

COURSE SYLLABUS AND OUTLINE
Environmental Monitoring & Analysis
CPH 502
Fall, 2008

Time: Lecture: Tuesdays 9 – 11:00
Lab: Thursdays 9-12:00

Location: Lectures: 1435 Fremont Ave. (Health Related Professionals) Room 130
Labs: 1435 Fremont Ave. (Health Related Professionals) Room 108

Course Instructors: Renée Anthony, Ph.D., CIH, CSP
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Teaching Assistant: Jason Roberge
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Course Description:

Introduction to sampling techniques and analytical methods to measure environmental contamination in air, water, soils, and food. Emphasis on instrument selection and quality control, including documentation, calibration, and sample management. 2 hr lecture, 1 3-hr lab per week (3 units)

Course Prerequisites: CPH 584 concurrently or permission of the instructor

Course Objectives: Monitoring is critical to the assessment of environmental hazards. Standard sampling and analytical techniques have been developed to assess contaminant levels for a variety of media, including water, air, and living systems. New analytical methods are also developed when existing methods are insufficient to quantify contaminant levels. The techniques for sampling, however, are fairly standard.

This course introduces sampling techniques and analytical methods for determining contaminant levels. Students will learn and practice many methods to be able to collect samples in their research and in their professions. Emphasis on quality control, including documentation, calibration, and sample management, will ensure that students can fully defend their data and can base good decisions on their measurements.

This course will consist of 2 hour of lecture and 3 hours of lab per week. At the end of this course, students will be able to: (1) Determine the analytical methods needed to collect

environmental samples for a range of contaminants, (2) calibrate instruments, collect appropriate documentation, and ensure quality control/assurance on their work, (3) statistically analyze the resulting data, and (4) describe the biases inherent with each collection method/type.

Recommended Texts / Readings: No text book is required, as materials are available on D2L. Because the scope of methods for this course is large and there is no single text that covers the material for the entire course, we recommend the purchase of the following books, depending on which discipline your educational / career goals are. You will use these texts for other projects throughout

- For students interested in an occupational hygiene or air pollution career, instructors recommend the purchase of *Air Sampling Instruments for Evaluation of Atmospheric Contaminants* (ISBN-13: 978-1882417087, \$120 at Amazon).
- For those interested in water quality issues, the following is recommended for your time at UA: *Standard Methods for the Examination of Water and Wastewater, 21st Ed. 2005 APHA, AWWA, WE* (\$250 retail, instructors can get you a discount through the association, ~ \$185).
- For those interested in microbiology, we recommend: *Manual of Environmental Microbiology*, 3rd Ed. Hurst (Ed) 2007 (\$160).

Class materials will be located on The University of Arizona's D2L website, at: <http://d2l.arizona.edu/index.asp>. You will need to log in with your Net ID and password. Select CPH 502. You must read the assignments *prior to* the scheduled meeting time: lectures are not intended to regurgitate the readings but to provide a forum for discussion of the topics and prepare you for hands on laboratory assignments. Preparation for the laboratory assignments are posted: you must review these and perform preliminary calculations in order to complete the lab in the time allotted.

Course Requirements & Class Attendance/Participation: You are expected to attend class and participate by responding to rhetorical questions, submit the assigned papers on time, take exams on the specified dates. The following excused absences will be recognized: "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." You will be asked to provide an e-mail address: The D2L website has web mail postings specific to this course. Check both e-mail locations frequently.

Grading/Student Evaluation: Student evaluations will be made based on the following assignments for the semester. There will be one midterm and a non-cumulative final. Assignments are short homework assignments to cover material needed to prepare for laboratories: these are 20 points each and are due one week after assignment. Lab reports will be graded at 50 points each and are due two weeks after the scheduled lab. One semester-long project will be treated as an additional lab for 50 points. Points will be deducted for late assignments. Reports must be turned in no later than at the beginning of the lecture / lab on the date assigned.

Assignment	Due Date	Point Total
Assignments		
#1: Sampling method refs.	Sept. 2	10
#2: Calculations	Sept. 9	10
#3: Particle questions	Sept. 16	20

#4: Particulate samplers	Sept. 23	10
#5: Direct reading calcs	Oct. 6	10
#6: Biomarker	Oct. 28	20
#7: Soils Calculations	Oct. 23	20
#8: Field Sampling protocols	Oct. 23	20
#9: Article review	Nov. 6	20
#10: Biomarker identification	Nov. 30- 11:59pm	20
Labs		
Lab #1: Air Sampling Calibration	Sept. 19	50
Lab #2: Optical Sizing	Sept. 26	50
Lab #3: Personal dust monitoring	Oct. 3	50
Lab #4a: Solvent monitoring	Oct. 17	50
Lab #4b: Analyze samples		
Lab #5: Biomarker SOP	Oct. 31	50
Lab #6: Food	Nov. 7	50
Lab #7: Bioaerosols	Nov. 14	50
Lab #8: Dilution and Plating / Membrane Filtration	Nov. 21	50
Lab #9: Molecular Lab	Dec. 5	50
Field Trip: Sampling field trip	-	-
Field Trip: POU treatment demo	-	-
Midterm (Air Sampling and Analysis)... Oct 9th		100
Final (Water, biologicals, food, media other than air)		100
Total Points Available:		810

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

- A = 90-100%
- B = 75-89%
- C = 65-74%
- D = 50-65%
- E = < 50%

Academic Integrity: Students are expected to abide by the University of Arizona Code of Academic Integrity found at <http://dos.web.arizona.edu/uapolicies/cai1.html> .

Classroom Behavior: (Statement of expected behavior and respectful exchange of ideas)

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

Cell Phones & Pagers: Set cell phones and pagers on vibrate prior to entering class. Do not speak on the phone in class. Leave the room if you must speak with someone.

MEZCOPH Grievance Policy: College of Public Health students who believe they have been subjected to unfair treatment in the administration of academic policies may seek resolution of their complaints through the College of Public Health Grievance Process found at: http://www.publichealth.arizona.edu/students/handbooks_info.htm

Disability Accommodation: Students who are registered with the Disability Resource Center must submit appropriate documentation to the instructor if they are requesting reasonable accommodations:

<http://drc.arizona.edu/instructor/syllabus-statement.shtml>

Changes to the Syllabus: 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 by the instructor. Adaptability is a good thing.

Course Schedule: CPH 502

Date TOPIC

Aug 26 Introduction (Anthony)

- a. Why monitor exposures?
- b. What do we do with samples?
- c. Classification of pollutants and methods
- d. Personal vs Environmental Samples
- e. Method collection considerations (based on analysis method)
- f. Description of Projects (to run all semester)
- g. Laboratory visits

Assignment #1: Sampling method references

Aug 28 *Meet in Lab*
Calculations
Bring calculators and assigned reading
Training on using air equipment

Sept 2 Air: Introduction (Anthony)

- a. Personal vs Environmental Sampling
- b. Sampling systems
- c. Calibration methods
- d. Calculations
- e. Decision matrices

Assignment #2: Calculations

Sept. 4 *Lab #1:* System calibration and primary standards

Sept 9 Air: Particulate Sampling (Anthony)

- a. Particle transport basics
- b. Health effects of particulates
- c. Particle size selective sampling basics

Assignment #3: Particle questions

Sept 11 *Lab #2: Optical Sizing*

Sept 16 Air: Particulate Sampling (Anthony)

- a. Particle size selective samplers
 - i. Occupational
 - ii. Environmental
- b. Particle speciation
- c. Hands on with sampling pumps and media

Assignment #4: Particulate samplers

Sept 18 *Lab #3: Size Selective Samplers*

Sept 23 Air: Gases and Vapors (Anthony)

- a. Active sampling

- b. Sorbent tube selection
- c. Analytical equipment

Sept 25 **Lab #4a:** Solvent monitoring

Sept 30 Air: Gases and Vapors (Anthony)

- a. Passive sampling
- b. Direct reading instrumentation

Assignment #5: Direct Reading

Oct 1 **Lab #4b:** Solvent monitoring

Oct 7 Other Air Sampling Methods (Anthony)

- a. Emissions Testing
- b. Auto exhaust
- c. Wipe samples

Oct 9: Midterm

Oct 14 Biomarkers (Anthony)

- a. Biological exposure indices
- b. Factors determining body system
- c. Procedures and requirements for sampling: blood, urine, buccal, toenail, hair, breath, dermal, human milk, cord blood, meconium

Assignment #6: Biomarker ID in OSHA Chemical-specific standards (industry) 1910 subpart B

Oct 16 **Lab #5:** Meet with S. Littau to discuss procedures for obtaining samples to analyze for biomarkers of occupational and environmental exposures. In FREMONT lab.

Oct 21 Food (O'Rourke)

- a. Environmental contamination of food
- b. Exposure assessment to food sources
- c. Personal Exposure Assessment methods

PREPARATION for LAB #7: Receive collection plates for Lab #7. THESE must be deployed and then "incubated" for at least one full week before Oct. 30th lab.

Oct 23 **Lab #6:** Personal Exposure Assessment from Food

Oct. 28 Bioaerosols (O'Rourke)

- a. Active and Passive Sampling
- b. Sampler Siting
- c. Effect modifiers
- d. Pollen
- e. Fungi (total vs CFU)

Oct 30 **Lab #7 :** Bioaerosol collection **and** identification and interpretation of Bioaerosols

- Nov 4 Soil lecture (Reynolds)
- a. Soil characteristics
 - b. Contaminant fate and transport
 - c. Monitoring considerations
 - d. Calculations
- Assignment #7:** Calculations
- Nov 6 Water lecture (Reynolds)
- a. Physicochemical characteristics
 - b. Quality monitoring/regulated contaminants
 - c. Methods overview
- Assignment #8:** Field sampling protocol
- Nov. 11: Veteran's Day: No Class
- Nov. 13** **Lab #8a:** Dilution and plating/Total vs culturable microbes
- Nov. 18 Water lecture (Reynolds)
- a. Microbial pathogens
 - b. Field testing equipment
 - c. Novel methodologies
 - d. Detection limits/accuracy/precision/extrapolation
- Nov. 20** **Lab #8b :** Membrane filtration/indicator organisms/chemical analysis
- Nov 25 Water lecture (Reynolds)
- a. Point vs non-point source pollution
 - b. distribution system contamination
 - c. low-cost monitoring techniques
- Assignment #9:** article review
- Nov. 27: Thanksgiving, no class
- Dec 2** Water lecture (Reynolds)... wrap up/ prep for field trip
- Dec 4** Sampling demo/field trip
- Dec 9 Wrap-up and course review
Course review
- December 16 from 8 – 10 am: Final Exam

Reading References (Abbreviations)

- Air Sampling Instruments for evaluation of atmospheric contaminants (ACGIH, 2001, 9th ed.) (ASI)
- NIOSH Manual of Analytical Methods (<http://www.cdc.gov/niosh/nmam/>) (NMAM)
- OSHA Technical Manual, Section II: Sampling, Measurement methods and Instruments (OTM)
(http://www.osha.gov/dts/osta/otm/otm_toc.html)
- OSHA Sampling and Analytical Methods (<http://www.osha.gov/dts/slrc/methods/>) see index(OSAM)
- ACGIH TLVs and BEIs (ACGIH)
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- Aug. 26: OTM Section II, Ch. 1: Sampling Media
ASI: Chapter 18, analytical instrumentation
Field sampling manual, Ch. 1-6.
- Aug. 28: IH Calculations workbook
CPH 502 Lab workbook
ASI: CH 10
- Sept 2, 4: NMAM Chapter C: quality assurance
NMAM Chapter D: general considerations
NMAM Chapter P: measurement uncertainty
NMAM Chapter E: development and evaluation of methods
OTM: Section II, Chapter 1
ASI: Chapter 7: Airflow Calibration
- Sept 9-18: NMAM Chapter N: aerosol sampling: minimizing particle losses
NMAM: Method 0500, 0600
OTM: Section II, Chapter 1
ASI CH 5: Size Selective Sampling
- Sept.23-25: ASI Chapter 16 and (NMAM methods from Table 16-1)
NMAM: Chapter H: portable electrochemical sensor methods
OTM: Section II, Chapter 1
OSAM <http://www.osha.gov/dts/slrc/methods/toc.html>
- Sept 30: ASI Ch. 17 and 18
- Oct 7: ASI Ch 20
EPA Emission Testing Methods
(<http://www.epa.gov/ttn/emc/>)
Arizona Inspection and Maintenance Program study
(<http://www.epa.gov/otaq/regs/im/az-rpt/420r97001.htm#sum>)
CFR Promulgated Test Methods

(<http://www.epa.gov/ttn/emc/promgate.html>)

OTM Section II, Chapter 2

OSAM surface methods (<http://www.osha.gov/dts/sltc/methods/>)

Oct 9 MIDTERM

Oct 14-16: Biomarker Journal Articles, posted on D2L, including:

- ACGIH BEIs
- Michael S. Morgan (1997) *The Biological Exposure Indices: A Key Component in Protecting Workers from Toxic Chemicals*, Environ Health Perspectives, 105 (Suppl 1):105-115

Oct 21-23: Food references, posted on D2L

Oct 28-30: Bioaerosol references, posted on D2L

Nov. 4 Klute, A. and Dirkson, C. (1982) *Methods of Soil Analysis. Part I- Physical and mineralogical methods*. Soil Science Society of America, Madison, Wisconsin.

Nov 4-25 Clesceri, L.S. Greenberg, A.E. and Eaton, A.D. eds. (1999) *Standard Methods for the Examination of Water and Wastewater*, 20th Ed. American Public Health Association, Washington, D.C.

USEPA. Monitoring and Assessing Water Quality (follow associated links)
<http://www.epa.gov/owow/monitoring/monintr.html>

USEPA. Maximum Contaminant Levels, United States Drinking Water
<http://www.epa.gov/safewater/mcl.html#mcls>

WHO. 2003. Assessing microbial safety of drinking water: improving approaches and methods
http://www.who.int/water_sanitation_health/dwq/9241546301/en/print.html

Dec 4: no reading: student presentations and discussion on Semester-Long Project