

Course Syllabus

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Course Description

This course presents the engineering principles of selecting and designing exposure controls to protect people from chemical physical and biological agents. The course is intended for graduate students in exposure assessment, occupational health, engineering, and environmental health. The class is broadly organized around modules on the concepts of source controls, pathway controls and receptor controls. A series of case study exercises by members of the class is designed to illustrate the application of exposure control techniques in real situations, and integrate the various approaches from the lecture material.

An extended content session (1hr/week, 1 credit) provides in-depth material related to the use of local exhaust ventilation (LEV) for source control in occupational settings. This session expands content on hood selection, and includes new material on duct system design, air cleaners and fan selection necessary for workplace ventilation. Students will complete an assignment in which they design a two-branch ventilation system. Students in the regular section (3 credits) receive instruction in the applications of local exhaust hoods for source control, but not in the design of LEV systems.

Learning Objectives

At the conclusion of this course, students will be able to:

1. Apply hazard ranking and banding strategies to workplace and environmental exposure scenarios
2. Name Federal and State regulation authorities and requirements related to human exposures
3. Compute exposure estimates for well-mixed rooms involving dilution ventilation and constant inputs
4. Describe the function of HVAC components used for building ventilation
5. Describe the role of HVAC in indoor air quality and infection control for health care settings
6. Measure the flow characteristics of a ventilation system and apply this data for system diagnostics
7. Select the appropriate type of local exhaust hood for controlling workplace exposures
8. Describe criteria for selecting chemical or biological protective clothing
9. Describe criteria for selecting protective equipment for physical agents such as noise or laser light
10. Describe the criteria for specifying respiratory protection based on appropriate protection factors
11. List the elements and evaluation of a comprehensive respiratory protection program
12. Describe the inventory control and chemical hygiene requirements for hazardous materials

Additional Ventilation Section Learning Objectives:

1. Compute exposure estimates for a dilution ventilation situation with variable input conditions.
2. Explain principles of fluid mechanics that apply to flow of air or liquids in building ducting and piping systems; describe fluid measurements in terms of pressure drop, flow rate, and velocity.

3. Estimate friction losses for flow through ducts or pipes using standard tables.
4. Design and specify the components of a single-branch local exhaust ventilation system.
5. Design and specify the components of a multiple branch local exhaust ventilation system.

Textbooks & Study Resources

- **Ventilation for Contamination Control.** McDermott H. (Excellent summary of industrial ventilation concepts)
- **Industrial Ventilation : A Manual of Recommended Practice.** American Conference of Governmental Industrial Hygienists. Committee on Industrial Ventilation. (Industrial ventilation reference book)
- **Environmental, Safety, and Health Engineering.** Woodside, G., & Kocurek, Dianna S. (1997). New York: Wiley. ISBN: 0471109320. (Contains principles of environmental engineering, safety engineering and industrial hygiene/occupational health engineering.)
- **NIOSH Pocket Guide to Chemical Hazards.** <https://www.cdc.gov/niosh/npg/default.html>
- **OSHA Publication 3151. Personal Protective Equipment.** (Revised 2004). <https://www.osha.gov/Publications/osha3151.pdf>
- **OSHA publication 3079. Respiratory Protection.** (Revised 2002). <https://www.osha.gov/Publications/osha3079.pdf>
- **OSHA publication 3384. Small Entity Compliance Guide for Respiratory Protection Standard.** <https://www.osha.gov/Publications/3384small-entity-for-respiratory-protection-standard-rev.pdf>

Course Grading Policy

Recommended reading assignments are posted under each class lecture on canvas.

Students are responsible for submitting assignments on time.

The final grade consists of the following components:

- Assignments (4) = 60%
- Lab exercise reports = 25%
- Class project/presentation = 15%

Note: students taking the class for 3 credits are responsible for all assignments except the second lab (15 points) and the third segment of assignment 4 (ventilation design) which is worth 10 points

Classroom Climate

The UW School of Public Health seeks to ensure all students are fully included in each course. We strive to create an environment that reflects community and mutual caring. We encourage students with concerns about classroom climate to talk to your instructor, your advisor, a member of the departmental or SPH Diversity Committee and/or the program director.

Access and Accommodations

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or [disability.uw.edu](http://depts.washington.edu/uwdrs/) [\(http://depts.washington.edu/uwdrs/\)](http://depts.washington.edu/uwdrs/). DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at [Religious Accommodations Policy](https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/) [\(https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/\)](https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using [the Religious Accommodations Request form](https://registrar.washington.edu/students/religious-accommodations-request/) [\(https://registrar.washington.edu/students/religious-accommodations-request/\)](https://registrar.washington.edu/students/religious-accommodations-request/).










Academic Integrity

Students at the University of Washington (UW) are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity.

The UW School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). We expect you to know and follow the university's policies on cheating and plagiarism, and [the SPH Academic Integrity Policy](http://sph.washington.edu/students/academicintegrity/) [\(http://sph.washington.edu/students/academicintegrity/\)](http://sph.washington.edu/students/academicintegrity/). Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct website.

Course Summary:










Date	Details	Due
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Date	Details	Due
Tue Jan 5, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785256&include_contexts=course_1434474)	8:30am to 10:30am
	 Hazard Ranking & Hierarchy of Controls (https://canvas.uw.edu/courses/1434474/assignments/5847145)	due by 1:30pm
Thu Jan 7, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785257&include_contexts=course_1434474)	8:30am to 10:30am
	 Regulatory Mandates & Requirements; Chemical/Material Safety Management (https://canvas.uw.edu/courses/1434474/assignments/5847150)	due by 1:30pm
Tue Jan 12, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785258&include_contexts=course_1434474)	8:30am to 10:30am
	 Substitution/Green Chemistry: finding safer alternatives (https://canvas.uw.edu/courses/1434474/assignments/5847154)	due by 1:30pm
Thu Jan 14, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785259&include_contexts=course_1434474)	8:30am to 10:30am
	 Chemical & Biological Agents; Chemical Protective Clothing (https://canvas.uw.edu/courses/1434474/assignments/5847136)	due by 1:30pm
Tue Jan 19, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785260&include_contexts=course_1434474)	8:30am to 10:30am



Date	Details	Due
	 Fluid Mechanics Primer: Density, Viscosity & Fluid Dynamics https://canvas.uw.edu/courses/1434474/assignments/5847143	due by 1:30pm
Thu Jan 21, 2021	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1785261&include_contexts=course_1434474	8:30am to 10:30am
	 Bernoulli Equation; Essential Pressure & Flow Relationships https://canvas.uw.edu/courses/1434474/assignments/5847135	due by 1:30pm
Fri Jan 22, 2021	 Assignment 1 - PPE Selection https://canvas.uw.edu/courses/1434474/assignments/5847129	due by 11:59pm
Tue Jan 26, 2021	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1785262&include_contexts=course_1434474	8:30am to 10:30am
	 Lab Exercise 1 (ROOSEVELT) https://canvas.uw.edu/courses/1434474/assignments/5847148	due by 1:30pm
Wed Jan 27, 2021	 Assignment 2 - Substitution https://canvas.uw.edu/courses/1434474/assignments/5847130	due by 11:59pm
Thu Jan 28, 2021	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1785263&include_contexts=course_1434474	8:30am to 10:30am
	 Hood Design & Entry Effects; Ventilation Assessment and Troubleshooting https://canvas.uw.edu/courses/1434474/assignments/5847146	due by 1:30pm
Tue Feb 2, 2021	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1785264&include_contexts=course_1434474	8:30am to 10:30am

Date	Details	Due
	 Dilution Ventilation: theory and confined space applications (https://canvas.uw.edu/courses/1434474/assignments/5847138)	due by 1:30pm
Wed Feb 3, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1929365&include_contexts=course_1434474)	12pm to 1:15pm
	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785265&include_contexts=course_1434474)	8:30am to 10:30am
Thu Feb 4, 2021	 Single Branch System Design Intro; Ventilation System Troubleshooting Case Studies (https://canvas.uw.edu/courses/1434474/assignments/5890121)	due by 11:59pm
	 Vent lab exercise #1 - writeup (https://canvas.uw.edu/courses/1434474/assignments/5847155)	due by 11:59pm
Mon Feb 8, 2021	 Dilution Ventilation Assignment Q&A Session (https://canvas.uw.edu/calendar?event_id=1934926&include_contexts=course_1434474)	1pm to 2pm
	 Assignment 3.1 - Dilution Ventilation Spreadsheet (https://canvas.uw.edu/courses/1434474/assignments/5894699)	due by 11:59pm
Tue Feb 9, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785266&include_contexts=course_1434474)	8:30am to 10:30am
	 Single Branch System Design Review; Multi Branch System Design (https://canvas.uw.edu/courses/1434474/assignments/5847153)	due by 8:30am

Date	Details	Due
	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1936649&include_contexts=course_1434474)	2pm to 3pm
Thu Feb 11, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785267&include_contexts=course_1434474)	8:30am to 10:30am
	 LEV Lab Exercise 2 (meet at Roosevelt Building) (https://canvas.uw.edu/courses/1434474/assignments/5847149)	due by 8:30am
Fri Feb 12, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1939098&include_contexts=course_1434474)	9am to 9:30am
Tue Feb 16, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785268&include_contexts=course_1434474)	8:30am to 10:30am
	 Confined Spaces (https://canvas.uw.edu/courses/1434474/assignments/5847137)	due by 1:30pm
	 Assignment 3.2 - Dilution Ventilation Problem Set (https://canvas.uw.edu/courses/1434474/assignments/5847131)	due by 11:59pm
Wed Feb 17, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1942886&include_contexts=course_1434474)	11am to 11:30am
Thu Feb 18, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785269&include_contexts=course_1434474)	8:30am to 10:30am
	 Fan Selection: Air Cleaning Systems (https://canvas.uw.edu/courses/1434474/assignments/5847128)	due by 1:30pm

Date	Details	Due
Fri Feb 19, 2021	 Assignment 4.1 - LEV System Design, Segment 1 https://canvas.uw.edu/courses/1434474/assignments/5847132	due by 11:59pm
Mon Feb 22, 2021	 Assignment 3.3 - Dilution Ventilation: Problem 1 Questions https://canvas.uw.edu/courses/1434474/assignments/6053957	due by 11:59pm
Tue Feb 23, 2021	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1785270&include_contexts=course_1434474	8:30am to 10:30am
	 Exposure Monitoring Strategies for Optimizing Exposure Control https://canvas.uw.edu/courses/1434474/assignments/5890561	due by 11:59pm
Wed Feb 24, 2021	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1950772&include_contexts=course_1434474	12pm to 12:30pm
Thu Feb 25, 2021	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1785271&include_contexts=course_1434474	8:30am to 10:30am
	 Vent lab exercise #2 - writeup (Not required for students taking 3 credit option) https://canvas.uw.edu/courses/1434474/assignments/5847156	due by 9am
Mon Mar 1, 2021	 Exposure Controls for Physical Agents https://canvas.uw.edu/courses/1434474/assignments/5847141	due by 1:30pm
	 ENV H 557 A Wi 21: Exposure Controls https://canvas.uw.edu/calendar?event_id=1955478&include_contexts=course_1434474	10am to 11am

Date	Details	Due
Tue Mar 2, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785272&include_contexts=course_1434474)	8:30am to 10:30am
	 HVAC, Thermal Comfort, IAQ & Plenum Systems (https://canvas.uw.edu/courses/1434474/assignments/5847147)	due by 1:30pm
Thu Mar 4, 2021	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785273&include_contexts=course_1434474)	8:30am to 10:30am
	 Respirator Selection & Uses (https://canvas.uw.edu/courses/1434474/assignments/5847152)	due by 1:30pm
	 Respirator Fit Testing & Training (https://canvas.uw.edu/courses/1434474/assignments/5847151)	due by 2:30pm
Tue Mar 9, 2021	 Assignment 4.2 - LEV System Design, Segment 2 (https://canvas.uw.edu/courses/1434474/assignments/5847133)	due by 11:59pm
	 ENV H 557 A Wi 21: Exposure Controls (https://canvas.uw.edu/calendar?event_id=1785274&include_contexts=course_1434474)	8:30am to 10:30am
Thu Mar 11, 2021	 Group Presentation (https://canvas.uw.edu/courses/1434474/assignments/5847142)	due by 1:30pm
	 Group Presentation (https://canvas.uw.edu/courses/1434474/assignments/5847144)	due by 8:30am
Tue Mar 16, 2021	 Assignment 4.3 - LEV System Design, Segment 3 (Not required for students taking 3 credit option) (https://canvas.uw.edu/courses/1434474/assignments/5847134)	due by 11:59pm
	 ENVH 557 Case Study Example (https://canvas.uw.edu/courses/1434474/assignments/5847139)	

Date	Details	Due
	 ENVH 557 Case Study Example V2 (https://canvas.uw.edu/courses/1434474/assignments/5847140)	
	 Lab Video #1a (https://canvas.uw.edu/courses/1434474/assignments/6045009)	