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:

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

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%

There is no final exam, however, we will meet during the scheduled final exam period for a tour of UW Physical Plant work areas that use local exhaust ventilation for contaminant control.

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

The following grading scale will be used.

# grade	Letter	%	# grade	Letter	%

4.0	A	> 98	2.9	B-	82.6
4.0	A	98.0	2.8	B-	81.2
3.9	A-	96.6	2.7	B-	79.8
3.8	A-	95.2	2.6	B-	78.4
3.7	A-	93.8	2.5	C+	77.0
3.6	A-	92.4	2.4	C+	75.6
3.5	B+	91.0	2.3	C+	74.2
3.4	B+	89.6	2.2	C	72.8
3.3	B+	88.2	2.1	C	71.4
3.2	B	86.8	2.0	C	70.0
3.1	B	85.4	1.9	C-	68.6
3.0	B	84.0	1.8	C-	67.2

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/)** . 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.

Religious Accommodations

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/)** 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/)** .

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/)** . 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

COVID-Related Expectations

Per UW policy, this class will be conducted in person. Therefore, unless you meet the criteria for an accommodation from Disability Resources for Students (DRS) or a special arrangement approved by the SPH Office of the Dean that allows you to take the course remotely [**see student communications here (https://sph.washington.edu/sites/default/files/2021-08/UWSPH_RTC_Student-Email.pdf)**] you should only register for this class if you can attend in-person.

- Please contact UW Disability Resources for Students (DRS) directly if you feel you may be eligible for an accommodation based on your status as an immunocompromised individual or based on other diagnosed physical or mental health conditions that might prevent you from being able to take classes in-person.
- If you are a student enrolled in a program in SPH, and you are either living with an individual who is immunocompromised, OR you are unable to obtain a visa to travel to the US, you may be eligible for a "special arrangement" that will allow you to take this course remotely. Requests for special arrangements to take the class remotely should have been submitted to and approved by the Students and Academic Services team in the Office of the Dean before the beginning of the quarter. If you have questions about this type of arrangement, please reach out to Student and Academic Services by email at **sphsas@uw.edu (mailto:sphsas@uw.edu)** .

All UW students are expected to complete their **vaccine attestation (https://www.washington.edu/coronavirus/vaccination-requirement/)** before arriving on campus and to follow the campus-wide face-covering policy at all times. You are expected to follow state, local, and UW COVID-19 policies and recommendations. If you feel ill or exhibit possible COVID symptoms, you should not come to class. If you need to temporarily quarantine or isolate per CDC guidance and/or **campus policy (https://www.washington.edu/coronavirus/2021/08/31/autumn-quarter-health-and-safety-measures-message-to-uw-personnel/)** , you are responsible for notifying your instructors as soon as possible by email. I**f you receive a positive COVID-19 test result, you must report to campus Environmental Health & Safety (EH&S) by emailing covidehc@uw.edu (mailto:covidehc@uw.edu) or calling 206-626-3344.**

Food is not allowed in the classroom. Drinks may be sipped with lifting or removal of your facemask for a brief moment, and immediate re-masking after drinking.

Please check your email daily BEFORE coming to class. If we need to conduct class remotely because the instructor or a guest speaker is complying with UW policies and unable to attend in person, we will send all registered students an email with a Zoom link for remote instruction. Thank you for your patience and support as we all transition together back to in-person learning!

Statement on Inclusion and Diversity

Diverse backgrounds, embodiments and experiences are essential to the critical thinking endeavor at the heart of University education. In SPH, we are expected:

1. To respect individual differences, which may include, but are not limited to, age, cultural background, disability, ethnicity, family status, gender identity and expression, citizenship and immigration status, national origin, race, religion, sex, sexual orientation, socioeconomic status and veteran status.

2. To engage respectfully in the discussion of diverse worldviews and ideologies embedded in course readings, presentations and artifacts, including those course materials that are at odds with personal beliefs and values.

On our first day of class we will create ground rules together to follow in promoting a productive learning environment for all members of the class. We are committed to making this class an equitable learning environment. Please talk with us right away if you experience disrespect in this class from other students and/or from us, and we will work to address it in an educational manner.

Reporting Learning Environment Concerns

The Office of the Dean has a **student concern policy (https://sph.washington.edu/students/student-concern-policy)** , a faculty concern policy and standard HR procedures for staff concerns. Students are encouraged to report any incidents of bias in any of the following ways:

- Report the incident to someone they feel comfortable with (including teaching staff, adviser or department staff) or directly inform the SPH Assistant Dean for Equity, Diversity & Inclusion Dr. Victoria Gardner at vg@uw.edu.
- Email **dcinfo@uw.edu (mailto:dcinfo@uw.edu)** to file a non-anonymous, confidential report (tracked by Director of Student and Academic Services and Assistant Dean of Equity, Diversity & Inclusion) or
- Send an anonymous and confidential report using the bias concern form **here (https://catalyst.uw.edu/webq/survey/vg/375764)** . Report is received by the Assistant Dean for EDI and the Director of Program Operations for Student and Academic Services and tracked for investigation and/or resolution. Reporter can remain completely anonymous but will not receive a response.

Course Summary:

Date	Details	Due
Tue Jan 4, 2022	**ENV H 557 A Wi 22: Exposure Controls** (https://canvas.uw.edu/calendar?event_id=2458883&include_contexts=course_1515841)	8:30am to 10:30am
	Hazard Ranking & Hierarchy of Controls (https://canvas.uw.edu/courses/1515841/assignments/6859646)	due by 8:30pm
Thu Jan 6, 2022	**ENV H 557 A Wi 22: Exposure Controls** (https://canvas.uw.edu/calendar?event_id=2458884&include_contexts=course_1515841)	8:30am to 10:30am

Date	Details	Due
	Regulatory Mandates & Requirements; Chemical/Material Safety Management (https://canvas.uw.edu/courses/1515841/assignments/6859652)	due by 8:30am
Tue Jan 11, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458885&include_contexts=course_1515841)	8:30am to 10:30am
	Substitution/Green Chemistry: finding safer alternatives (https://canvas.uw.edu/courses/1515841/assignments/6859657)	due by 8:30am
Thu Jan 13, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458886&include_contexts=course_1515841)	8:30am to 10:30am
	Chemical & Biological Agents; Personal Protective Equipment (non-respiratory) (https://canvas.uw.edu/courses/1515841/assignments/6859635)	due by 8:30pm
Tue Jan 18, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458887&include_contexts=course_1515841)	8:30am to 10:30am
	Fluid Mechanics Primer: Density, Viscosity & Fluid Dynamics (https://canvas.uw.edu/courses/1515841/assignments/6859643)	due by 8:30am
Thu Jan 20, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458888&include_contexts=course_1515841)	8:30am to 10:30am
	Bernoulli Equation; Essential Pressure & Flow Relationships (https://canvas.uw.edu/courses/1515841/assignments/6859634)	due by 8:30am

Date	Details	Due
Sun Jan 23, 2022	Assignment 1 - PPE Selection (https://canvas.uw.edu/courses/1515841/assignments/6859626)	due by 11:59pm
Tue Jan 25, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458889&include_contexts=course_1515841)	8:30am to 10:30am
	Lab Exercise 1 (ROOSEVELT) (https://canvas.uw.edu/courses/1515841/assignments/6859649)	due by 8:30am
Thu Jan 27, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458890&include_contexts=course_1515841)	8:30am to 10:30am
	Hood Design & Entry Effects; Ventilation Assessment and Troubleshooting (https://canvas.uw.edu/courses/1515841/assignments/6859647)	due by 8:30am
Sun Jan 30, 2022	Assignment 2 - Substitution (https://canvas.uw.edu/courses/1515841/assignments/6859627)	due by 11:59pm
Tue Feb 1, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458891&include_contexts=course_1515841)	8:30am to 10:30am
	Dilution Ventilation: theory and confined space applications (ROOSEVELT) (https://canvas.uw.edu/courses/1515841/assignments/6859637)	due by 8:30am
Thu Feb 3, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458892&include_contexts=course_1515841)	8:30am to 10:30am
	Single Branch System Design Intro; Ventilation System Troubleshooting Case Studies (https://canvas.uw.edu/courses/1515841/assignments/6859655)	due by 8:30am

Date	Details	Due
Fri Feb 4, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2610810&include_contexts=course_1515841)	8:30am to 9am
	Vent lab exercise #1 - writeup (https://canvas.uw.edu/courses/1515841/assignments/6859658)	due by 1pm
Mon Feb 7, 2022	Assignment 3.1 - Dilution Ventilation Spreadsheet (https://canvas.uw.edu/courses/1515841/assignments/6859628)	due by 11:59pm
Tue Feb 8, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458893&include_contexts=course_1515841)	8:30am to 10:30am
	Single Branch System Design Review; Multi Branch System Design (https://canvas.uw.edu/courses/1515841/assignments/6859656)	due by 8:30am
Thu Feb 10, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458894&include_contexts=course_1515841)	8:30am to 10:30am
	LEV Lab Exercise 2 (meet at Roosevelt Building) (https://canvas.uw.edu/courses/1515841/assignments/6859651)	due by 8:30am
Tue Feb 15, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458895&include_contexts=course_1515841)	8:30am to 10:30am
	Confined Spaces (https://canvas.uw.edu/courses/1515841/assignments/6859636)	due by 8:30am
Thu Feb 17, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458896&include_contexts=course_1515841)	8:30am to 10:30am

Date	Details	Due
	Fan Selection and Air Cleaning Systems (https://canvas.uw.edu/courses/1515841/assignments/6859642)	due by 8:30am
	Assignment 3.2 - Dilution Ventilation Problem Set (https://canvas.uw.edu/courses/1515841/assignments/6859629)	due by 11:59pm
Mon Feb 21, 2022	Assignment 4.1 - LEV System Design, Segment 1 (https://canvas.uw.edu/courses/1515841/assignments/6859631)	due by 11:59pm
Tue Feb 22, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458897&include_contexts=course_1515841)	8:30am to 10:30am
	Exposure Monitoring Strategies for Optimizing Exposure Control (https://canvas.uw.edu/courses/1515841/assignments/6859641)	due by 8:30am
Wed Feb 23, 2022	Vent lab exercise #2 - writeup (Not required for students taking 3 credit option) (https://canvas.uw.edu/courses/1515841/assignments/6859659)	due by 9am
Thu Feb 24, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458898&include_contexts=course_1515841)	8:30am to 10:30am
	Respirator Fit Testing & Training (ROOSEVELT) (https://canvas.uw.edu/courses/1515841/assignments/6859653)	due by 8:30am
	Respirator Selection & Uses (Roosevelt) (https://canvas.uw.edu/courses/1515841/assignments/6859654)	due by 8:30am
Tue Mar 1, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458899&include_contexts=course_1515841)	8:30am to 10:30am

Date	Details	Due
	HVAC, Thermal Comfort, IAQ & Plenum Systems (ROOSEVELT) (https://canvas.uw.edu/courses/1515841/assignments/6859648)	due by 8:30am
	Assignment 4.2 - LEV System Design, Segment 2 (https://canvas.uw.edu/courses/1515841/assignments/6859632)	due by 11:59pm
Thu Mar 3, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458900&include_contexts=course_1515841)	8:30am to 10:30am
	Exposure Controls for Physical Agents (https://canvas.uw.edu/courses/1515841/assignments/6859640)	due by 8:30am
Tue Mar 8, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458901&include_contexts=course_1515841)	8:30am to 10:30am
	Group Presentation (https://canvas.uw.edu/courses/1515841/assignments/6859645)	due by 8:30am
Thu Mar 10, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458902&include_contexts=course_1515841)	8:30am to 10:30am
	Group Presentation (https://canvas.uw.edu/courses/1515841/assignments/6859644)	due by 8:30am
Fri Mar 11, 2022	Assignment 4.3 - LEV System Design, Segment 3 (Not required for students taking 3 credit option) (https://canvas.uw.edu/courses/1515841/assignments/6859633)	due by 11:59pm
Tue Mar 15, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458903&include_contexts=course_1515841)	8:30am to 10:30am

Date	Details	Due
Thu Mar 17, 2022	ENV H 557 A Wi 22: Exposure Controls (https://canvas.uw.edu/calendar?event_id=2458904&include_contexts=course_1515841)	8:30am to 10:30am
	ENVH 557 Case Study Example (https://canvas.uw.edu/courses/1515841/assignments/6859638)	
	ENVH 557 Case Study Example V2 (https://canvas.uw.edu/courses/1515841/assignments/6859639)	
	Lab Video #1a (https://canvas.uw.edu/courses/1515841/assignments/6859650)	