

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.

Course Information

Wednesdays, 12:20 – 4:25 PM

Primary Location: Industrial Hygiene Laboratory, Boynton Health Service Room S55 (Sub-basement)

2 credits

Instructor Information

Lead Instructors:

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Additional Instruction:

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Course Materials

Laboratory instructions and assignments required for laboratory sessions will be posted on the course's Moodle site that can be accessed through <http://moodle.umn.edu>. Supplemental readings may be specified.

Course Objectives

By the end of the course, students will 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 agents

Course Grading

The course will include on-line lab safety training that must be completed before the second session, a calculation exercise, and 8 laboratory exercises. Students are expected to turn in a written laboratory report for each of the 8 laboratory exercises describing their methods, reporting data and results, and discussing questions posed in the assignments. Reports will be due within 2-3 class sessions of the conclusion of the laboratory exercise. The reports will be graded on a 100-point scale. Grades will be reduced by 5 points for each weekday that the assignment is late. Attendance at all class sessions will be part of the course grade. Failure to attend a class session will lead to a deduction of 1 point from the final course grade. Students will not be penalized for absence due to unavoidable or legitimate circumstances including verified illness, subpoenas, jury duty, military service, bereavement, and religious observances. However, additional work to compensate for missing a class session will need to be agreed upon between the student and the instructors to earn the point for the session. The course will have no exams.

The breakdown of grading for the course is:

Attendance	15 %
Successful completion of on-line lab safety training	5 %
Laboratory Calculations Assignment	5 %
Lab Exercise Report #1: Flow Calibration of Air Sampling Systems	5 %
Lab Exercise Report #2: Direct Reading Gas & Vapor Measurements	10 %
Lab Exercise Report #3: Time-Integrated Vapor Measurements	10 %
Lab Exercise Report #4: Time-Integrated Particle Measurements	10 %
Lab Exercise Report #5: Direct Reading Particle Measurements	10 %
Lab Exercise Report #6: Dermal and Surface Sampling	10 %
Lab Exercise Report #7: Aerobiological Measurements	10 %
Lab Exercise Report #8: Waterborne Chemical Measurements	10 %

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

A	(93-100 %)	Outstanding achievement relative to course expectations
A–	(90-93 %)	
B+	(87-90 %)	
B	(83-87 %)	Achievement above minimum course expectations
B–	(80-83 %)	
C+	(77-80 %)	
C	(73-77 %)	Achievement meeting the minimum course expectations
C–	(70-73 %)	
D+	(67-70 %)	
D	(60-67 %)	Achievement below minimum expectations, but sufficient for credit
F	(< 60 %)	No credit awarded

The University of Minnesota Uniform Grading and Transcript Policy can be found at <http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html>.

The SPH will collect student course evaluations electronically using a software system called CoursEval: <http://www.sph.umn.edu/courseval>. The system will send email notifications to students when they can access and complete their course evaluations. Students who complete their course evaluations promptly will be able to access their final grades just as soon as the faculty member renders the grade in SPHGrades: <http://www.sph.umn.edu/grades>. All students will have access to their final grades through OneStop two weeks after the last day of the semester regardless of whether they completed their course evaluation or not. Student feedback on course content and faculty teaching skills are an important means for improving our work. Please take the time to complete a course evaluation for each of the courses for which you are registered.

A grade of incomplete "I" shall be assigned at the discretion of the instructor when, due to extraordinary circumstances (e.g., documented illness or hospitalization, death in family, etc.), the student was prevented from completing the work of the course on time. The assignment of an "I" requires that a contract be initiated and completed by the student before the last official day of class, and signed by both the student and instructor. If an incomplete is deemed appropriate by the instructor, the student in consultation with the instructor, will specify the time and manner in which the student will complete course requirements. Extension for completion of the work will not exceed one year (or earlier if designated by the student's college). For more information and to initiate an incomplete contract, students should go to SPHGrades at: <http://www.sph.umn.edu/grades>.

Content of Laboratory Reports

Reports should be produced electronically. The report must comply with the page limits below, and be single-spaced with no smaller than 11-point font. Pages should have a 1-inch border on the top, bottom, and both sides. Shorter reports are preferred if they cover all requirements!!

1. Title, name, and date
2. Background section providing the purpose of the experiment, principles and theory, and calculation formulae (2 pages 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 & Discussion section 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 (8 pages or less).
5. References
6. Appendices: only necessary if information provided is vital to support your report.

What the Instructors Expect from Students

- Students are expected to attend all classes, arrive on time, and pay attention.
- Students will comply with all laboratory health and safety requirements.
- Students should review laboratory instructions and assignments prior to class.
- Students should be sure that electronic devices are muted during class sessions.
- Students will download handouts, laboratory instructions, and assignments from the course's Moodle site that can be accessed through <http://moodle.umn.edu/>.
- Students should bring a laptop or 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.
- Students are expected to turn assignments in on time.
- 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 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 post handouts, laboratory instructions, and assignments on the course's Moodle site at least 1 week before they are due.
- The instructors will begin and conclude classes on time.
- The instructors will answer all questions posed during class by students. Whenever possible, questions will be answered immediately. As an alternative, the instructors may indicate that the question will be addressed later in the class or that they will answer the question at the beginning of the next class session if they do not know the answer.
- The instructors will ensure that all discussions in class are conducted in a professional and collegial manner.
- 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 create laboratory activities and assignments with clear expectations.
- The instructors will grade and return assignments within one week of submission.

- The instructors will grade assignments objectively.
- 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

For full-semester courses, students may change their grade option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester courses) can be found at <http://onestop.umn.edu>.

Students should refer to the Refund and Drop/Add Deadlines for the particular term at <http://onestop.umn.edu> for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw. Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Office of Admissions and Student Resources at sph-ssc@umn.edu for further information.

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf. Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: <http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data

analysis (Student Conduct Code:

http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf). If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: <http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html>.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty:

<http://www1.umn.edu/oscai/integrity/student/index.html>. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see:

<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>.

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see:

<http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: <https://policy.umn.edu/hr/sexharassassault>.

The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy:

http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center Student Services is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health,

attentional, learning, chronic health, sensory, or physical), please contact DRC at 612-626-1333 or <mailto:drc@umn.edu> to arrange a confidential discussion regarding equitable access and reasonable accommodations. If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course. For more information, please see the DS website, <https://diversity.umn.edu/disability/>.

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: <http://www.mentalhealth.umn.edu>.

The Office for Student Affairs provides services, programs, and facilities that advance student success, inspire students to make life-long positive contributions to society, promote an inclusive environment, and enrich the University of Minnesota community. Units within the Office for Student Affairs include, the Aurora Center for Advocacy & Education, Boynton Health Service, Central Career Initiatives (CCE, CDes, CFANS), Leadership Education and Development – Undergraduate Programs (LEAD-UP), the Office for Fraternity and Sorority Life, the Office for Student Conduct and Academic Integrity, the Office for Student Engagement, the Parent Program, Recreational Sports, Student and Community Relations, the Student Conflict Resolution Center, the Student Parent HELP Center, Student Unions & Activities, University Counseling & Consulting Services, and University Student Legal Service. For more information, please see the Office of Student Affairs at <https://osa.umn.edu/>.

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college (Dr Kristin Anderson, SPH Dean of Student Affairs), or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

Students who wish to improve their academic performance may find assistance from Student Academic Support Services. While tutoring and advising are not offered, SASS provides resources such as individual consultations, workshops, and self-help materials.



Course Schedule

1/17/18 Week 1

Course Introduction

Discussion: Course syllabus; report requirements; lab notebooks; laboratory safety training;

Activity: Industrial Hygiene Laboratory tour

Laboratory Calculations

Discussion: Variability and error; limits of detection and quantification; calibration curves; quality assurance and quality control

Activity: Begin laboratory calculations exercise working together with other students in class

1/24/18 Week 2

Lab Exercise #1: Flow Calibration of Air Sampling Systems

Discussion: Common sampling systems; practical aspects of sampling systems; flow calibration

Activity: Calibrate various sampling pumps using primary and secondary calibration standards.

ON-LINE LAB SAFETY TRAINING MUST BE COMPLETED

1/31/18 Week 3

Lab Exercise #2: Direct Reading Gas & Vapor Measurements

Discussion: Gas/vapor measurement principles, calibrating and cross-validating direct reading instruments; measuring concentrations of mixtures; confined space considerations

Activity: Measure concentration of pure vapor using direct-reading instruments; measure vapor concentrations of a mixture

LABORATORY CALCULATIONS ASSIGNMENT DUE

2/7/18 Week 4

Lab Exercise #3: Time-Integrated Vapor Measurements

Discussion: Sampling media for gases and vapors; sampling systems for gases and vapors; color-changing indicator tubes

Activity: Determine sampling conditions for vapor hazards; calibrate sampling systems for gas and vapor sampling

LAB EXERCISE #1 REPORT DUE

2/14/18 Week 5

Lab Exercise #3: Time-Integrated Vapor Measurements

Discussion: Chain-of-custody forms

Activity: Perform vapor sampling; prepare samples for laboratory analysis

2/21/18	Week 6	Meet at EMSL Analytical Laboratory, 1800 Elm St. SE, Suite 1830, Minneapolis, MN
		<p>Lab Exercise #3: Time-Integrated Vapor Measurements <u>Discussion:</u> Handling of incoming samples at an analytical laboratory; analytical equipment for gas/vapor and particle samples; calibration of analytical equipment <u>Activity:</u> Tour EMSL Analytical Industrial Hygiene Laboratory; receive analyses of vapor samples</p>
		LAB EXERCISE #2 REPORT DUE
2/28/18	Week 7	<p>Lab Exercise #4: Time-Integrated Particle Measurements <u>Discussion:</u> Sampling media for airborne particles; sampling systems for particles; size-selective particle samples <u>Activity:</u> Calibrate sampling systems for particle sampling; prepare media for particle sampling; take initial weights of sampling media</p>
3/7/18	Week 8	<p>Lab Exercise #4: Time-Integrated Particle Measurements <u>Activity:</u> Perform airborne particle sampling; take final weights of sampling media</p>
		LAB EXERCISE #3 REPORT DUE
3/14/18		<i>SPRING BREAK!! ☺</i>
3/21/18	Week 9	<p>Lab Exercise #5: Direct Reading Particle Measurements <u>Discussion:</u> Direct-reading instruments for airborne particles; particle size distributions; uses for direct-reading aerosol instruments <u>Activity:</u> Sample several types of particles using direct-reading instruments</p>
3/28/18	Week 10	<p>Lab Exercise #6: Dermal and Surface Sampling <u>Discussion:</u> Sampling techniques for dermal exposures; collecting samples from skin surfaces; collecting samples from inanimate surfaces <u>Activity:</u> Sample skin and inanimate surfaces for metals; prepare samples for delivery to an analytical laboratory</p>
		LAB EXERCISE #4 REPORT DUE
4/4/18	Week 11	<p>Lab Exercise #6: Dermal and Surface Sampling <u>Discussion:</u> Analytical approaches for metals <u>Activity:</u> Receive analyses of dermal and surface samples; perform calculations of dermal and surface loading</p>
		LAB EXERCISE #5 REPORT DUE

- 4/11/18 Week 12 **Lab Exercise #7: Aerobiological 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
- 4/18/18 Week 13 **Lab Exercise #7: Aerobiological Measurements**
Discussion: Assessment of incubated samples; converting counts into concentrations; practical uses for results
Activity: Assess samples collected and incubated the week before
- LAB EXERCISE #6 REPORT DUE**
- 4/25/18 Week 14 **Lab Exercise #8: Waterborne Chemical Measurements**
Discussion: Common sampling systems for waterborne chemicals; practical aspects of water sampling; sampling techniques and media preparation of samples for analysis;
Activity: Perform water sampling; prepare water samples for analysis
- 5/2/18 Week 15 **Lab Exercise #8: Waterborne Chemical Measurements**
Discussion: Analytical techniques for water samples; working with data produced by analytical instruments
Activity: Run samples on analytical instruments; interpret results of analyses
- LAB EXERCISE #7 REPORT DUE**
- 5/9/18 **LAB EXERCISE #8 REPORT DUE**