

**Summary**

Physical agents in the workplace include ionizing radiation, noise, temperature extremes, and poor ergonomic conditions. Occupational health specialists should be able to recognize physical agents, assess exposure to the agents, determine when the agents present a hazard to workers, and recommend strategies for controlling the exposure, if necessary. This course will survey a variety of physical agents commonly found in workplaces. Several guest lecturers especially familiar with certain of these agents will share their expertise with participants. In addition, students will be able to see and try out instruments used to measure exposure to many of the hazards. The course will include lessons presented by students in groups in which they will research a type of physical agent not otherwise considered during the course and teach the rest of the class about their findings.

**Course Information**

Mondays, 4:40 – 6:40 PM (we'll take a 5-10 minute break during lectures)  
Mayo D199  
2 credits

**Lead Instructor Information**

Pete Raynor, Ph.D., Associate Professor

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Office: Mayo 1242

Office hours: By appointment

**Course Materials**

Web-based reading or video assignments will be required for most classes. Supplemental readings will be specified from *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition* (ISBN 978-1-935082-15-6) edited by Daniel H. Anna and published by AIHA in 2011. This book is available for "check-out" from the small Midwest Center for Occupational Health and Safety library in 1260 Mayo. Equivalent chapters in the earlier editions – *The Occupational Environment – Its Evaluation, Control, and Management, 2<sup>nd</sup> Edition* (ISBN 1-931504-43-1) or *The Occupational Environment – Its Evaluation and Control* (ISBN 0-932627-82-X), both edited by S.R. DiNardi and published by AIHA in 2003 and 1997, respectively – would be suitable as well.

**Learning Objectives**

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

- describe the properties of physical agents
- explain how physical agents interact with the human body
- list the regulations and guidelines that govern workplace exposure to physical agents
- select instruments to measure exposure to physical agents
- participate in the design of a radiation safety program

- participate in the design of a hearing conservation program
- participate in the design of an ergonomics program
- prioritize potential control solutions when confronted with a physical hazard
- present a lesson on a physical agent to adult learners

### **Assignments**

#### *Individual Response Assignments*

The course will include short written responses to the readings or videos that are required for each class session except the first one and the one after Spring Break. The reading or video assignments and the requirements for the written responses will be posted for each class session at least 1 week before the session on the course Moodle site. These assignments will be "handed in" by posting them to the Moodle site by 4:40 PM on the day of the session. Late responses will not be accepted. The responses will be graded on a 10-point scale. Students may discuss these written responses together, but students should write their own response and post it individually to the course Moodle site.

#### *Homework Assignments*

The course will include 4 homework assignments. The assignments will be posted on the course's Moodle site at least 2 weeks prior to the due date. They are due in the hands, mailbox, or email inbox of Dr. Raynor on the dates indicated on the course schedule. The assignments will each be graded on a 100-point scale, and grades will be reduced by 5 points for each weekday that the assignment is late. Students may work together on homework assignments. However, students must submit their own assignments for grading.

#### *Student-Led Group Lessons*

Students will be required to work in groups of 3-4 to learn about one of the following physical agents in occupational settings: (1) combustible dust, (2) electricity, (3) non-ionizing radiation, or (4) vibration. Because these topics will not otherwise be covered during the course, each group will teach a 55-minute lesson to the rest of the class about the agent during one of the last 2 class sessions. Topics for each agent must include the properties of the agents, the effects on worker health, methods of assessing exposure, and ways to minimize harmful effects of the agent. Lessons will be developed over the entire semester. After groups are chosen, graded checkpoints during the semester will include a draft lesson outline, a draft presentation, and an individual response assignment for the rest of the class to complete. Assessments of the lessons will be made by Dr. Raynor and class members outside of the group. The contribution of each member of the group will be graded by all members of the group. More details about the student-led group lessons will be provided in a separate document.

### **Course Grading**

The course will have neither a midterm nor a final exam. For all assignments, partial credit will be awarded, so students should show all work. In addition, the neatness of the work is important because the instructor will be able to follow the students' reasoning more easily when trying to award partial credit. 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 Dr. Raynor to earn the point for the session. The breakdown of grading for the course is:

Individual Response Assignments	23 %
Homework Assignments	28 %
Student-Led Group Lesson	35 %
Attendance	14 %

Final grades for the A/F option will be assigned 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

Final grades for the S/N option will be assigned as follows:

S	(70-100 %)	
N	(< 70 %)	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 CourseEval: <http://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: <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>.

### **What the Instructors Expect from Students**

- Students are expected to attend all classes, arrive on time, and pay attention.
- Students should be sure that electronic devices are muted during class sessions.
- Students will download handouts and assignments from the course's Moodle site that can be accessed through <http://moodle.umn.edu/>.
- Students are expected to complete the individual response assignments prior to class.
- Students should bring a calculator to all classes.
- Students are expected to answer questions posed by the instructors and participate in classroom discussions.
- Students are responsible for asking questions and/or letting instructors know when they do not understand lectures or course materials.
- Students are expected to turn assignments in on time.
- Although students may discuss individual response assignments together, each student's work should reflect independent thought.
- Although students may work together on homework assignments, they should each submit their own independent final version.
- Students will work together cooperatively in teams on their student-led group lessons.
- Students are expected to utilize the University of Minnesota Libraries as necessary, either on-line or in person.
- 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 and lecture slides on the course's Moodle site before class.
- The instructors will post individual response assignments on the course's Moodle site at least 1 week before they are due.
- The instructors will post homework assignments on the course's Moodle site at least 2 weeks before they are due.
- The instructors will begin and conclude classes on time.
- The instructors will take a 5-10 minute break about halfway through each class session.
- The instructors will answer all questions posed during class by students. Whenever possible, questions will be answered immediately. As an alternative, the lead instructor may indicate that the question will be addressed later in the class or that he will answer the question at the beginning of the next lecture if he does not know the answer.
- 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 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](mailto: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](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](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](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

- 1/22/18      Week 1      **Course Introduction (Pete Raynor)**  
Course syllabus, schedule, and requirements; discussion of student-run group lessons; types of physical agents
- Introduction to Ionizing Radiation (Pete Raynor)**  
Types of radiation; electromagnetic spectrum; terminology; units; common workplace sources;
- Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 26, pp. 831-848
- 1/29/18      Week 2      **Ionizing Radiation Management (Pete Raynor)**  
Radioactive decay; regulations; health effects; exposure limits; control measures; radiation safety programs
- Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 26, pp. 848-859
- INDIVIDUAL RESPONSE ASSIGNMENT #1 DUE**
- GROUP LESSON PREFERENCES DUE**
- 2/5/18      Week 3      **Ionizing Radiation Measurement (Brian Vetter, University of Minnesota)**  
Instrumentation for measuring emissions and exposure; hands-on activity with instruments
- Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 26, pp. 859-885
- INDIVIDUAL RESPONSE ASSIGNMENT #2 DUE**



- 2/12/18      Week 4      **Introduction to Noise (Pete Raynor)**  
Elements of sound; units; frequency weighting
- Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 24, pp. 665-670
- INDIVIDUAL RESPONSE ASSIGNMENT #3 DUE**
- 2/19/18      Week 5      **Noise Management (Ted Madison, 3M)**  
Regulations relating to noise and hearing; hearing loss prevention; hearing conservation programs
- Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 24, pp. 670-680
- INDIVIDUAL RESPONSE ASSIGNMENT #4 DUE**
- HOMEWORK ASSIGNMENT #1 (Ionizing Radiation) DUE**
- 2/26/18      Week 6      **Noise Measurement #1 (Carl Johnson, 3M)**  
Workplace noise measurement; use of instruments; analyses of data
- Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 24, pp. 680-687
- INDIVIDUAL RESPONSE ASSIGNMENT #5 DUE**
- 3/5/18      Week 7      **Noise Measurement #2 (Carl Johnson, 3M)**  
Community noise measurement; analyses of data; exposure assessment
- Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 24, pp. 687-712
- INDIVIDUAL RESPONSE ASSIGNMENT #6 DUE**
- GROUP LESSON DRAFT OUTLINE DUE**
- 3/12/18      **SPRING BREAK!!**

3/19/18      Week 8      **Temperature Extremes (Pete Raynor)**  
Heat stress and heat strain; cold stress

Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 27, pp. 891-914 & Chapter 28, pp. 919-946

3/26/18      Week 9      **Ergonomics: Introduction (Steve Gutmann, Allina Health Systems)**  
Background; exposure assessment and control; regulatory perspective; anthropometry

Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 30, pp. 979-1019

**INDIVIDUAL RESPONSE ASSIGNMENT #7 DUE**

**HOMEWORK ASSIGNMENT #2 (Noise) DUE**

4/2/18      Week 10      **Ergonomics: Manual Material Handling (Steve Gutmann)**  
Background; lifting and lowering tasks; push/pull tasks

Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 31, pp. 1025-1051

**INDIVIDUAL RESPONSE ASSIGNMENT #8 DUE**

**GROUP LESSON INDIVIDUAL RESPONSE ASSIGNMENTS DUE**

4/9/18      Week 11      **Ergonomics: Upper Extremities (Steve Gutmann)**  
Background; upper extremity tasks; examples of workplace issues and solutions

Supplemental Reading: *The Occupational Environment – Its Evaluation, Control, and Management, 3<sup>rd</sup> Edition*, Chapter 32, pp. 1059-1080

**INDIVIDUAL RESPONSE ASSIGNMENT #9 DUE**

**GROUP LESSON DRAFT PRESENTATION DUE**

