DEPARTMENT: Environmental Health
COURSE NUMBER: EH 540  SECTION NUMBER: 000  SEMESTER: Fall 2014
CREDIT HOURS: 2 Credits
COURSE TITLE: EH540 Environmental Hazards I.

INSTRUCTOR NAME  P. Barry Ryan

INSTRUCTOR CONTACT INFORMATION
EMAIL: bryan@emory.edu
PHONE: 404.727.3826
SCHOOL ADDRESS OR MAILBOX LOCATION: CNR Rm 2041 MS 1518-002-2BB
OFFICE HOURS  By Appointment

Teaching Assistants: Kostya Kartavenka (kanstantsin.kartavenka@emory.edu)
Jed Snyder (jedidiah.snyder@emory.edu)

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 540 is a required course for all EH, GEH, and both EH/EPI and BS/MPH Dual Degree students.

LIST SCHOOL LEVEL, DEPARTMENT, AND/ OR PROGRAM COMPETENCIES
Upon completion of the EH540, 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 environmental science, environmental hygiene, and industrial hygiene 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 industrial and environmental hygiene and basic environmental science.

1. The course will develop basic competencies necessary for continued work in Environmental and Occupational Health

2. All classes subsequent to this one 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 environmental science, environmental hygiene, and industrial hygiene.

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 29. 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 can be found on BlackBoard. Supplemental readings are available for checkout outside Dr. Ryan’s office, CNR 2041.

Week #1 2 September 2014
SESSION #1  ADMINISTRATIVE (15 MINUTES)
We will discuss course expectations, requirements, and grading criteria.

SESSION #2  ATMOSPHERE- GAS LAWS AND GENERAL CIRCULATION OF THE ATMOSPHERE,
This lecture will cover aspects of the atmosphere important for understanding the impact on environmental health. Topics covered will include the composition of the atmosphere, including trace gas concentrations and the atmosphere as an ideal gas

Readings (found on Blackboard) Week #1 and Week #2
“Elementary Thermodynamics.”  P. Barry Ryan
An Interesting Website:
http://ocw.usu.edu/forest__range__and_wildlife_sciences/wildland_fire_management_and_planning/unit_7__atmospheric_stability_and_instability_1.html

Supplemental Literature (Available Outside Office for Checkout)


Chapters 3, 8, 9-14 in Atmospheric Change. An Earth System Perspective.  TE Graedel and PJ Crutzen.  WH Freeman and Company.  New York.  1993.  These chapters are quite readable and will give a good background in atmospheric and water chemistry and physics.


Week #2 9 September 2014  Pressure and Temperature Structure of the Atmosphere
This lecture will focus on the pressure structure and the temperature structure of the atmosphere and how it affects atmospheric stability and results in different effects in different parts of the atmosphere.

**Homework #1**  
*Problem Solving* Due Friday 12 September 2014 at 5PM in EH540 CNR Second-Floor Mailbox. Help sessions to be held during the weeks of September 1 and September 8.

**Week #3**  
16 September 2014. **GLOBAL ENERGY BALANCE AND GLOBAL CLIMATE CHANGE**  
Another topic receiving interest in the popular press and in the scientific community is the so-called “Greenhouse Effect”. In this lecture, we will discuss the global balance of energy of the planet and the role trace gases in the atmosphere have on temperature near the surface. We will discuss the impact of changing the concentrations of these trace gases, which ones are important and which ones are not. We will discuss the effects of continued increase in certain trace gases with regard to inhabited areas of the planet.

*Readings (On BlackBoard):*  
“Atmospheric Energy Balance.”  P. Barry Ryan

*Supplemental Literature (Available Outside Office for Checkout)*  

**Week #4**  
23 September 2014  
**SESSION #1: ATMOSPHERIC POLLUTION EFFECTS: STRATOSPHERIC AND TROPOSPHERIC CHEMISTRY.**  
The hole in the ozone layer is current topic of news and scientific interest. The causes behind the phenomenon, the persistence of the problem, and potential cures will be the topic of this lecture. We will explore the physics of the stratosphere and the chemistry of ozone to discover why this problem occurs and persists. We will discuss its biological impact and measures being instituted to control the problem. In contrast to stratospheric ozone where less is bad, in the troposphere, the presence of ozone is a problem. We will discuss the physics and chemistry of the lower troposphere to discover how the problem arises initially. We will spend time examining control strategies and discuss the effects of such strategies alone and in concert with one another. Finally, we will look briefly at the indoor environment and examine the special problems of concern there.

*Readings (On BlackBoard):*  
Notes on Stratospheric and Tropospheric Chemistry.
SESSION #2: AIR POLLUTION CHEMISTRY.
We will focus on the polluted urban atmosphere discussion smog formation, aerosol formation, sources, mechanisms, and natural clean-up processes. This discussion will be in preparation for addressing modeling of pollution transport.

Readings (On BlackBoard):
Notes on Atmospheric Chemistry.

Supplemental Literature (Available Outside Office for Checkout)

Homework #2 The Atmosphere. Due Friday 26 September 2014 at 5PM in EH540 CNR Second-Floor Mailbox

Week #5 30 September 2014 Energy Production.
This session will focus on the production of energy in the United States through coal, natural gas, hydro, and nuclear systems. The principal aim will be to evaluate the pollution produced given the energy produced. A cradle-to-grave identification of the system will be evaluated. What contamination of the environment occurs during mining, refining, use, and waste streams from each of these?

Readings (Found on BlackBoard):
“Energy Production.” P. Barry Ryan

Week #6 7 October 2014 THE HYDROSPHERE AND GROUNDWATER
SESSION #1- IN CLASS MID-TERM QUIZ
Material to be covered includes all lectures through Energy Production

SESSION #2: THE WATER CYCLE. Cycling of water on the Earth, ocean-atmosphere heat coupling – El Nino, weather, and acidic deposition.

Readings (found on Blackboard)
“The Hydrological Cycle.” P. Barry Ryan

Supplemental Literature (Available Outside Office for Checkout)
Week #7  21 October 2014  INTRODUCTION TO BIOMARKERS
Biomarkers are commonly used in both occupational and environmental settings to quantify the exposure experienced by individuals. In this lecture, we will explore the utility of biomarkers and discuss some specific examples in common use.

Readings (Found on BlackBoard):

Other readings will be developed and selected over the course of the semester.

Week #8  28 October 2014  MOVEMENT OF WATER IN THE ENVIRONMENT
SESSION #1: DISCUSSION OF GROUNDWATER AQUIFERS, THEIR CONTAMINATION
Confined and unconfined aquifers, surficial and artesian well systems, groundwater movement, and Darcy’s Law and its relationship to soil makeup and permeability as it affects pollutant movement through the environment.

SESSION #2: EVALUATION OF SURFACE RUNOFF AND GROUNDWATER MOVEMENT
We will use topographical maps as a tool to evaluate surface runoff. We will contrast surface runoff with groundwater movement by examining elementary geohydrology.

Readings (found on Blackboard)
“The Hydrological Cycle” P. Barry Ryan

Optional Paper Topic due by this class.

Homework #4. Hydrosphere and Biomarkers.  Due Friday 31 October 2014 at 5PM in EH540 CNR Second-Floor Mailbox.

Week #9  4 November 2014  INTRODUCTION TO WATER AND SANITATION
SESSION #1: THE DEVELOPED WORLD
SESSION #2: THE DEVELOPING WORLD
In these two sessions we will follow a parallel development geared towards understanding the topics of clean water delivery and water sanitation. We will first explore the developed world with a discussion of modern water purification and wastewater treatment plants. We will then spend time discussing the developing world with the needs and particular
challenges found in regions for which safe drinking water and proper sanitation are not yet common.

Readings will be developed and selected over the course of the semester.

Week #10 11 November 2014 THE INDUSTRIAL HYGIENE PARADIGM- ANTICIPATION, RECOGNITION, EVALUATION, AND CONTROL.
This lecture will present the Anticipation, Recognition, Evaluation and Control paradigm for evaluation of environmental health and safety in the occupational environment.

Readings (Found on BlackBoard) generally Applicable for Weeks 8-13:

Supplemental Literature (Available Outside Office for Checkout)
“The Industrial Hygiene Survey and Personnel.” James O. Pierce.


Week #11 18 November 2014
INSTRUMENTATION FOR MONITORING- AIR AND WATER
The class will be devoted to demonstrations of equipment used in air and water monitoring. Basic principles of sample collection, instrumental calibrations, and data workup will be discussed.

**Homework #5. Groundwater Movement, Water, and Sanitation. Due Friday 21 November 2014 at 5PM in EH540 CNR Second-Floor Mailbox**

**Week #12 25 November 2014**

**SESSION #1: ELEMENTS OF ENVIRONMENTAL MODELING.**
This session will focus on compartmental (“box”) models and their application to various environmental systems. Concepts covered include sources, sinks, and lifetime in environmental compartments. The session will end with a brief overview of alternative applications of compartmental models including pharmacokinetics.

**SESSION #2: COMPARTMENTAL MODELING- EXAMPLES.**
This session will focus on applications of compartmental modeling. The session will include a computer laboratory session in which simple compartmental models of environmental systems will be developed. These will be drawn from important problems such as indoor air quality, industrial ventilation, and contaminated ponds.

**SESSION #3: MULTI-COMPARTMENT MODELING**
If time allows, we will extend our discussion of compartmental modeling to multi-compartment systems. We will examine two-compartment systems first, followed by more complex, and useful, systems. The second half of the class will be devoted to solving such systems using MSExcel.

**Readings (found on Blackboard)**
“Compartmental Modeling in Environmental Health” P. Barry Ryan.

**Supplemental Literature (Available Outside Office for Checkout)**

**Homework #6 Industrial Hygiene, Monitoring, and Modeling. Due Friday 5 December 2014 at 5PM in EH540 CNR Second-Floor Mailbox**

**Week #14 2 December 2014**

**OVERVIEW OF SPECIFIC ENVIRONMENTAL AND OCCUPATIONAL HAZARDS I**
In the final two classes, we will discuss specific environmental hazards as outlined here. Readings will be developed and selected over the course of the semester.
Focus on Neurological and Neurodevelopmental Effects  
SESSION #1: METALS EFFECTS  
SESSION #2: PESTICIDES

Week #15  9 December 2014

OVERVIEW OF SPECIFIC ENVIRONMENTAL AND OCCUPATIONAL HAZARDS II  
Focus on Pulmonary and Cardiovascular Effects  
SESSION #1: COMMUNITY AIR POLLUTANTS  
SESSION #2: OCCUPATIONAL EXPOSURES

Week #17  Take Home Exam Due Friday 12 December 2014 at 5PM in EH540 CNR  
Second-Floor Mailbox  
Material to be covered includes all material through Week #13, Environmental Modeling. The lecture material from Weeks #14 and #15, are general and will not be quizzed.