Summary

Environmental and occupational health scientists must frequently measure exposures to potentially hazardous chemical, physical, and biological agents in air or water. These measurements involve sampling the agent from the air or water, preparing the sample for analysis, conducting the analysis, and interpreting the resulting data. Students in this course will learn about methods to accomplish each of these steps. The course will consist of short lectures and demonstrations followed by laboratory exercises to help students learn about a broad array of sampling, analytical, and data interpretation techniques. It will emphasize the practical application of environmental and occupational health concepts and methods. The course will include a project in which the students will evaluate an exposure and make oral and poster presentations of their findings.

Course Information

Wednesdays, 12:20 – 4:25 PM
Industrial Hygiene Laboratory, Boynton Health Service Room S55 (Sub-basement)
Environmental Chemistry Laboratory, Mayo Room 1135
2 credits

Instructor Information

Pete Raynor, Ph.D., Assistant Professor
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Email: praynor@umn.edu

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Office hours: By appointment
Email: msimcik@umn.edu

Course Prerequisites

Any of the following: PubH 6100 (Measurement and Properties of Air Contaminants), PubH 6190 (Environmental Chemistry), or PubH 6191 (Air Pollution) or instructor consent.
Course Materials

Laboratory instructions and assignments required for laboratory sessions will be posted on the course's web page that can be accessed through [http://www.myu.umn.edu](http://www.myu.umn.edu). Supplemental readings may be specified; some may be from books set aside on reserve at the Bio-Medical Library and others from web resources.

Course Objectives

By the end of the course, students should be able to:

• select appropriate sampling methods and equipment to evaluate the potential risks of airborne or waterborne exposures
• utilize common sampling and analytical methods to evaluate exposures to a variety of environmental and occupational health hazards
• interpret the data produced by the sampling and analytical procedures used in environmental measurements
• work individually or in small groups to solve complex environmental sampling problems
• communicate and present data and experimental results with appropriate uncertainty
• describe common difficulties associated with measuring environmental hazards

Course Grading

The course will include 1 in-class calculation exercise, 6 laboratory exercises, and a project. Students are expected to turn in a written laboratory report for each of the 6 laboratory exercises describing their methods, reporting data and results, and discussing questions posed in the assignments. Reports will be due within two weeks of the conclusion of the laboratory exercise. The reports will be graded on a 100-point scale. Grades may be reduced by 5 points for each weekday that the assignment is late. The course will not have any exams.

Each student will complete an environmental sampling and analysis project during this course. Students will be required to plan the sampling study, collect and analyze the samples, and evaluate the data they collect. The products of this work will include a poster shown during the final class session and an oral presentation of the information shown in the poster. The poster and oral presentation should include the aims of the study, the methods used, the results, a discussion of implications, and conclusions.

The presentation of reports will be taken into consideration during grading; a report structured logically will frequently receive a better grade because the instructors follow the student's reasoning more easily. Partial credit will be awarded wherever possible, so reasoning and calculations leading to an answer should be provided when appropriate.

The breakdown of grading for the course is:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>In-class calculation exercise</td>
<td>5 %</td>
</tr>
<tr>
<td>Laboratory report #1: Gas &amp; Vapor Concentration Measurements</td>
<td>15 %</td>
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<tr>
<td>Laboratory report #2: Direct Reading Gas &amp; Vapor Measurements</td>
<td>10 %</td>
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</tbody>
</table>
Laboratory report #3: Airborne Particle Concentration Measurements 15 %
Laboratory report #4: Direct Readings Airborne Particle Measurements 10 %
Laboratory report #5: Bioaerosol Measurements 10 %
Laboratory report #6: Waterborne Chemical Concentration Measurements 15 %
Project poster 10 %
Project oral presentation 10 %

Final grades will be assigned on an A/F basis as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>(93-100 %)</td>
<td>Outstanding achievement relative to course expectations</td>
</tr>
<tr>
<td>A−</td>
<td>(90-93 %)</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>(87-90 %)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>(83-87 %)</td>
<td>Achievement above minimum course expectations</td>
</tr>
<tr>
<td>B−</td>
<td>(80-83 %)</td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>(77-80 %)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>(73-77 %)</td>
<td>Achievement meeting the minimum course expectations</td>
</tr>
<tr>
<td>C−</td>
<td>(70-73 %)</td>
<td></td>
</tr>
<tr>
<td>D+</td>
<td>(67-70 %)</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>(60-67 %)</td>
<td>Achievement below minimum expectations, but sufficient for credit</td>
</tr>
<tr>
<td>F</td>
<td>(&lt; 60 %)</td>
<td>No credit awarded</td>
</tr>
</tbody>
</table>

The University of Minnesota's Uniform Grading and Transcript Policy can be found at [http://onestop.umn.edu](http://onestop.umn.edu).

**Content of Laboratory Reports**

Reports should be produced electronically. The report must be no longer than 8 pages, single-spaced with no smaller than 11-point font, excluding any appendices. A shorter report is fine if it covers all requirements!!

1. Title, name, and date.
2. Background section providing the purpose of the experiment, principles and theory, and calculation formulae (1 page or less).
3. Methods section including a short discussion of the instruments and devices used, a diagram of the experimental set-up, and description of the experimental procedure (2 pages or less).
4. Results & Discussions sections with data in tabular form; figures; qualitative and, wherever possible, quantitative analyses of errors and variability; and answers to questions posed in the laboratory assignment (no more than 5 pages).
5. Conclusions (less than ½ page).
6. Appendices that include only vital information supporting your report. Note: No appendices are necessary!!
What the Instructors Expect from Students

- Students are expected to attend all classes and to arrive on time.
- Students will comply with all laboratory health and safety requirements.
- Students should review laboratory instructions and assignments prior to class.
- Students will download handouts and laboratory instructions and assignments from the course's web site that can be accessed through http://www.myu.umn.edu
- Students should bring a calculator to all classes.
- Students are responsible for asking questions and/or letting instructors know when they do not understand lectures, laboratory instructions, or course materials.
- Although students will work together to produce data in the laboratory and may discuss data analysis procedures required for laboratory reports, each student's report is expected to reflect primarily individual analyses and consideration of the data.
- Laboratory reports must be written using word processing and graphics software.
- Students may discuss their projects with one another and others, but they must show their own work in their project reports and presentations.
- Students are encouraged to provide constructive feedback to the instructors when they are dissatisfied with the course content or teaching methods.

What Students Should Expect from the Instructors

- The instructors will be enthusiastic about the class and the subject matter.
- The instructors will begin and conclude sessions on time.
- The instructors will state learning objectives for each session.
- The instructors will answer all questions posed during class by students. Whenever possible, questions will be answered immediately. Otherwise they will be answered during the next session.
- The instructors will ensure that all discussions in class are conducted in a professional and collegial manner.
- The instructors will create assignments with clear expectations.
- The instructors will provide detailed explanations regarding the use of equipment and methods in the experimental exercise to be performed.
- The instructors will prepare the laboratory equipment and experimental set-up prior to class.
- The instructors will grade and return assignments within one week of submission.
- The instructors will provide feedback on assignments that identifies both strengths and weaknesses in student work with constructive suggestions for improvement.
- The instructors will make themselves available outside of class to discuss any aspect of the course with students.

Additional Information

Every class is influenced by the fact that participants bring diverse values, experiences, and abilities into the classroom. All participants will be expected to listen to those with differing views, disagreeing with the views while remaining respectful of the individuals who hold them. Students should feel free to question the instructors and each other collegially at any time.
School of Public Health students may withdraw from a course through the second week of the semester without permission. No "W" will appear on the transcript. After the second week students are required to do the following:

- The student must contact and notify their advisor and course instructor informing them of the decision to withdraw from the course.
- The student must send an e-mail to the SPH Student Services Center (SSC). The email must provide the student name, ID#, course number, section number, semester and year with instructions to withdraw the student from the course, and acknowledgement that the instructor and advisor have been contacted.
- The advisor and instructor must email the SSC acknowledging the student is canceling the course. All parties must be notified of the student’s intent.
- The SSC will complete the process by withdrawing the student from the course after receiving all emails (student, advisor, and instructor). A "W" will be placed and remain on the student transcript for the course.

After discussion with their advisor and notification to the instructor, students may withdraw up until the eighth week of the semester. There is no appeal process.

An incomplete grade is permitted only in cases of extraordinary circumstances and following consultation with the instructor. In such cases an "I" grade will require a specific written agreement between the instructor and student specifying the time and manner in which the student will complete the course requirements. Extension for completion of the work will not exceed one year.

Students are responsible for knowing the University of Minnesota, Board of Regents' policy on Student Conduct and Sexual Harassment found at www.umn.edu/regents/polindex.html.

Scholastic dishonesty as defined in the policy and will be reported to the Office for Student Conduct and Academic Integrity (http://www1.umn.edu/oscai/index.html) and will result in a grade of "F" or "N" for the entire course. Plagiarism is an important element of this policy. It is defined as the presentation of another's writing or ideas as your own. Serious, intentional plagiarism will result in a grade of "F" or "N" for the entire course. For more information on this policy and on how to prevent plagiarism, consult University policies and procedures regarding academic integrity: http://www.writing.umn.edu/sws/quicktips/online_resources.htm#plagiarism. Students are urged to be careful to properly attribute and cite others' work in their own writing. For guidelines for correctly citing sources, go to http://tutorial.lib.umn.edu/ and click on "Citing Sources". In addition, original work is expected in this course. It is unacceptable to hand in assignments for this course for which you receive credit in another course unless by prior agreement with the instructor. Building on work begun in another course or leading to a thesis, dissertation, or final project is acceptable. If you have any questions, consult the instructor.

Any student with a documented disability (e.g., physical, learning, psychiatric, vision, hearing, etc.) who needs to arrange reasonable accommodations must contact the instructor and Disability Services at the beginning of the semester. All discussions will remain confidential. For further information contact the University of Minnesota Disability Services website at http://ds.umn.edu/ or call (612) 626-1333 (V/TTY). Disability Services is located in Suite 180 McNamara Alumni Center, 200 Oak Street.
COURSE SCHEDULE

1/21/09  Week 1  Course Introduction
Discussion: Course syllabus; discussion of report requirements; lab notebooks; laboratory safety training

Uncertainties in Measurements
Discussion: Variability and error; quality assurance and quality control
Activity: In-Class Exercise on Uncertainty

1/28/09  Week 2  Lab Exercise #1: Gas & Vapor Concentration Measurements
Discussion: Common sampling systems for gases and vapors; practical aspects of sampling systems; sampling media; flow calibration
Activity: Calibrate sampling systems for gas and vapor sampling

ON-LINE LAB SAFETY TRAINING MUST BE COMPLETED

2/4/09  Week 3  Lab Exercise #1: Gas & Vapor Concentration Measurements
Activity: Perform gas and vapor sampling

2/11/09  Week 4  Lab Exercise #1: Gas & Vapor Concentration Measurements
Discussion: Analytical techniques for gases and vapors; preparation of samples for analysis
Activity: Prepare gas and vapor samples for analysis; run samples on analytical instruments

2/18/09  Week 5  Lab Exercise #1: Gas & Vapor Concentration Measurements
Discussion: Working with data produced by analytical instruments
Activity: Evaluate data produced by analytical instruments

2/25/09  Week 6  Lab Exercise #2: Direct Reading Gas & Vapor Measurements
Discussion: Real-time instruments for gases and vapors; confined space concerns and entry procedures
Activity: Sample gases and vapors using real-time instruments

3/4/09  Week 7  Lab Exercise #3: Airborne Particle Concentration Measurements
Discussion: Common sampling systems for airborne particles; size-selected particle samples; practical aspects of particle sampling systems; sampling media
Activity: Calibrate sampling systems for particle sampling; prepare media for particle sampling; take initial weights of sampling media

LAB EXERCISE #1 REPORT DUE
3/11/09 Week 8 Lab Exercise #3: Airborne Particle Concentration Measurements
Activity: Perform airborne particle sampling; take final weights of sampling media

LAB EXERCISE #2 REPORT DUE

3/18/09 SPRING BREAK!!

3/25/09 Week 9 Lab Exercise #3: Airborne Particle Concentration Measurements
Discussion: Analytical techniques for sampled particles; preparation of samples for analysis; working with data produced by analytical instruments
Activity: Prepare particle samples for analysis; run samples on analytical instruments

4/1/09 Week 10 Lab Exercise #4: Direct Readings Airborne Particle Measurements
Discussion: Real-time instruments for airborne particles; particle size distributions; uses for real-time aerosol instruments
Activity: Sample particles using real-time instruments

4/8/09 Week 11 Lab Exercise #5: Bioaerosol Measurements
Discussion: Microbiological organisms; airborne versus deposited microorganisms; common sampling systems and approaches for microorganisms; practical aspects of bioaerosol sampling systems; sampling media
Activity: Sample biological particles and prepare for incubation

Note: Students will need to return to laboratory subsequent to lab period to count colonies formed on sampling media

LAB EXERCISE #3 REPORT DUE

4/15/09 Week 12 Lab Exercise #6: Waterborne Chemical Concentration Measurements
Discussion: Common sampling systems for waterborne chemicals; practical aspects of water sampling; sampling techniques and media
Activity: Perform water sampling

LAB EXERCISE #4 REPORT DUE
<table>
<thead>
<tr>
<th>Date</th>
<th>Week</th>
<th>Event Description</th>
</tr>
</thead>
</table>
| 4/22/09    | 13   | **Lab Exercise #6: Waterborne Chemical Concentration Measurements**  
Discussion: Analytical techniques for water samples; preparation of samples for analysis; working with data produced by analytical instruments  
Activity: Prepare water samples for analysis; run samples on analytical instruments |
| 4/29/09    | 14   | **Laboratory Tour** |
| 5/6/09     | 15   | **Project Presentations**  
Pizza; poster viewing; oral presentation of project |
| 5/13/09    |      | **LAB EXERCISE #6 REPORT DUE** |