the student will be able to:
- Describe major environmental risks to human health ranging from the local to global scale
- Assess the sources and movement of contaminants through the environment
- Characterize the magnitude, frequency and duration of environmental exposures
- Evaluate the risks posed by environmental hazards using risk assessment methods (Partial)
LIST LEARNING OBJECTIVES ASSOCIATED WITH THE COMPETENCIES

1. To familiarize students with the basic analytical methods of environmental and occupational health.

2. To introduce concepts of exposure science, as part of the risk assessment paradigm, in a quantitative fashion.

3. To have students begin to synthesize these concepts through thorough analysis of selected environmental problems.

   Students will be introduced to the basic material of environmental and occupational health through a series of lectures focusing on concepts in environmental and industrial hygiene and basic environmental science.

1. The course will develop basic competencies necessary for continued work in Environmental Health, especially those considering a focus in exposure science.

2. Classes subsequent to this one that focus on exposure topics, e.g., Biomarkers, Air Quality, etc., will assume that the material covered in this course has been mastered.

3. A unique feature of the course will be the integration of aspects of science into multiple aspects of environmental health.

EVALUATION

Homework Sets: Note: Homework sets have different numbers of total points, but each counts 12% of the grade. If you get 80/160, it is the same as getting 45/90 for the purposes of this grading. Note the due dates for each homework are general due on Fridays with the exception of Thanksgiving week when they are due on Tuesday. Answers will be posted at 5PM the Monday following the due date. No homeworks will be accepted after the answers are posted.

   Homework Set #1: 12%
   Homework Set #2: 12%
   Homework Set #3: 12%
   Homework Set #4: 12%
   Homework Set #5: 12%
   Homework Set #6: 12%
   Mid-term Quiz 14%
   End-of-term Quiz or Paper 14%

If you choose to do a five-page paper, the topic must be cleared with the Instructor by October 28. Failure to do so will result in a default to the end-of-term quiz.

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.
Syllabus for the Class
There are readings associated with each class session. The required readings are found on Canvas. Supplemental readings are available for checkout outside Dr. Ryan’s office, CNR 2041.

Week #1  16 January 2018 – 22 January 2018
Session #1  Administrative
Discussion of the class organization, grading policies, and scheduling. Solicit expectations from the students.

Session #2  Systems
The Great Spheres
OneHealth
Discussion of the environment as an interactive system and the role that human being play in this systemic approach. Discussion of how exposure to environmental contaminants plays into human health and environmental health as a whole.

Session #3  What is Exposure? Concentration, Exposure, and Dose
We begin our discussion of exposure by developing a common language for discussion of exposure to environmental contaminants.

Week #2  23 January 2018 – 29 January 2018
The Exposome
The concept of the exposome- the total exposure to environmental contaminants both exogenously and endogenously, is the current best paradigm for considering environmental impacts on human health. This concept will be presented and discussed in this session.

Week #3  30 January 2018 – 5 February 2018
Exposure Measurements- How do we Measure Exposure?
Field Data Collection, Laboratory Analysis, Data Analysis
This lecture presents the basics on how exposure data are collected in the field, how they are analyzed in the laboratory, and what types of data analysis are performed on the results. We keep in mind throughout this lecture the need for improved understanding of the impact on the health of human beings and the environment as a whole.

Homework #1 Due

Week #4  6 February 2018 – 12 February 2018
Design of Field Investigations
Anecdotal Studies, Representative Studies, Censuses, Focused Panel Studies
In this presentation, we will determine how to design investigations before going out into the field for data collection. We focus in this lecture on how to carry out exposure investigations with differing total resources and varying aims. We ask: What type of studies give us generalizable information? What supply us with useful data from future designs? What do we do if we can only look at a small number of individuals due to the expensive nature of data collection?

Week #5  13 February 2018 – 19 February 2018
Exposure and Risk
We wrap up the overview and synthesis component of the class by assessing the tie-in between exposure data collection and the development of a risk assessment. Exposure assessment is an
essential component of the risk paradigm, but is often given only passing consideration. In this presentation, we will describe the need for understanding exposure as part of the risk evaluation.

Homework #2 Due

Week #6 20 February 2018 – 26 February 2018
Movement of Contaminants in the Environment- Fate and Transport of Contaminants from the Source to Human Receptors, Concept of Advection, and Concept of Dispersion
We now begin our discussion of how exposure occurs. We first explore the mechanisms of transport of contaminants from sources to the human receptor and consequent health outcomes. We follow this with a discussion of how contaminants change from the emission source to the receptor as they move through the environment. We will choose various examples and discuss how chemistry and physics affect the mix of contaminants that are available to produce an exposure as we move away from the release point.

Week #7 27 February 2018 – 5 March 2018
Air as a Medium of Exposure
Field Data Collection, Laboratory Analysis, Data Analysis
Contaminants move through various environmental media in different ways to produce exposure. We explore airborne contamination first, as the physics of such movement is most easily understood. We will examine some of the complexities and long-distance impact on human exposure using chemical and environmental insight.

Homework #3 Due

Week #8 6 March 2018 – 12 March 2018
Session #1 Air as a Medium for Exposure (Completion)
In the first hour of this class day, we will complete our evaluation of airborne contamination through a condensed discussion of global effects including ozone depletion, atmospheric chemistry and climate change focusing on chemical and physical arguments and exposure-related outcomes.

Session #2 Mid-Term Exam
One-Hour Quiz on Material through Week 6, Movement of Contaminants in the Environment
Our first quiz, at the middle of the semester will look at all topics covered up through an including Week 6. This quiz will count as 14% of the grade.

Week #9 13 March 2018 – 19 March 2018 Spring Break. No Classes

Week #10 20 March 2018 – 26 March 2018
Water as a Medium for Exposure
Field Data Collection, Laboratory Analysis, and Data Analysis
We next look at water-borne contamination and its movement through the environment focusing on the movement of chemical contaminants. We ask: How are air and water, as media through which contaminants move, similar and different? We will examine differences between
water-soluble contaminants, surfactants, and water-insoluble materials. We will choose examples, e.g., perchlorates, perfluorocarbons, low-density insoluble compounds such as gasoline, and dense non-aqueous phase liquids to illustrate how exposures vary substantial in both amount and duration for such water-borne specials. We will discuss mitigation strategies for these compounds as well as current-interest exposures, e.g., GenX, in water supplies.

**Week #11 27 March 2018 – 4 April 2018**

*Soil as Medium for Exposure*

*Field Data Collection, Laboratory Analysis, Data Analysis*

We next look at soil-related exposure differentiating between soil-contact and materials contaminating soil for long periods. We will explore bioavailability and laboratory evaluations of bioavailability current being used by exposure scientist. We will contrast soil-based exposure to heavy metals, such as lead, and organic-contaminants, such as legacy pesticides, in terms of transport through the environment and the fate of such compounds over time.

*Homework #4 Due*

**Week #12 5 April 2018 – 11 April 2018**

*Other Exposure Media, Occupational Exposures, Water and Sanitation-Related Exposures*

*Dietary Exposure- Collection, Laboratory Analysis, and Data Analysis. Special Considerations for Occupational Exposures, and Exposures in the Developing World*

We continue our discussion of exposures occurring through various media by looking at specific media is more detail. We focus on dietary/food consumption as a pathway for exposure to a number of specific medium as an example. We continue our discussion by looking at special consideration associated with occupational exposure asking: Why are such exposures different and what are the health outcomes. We commence our discussion of exposures of contaminants experienced in developing countries, which we will continue in the next lecture.

**Week #13 12 April 2018 – 18 April 2018**

*Exposures in the Developing World*

*Chemical Exposures, Disease Vectors, Safe Water and Sanitation*

The focus of this lecture and discussion is on exposure-related dominant in the developing world. We will expand upon exposure to environmental chemicals associated with activities such as electronics recycling and battery reclamation. We will also look at exposures to “biological materials” including assessment of vector-borne diseases, and exposures associated with biologically contaminated drinking-water supplies and the impact of poor sanitation on exposures to biological contamination.

*Homework #5 Due*

**Week #14 19 April 2018 – 25 April 2018**

*Data Analysis and Modeling for Exposure Assessment*

*Cross-Sectional versus Longitudinal Data Analysis, Compartmental Modeling*

In this lecture, we will examine modern methods for analyzing exposure data of all types and compare descriptive studies, and contrast cross-sectional exposure investigations and longitudinal investigations of exposure factors and effects. In addition, we will develop a simple compartmental model that often proves useful in estimating exposures to various contaminants knowing something about rates of production and elimination components for the contaminant of interest.
Week #15  26 April 2018 – 2 May 2018

Session #1  Course Wrap-up
We will spend about 45 minutes summarizing the essential results of this course focusing on what exposure means, how we measure it, and what results we can expect from an exposure assessment.

Session #2  Final Exam

One-Hour Quiz on Material from Week 7 *Air as a Medium of Exposure* through Week 14, *Data Analysis and Modeling for Exposure Assessment*
Our second quiz will look at all topics covered up from week 7 – Week 14. This quiz will count as 14% of the grade. Alternatively, students may wish to write five—page paper on an approved topic associated with exposures and environmental health.

*Homework #6 Due*