

PubH 6192
Measurement and Properties of Air Contaminants
Fall 2015

Credits:	2
Meeting Days:	Wednesday and Fridays
Meeting Time:	12:20 pm to 2:15 pm
Meeting Place:	Mayo Building 1250
Instructor:	Gurumurthy Ramachandran
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I. Course Description

This course explores the physical nature of gaseous and particulate air contaminants, their occurrence in workplaces, the factors governing generation and dispersal, the criteria, rationales and standards under which practical measurement in the workplace is conducted, the principles underlying industrial hygiene measurement techniques; processes of inhalation and deposition of aerosols and their ultimate fate, and scenarios linking exposure with aerosol-related ill-health.

II. Course Prerequisites

Students are expected to have a good grasp of elementary physics, chemistry, and mathematics, including calculus.

III. Course Goals and Objectives

Upon completion of the course, the students should be able to:

1. Understand the physical nature of both particulate and gaseous airborne contaminants and be able to express these properties quantitatively as well as qualitatively.
2. Understand the factors governing generation and dispersal, and relate such knowledge to the nature and magnitude of the exposures of people to such contaminants.

3. Understand the criteria, rationales and standards under which practical measurement in the workplace is conducted.
4. Understand the principles underlying industrial hygiene measurement techniques and relate it to the assessment of human inhalation exposures.
5. Understand the processes of inhalation and deposition of aerosols and their ultimate fate, and scenarios linking exposure with aerosol-related ill-health.
6. Critically evaluate measurement studies in current scientific literature, and produce a written report that evaluates the quality of a journal article.

IV. Methods of Instruction and Work Expectations

The course is comprised of lectures, examples, and group discussions.

V. Course Text and Readings

Occupational Exposure Assessment for Air Contaminants by Gurumurthy Ramachandran. CRC Press, Taylor and Francis, 2005.

VI. Course Outline/Weekly Schedule

Week 1

Wed, September 9

- Introduction to the course
- Properties of gases

Friday, September 11

- Properties of gases (Continued)
- Elementary fluid mechanics

Week 2

Wednesday, September 16

- Uncertainties in physical measurements, calibration, random and systematic errors, propagation of errors, quantifying uncertainty, elementary statistics, the normal distribution.

Friday, September 18

- Air sampling systems;
Sampling heads, filters, pumps; flow measurement, primary and secondary standards, calibration.

Week 3

Wednesday, September 23

- Gas and vapor sampling systems
Sampling strategies: Active vs. passive; short-term vs. long term, area vs. personal. Absorption, adsorption, collection media; Detector tubes; Concept of "breakthrough"; Diffusion badges.

Friday, September 25

- Analytical methods for gases and vapors: Gas Chromatography; elementary principles; Mass spectrometry, Practical applications in industrial hygiene

Week 4

[Self Study: Direct reading instrumentation for gases and vapors. Instruments based on absorption and emission of radiation, electrochemical properties, and thermal properties.]

Wednesday, September 30

- Basic aerosol properties.

Friday, October 2

- Elementary size statistics; particle size distributions; Hatch-Choate equation.

Week 5

Wednesday, October 7

- The motion of airborne particles.

Friday, October 9

- Equations of particle motion, particle aerodynamic diameter; elutriators; inertial impaction; cascade impactors; diffusion

Week 6

Wednesday, October 14 (Avula Sreenath, TSI)

- Direct reading instrumentation for aerosols

Friday, October 16 (Avula Sreenath, TSI)

- The optical properties of aerosols.

Week 7

Wednesday, October 21

- Inhalation and respiratory deposition..

Friday, October 23

- Sampling of aerosols

VII. Evaluation and Grading

Student performance is based on the following:

Homework assignments	50%
Final Exam	50%

A set of homework problems based on the lectures and classroom discussions will be assigned every week and will be due the next class. These problem sets will contain both quantitative as well as essay-type questions. Students can work together on these problem sets and seek help from the instructor.

The final exam will be a take-home exam that will be given to the students during the last week of classes. They will be due one week later. The exam will be based on real-life problems and situations requiring use of the knowledge gained in the course. The exam will comprise both quantitative problems and discussions of measurement issues.

Extra credit work will not be accepted to improve the final grade. Assignment of final letter grades for the course will be based on the following guidelines:

- A Outstanding achievement relative to course expectations (approx. 90-100%)
A-
B+
- B Achievement above course expectations (approx. 80-90%)
B-
C+
- C Achievement meeting the minimum course expectations (approx. 70-80%)
C-
D+
- D Achievement below minimum course expectations but sufficient to be awarded credit (approx 60-70%)
- F No credit awarded (approx. below 60%)

Course Evaluation

The SPH will collect student course evaluations electronically using a software system called CourseEval: www.sph.umn.edu/courseeval. 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: 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.

Incomplete Contracts

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: www.sph.umn.edu/grades.

Other Course Information and Policies

Grade Option Change (if applicable)

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 onestop.umn.edu.

Course Withdrawal

Students should refer to the Refund and Drop/Add Deadlines for the particular term at 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.

Student Conduct Code

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."

Use of Personal Electronic Devices in the Classroom

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>.

Scholastic Dishonesty

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.

Makeup Work for Legitimate Absences

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>.

Appropriate Student Use of Class Notes and Course Materials

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

"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: <http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf>

Equity, Diversity, Equal Opportunity, and Affirmative Action

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.

Disability Accommodations

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) 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 DS at 612-626-1333 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/>.

Mental Health and Stress Management

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>.

Academic Freedom and Responsibility: *for courses that do not involve students in research*

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, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost. [*Customize with names and contact information as appropriate for the course/college/campus.*]

*** Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".**