ENVH 577, PUBPOL 589, CEWA 560: Risk Assessment for Environmental Health Hazards
Autumn Quarter 2020
4 credits

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Dr. Elaine M. Faustman (pronouns: she/her/hers), Professor and Director of the Institute of Risk Analysis and Risk Communication, School of Public Health, University of Washington, Seattle. Dr. Faustman directs the Center for Children's Health Research and directed the Pacific Northwest Center for the National Children's Study and the Oceans and Human Health Center. She is an elected fellow of the American Association for the Advancement of Science and the Society for Risk Analysis. She has served on the USEPA Science Advisory Board and chaired the National Academy of Sciences Committee on Developmental Toxicology. She has also served on the National Advisory Environmental Health Sciences Council, NIEHS-NTP Board of Scientific Counselors and Committee on Alternative Toxicology Methods, National Academy of Sciences Committee on Toxicology and the Institute of Medicine Upper Reference Levels of Nutrient Subcommittee of the Food and Nutrition Board. She has served as the Secretary General for the International Union of Toxicology (IUTOX) and is currently a member of the International Science Council (ISC) World Data Systems Advisory Board. For over 2 decades, she has been involved and directed Stakeholder forums and Community Based Participatory Research for DOE, EPA and NIH. She currently serves on the ISC CODATA Citizen Sciences Task group. Her research expertise is on integrative scientific approaches including identifying molecular mechanisms of developmental, reproductive, and neuro toxicants, characterizing in vitro techniques for toxicology assessment, and developing biological and exposure based dose-response models. She has over 200 peer reviewed research publications and reports.

Teaching Assistant: Orly Stampfer
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Orly Stampfer (pronouns: she/her/hers) is a PhD student in the Department of Environmental and Occupational Health Sciences at University of Washington. She graduated with an MPH from the same department in 2018. Prior to graduate school, Orly worked in environmentally sustainable healthcare and environmental education. Orly is interested in environmental health research partnerships with communities, where the research addresses community priorities and can lead to practical action. Orly's current research focuses on indoor and outdoor air pollution, the use of low-cost air pollution

sensors, and building collaborative research partnerships. Orly has experience in both qualitative and quantitative research.

Background

Risk Assessment is a lens through which you will learn to explore and tackle environmental and public health sciences problems and characterize risk within a broad public health context.

Risk Assessment is a transdisciplinary, multifaceted approach to solving public and environmental health science problems because it combines the key principles of exposure sciences (through assessment of exposure), toxicology and epidemiology (through hazard identification), and modeling (through dose-response assessment) to characterize risks from biological, chemical, or physical agents for public health questions. Risk management includes delineating options, making decisions, and taking actions to address the risks identified. Making decisions in the face of significant uncertainty is a key challenge to which risk assessment and risk management approaches can be applied. Risk communication identifies approaches to exchange information about risks to stakeholder groups. Understanding how individuals perceive risk can provide ideas for improved risk communication and for risk evaluation.

Course Description

ENVH 577 "Risk Assessment for Environmental Health Hazards" is a graduate course that introduces students to the fundamentals of environmental risk assessment through a series of lectures, case examples, readings, assignments, and a final group project. Students learn to identify, characterize and predict environmental health risk for a spectrum of public and environmental health science problems. Quantitative prediction methods are taught and students will have an opportunity to use these approaches. Methods for evaluating uncertainty in such predictions are presented. Approaches for preventing and controlling potential risks are also included in the course content and this will involve discussion of legislative and regulatory options as well as risk communication techniques. Students will prepare a risk assessment within a group project setting.

Since risk assessment practice requires a transdisciplinary understanding across technical and social sciences, this course has transdisciplinary student participation, which is exemplified by its listing in three schools. It is designed for students in public health in all of the 5 core disciplines. In addition, students in engineering and environmental disciplines (civil and systems) are key participants. It is also designed for students in engineering law, policy, risk management, and students in public affairs to provide essential context for risk application.

Through the use of case examples in all lectures and in the group project, students will become familiar with examples of chemical, physical and biological agents and will be able to understand the sources of such risks within the community. For example, media-specific (air, water, soil) as well as context-specific (food, occupational, medicine, etc.) factors will be included. Natural as well as man-made risks will be

assessed (earthquakes, hurricanes, built environments, etc.). Lectures and student exercises will emphasize the significance of integrating information from core public health disciplines of environmental health, epidemiology, health policy management and social and behavioral sciences alongside engineering (civil, environmental) and with policy (management, decision analytics, etc.). Opportunities to participate in facilitated exercises and group discussions will be encouraged.

Course Credit:

The course is a 4-credit course and class time will be used in a balance of didactic lectures as well as participatory exercises and discussion.

Course Objectives:

The course objectives include:

1. Identifying health hazards and understanding the methodologies and types of data generated by public health studies (epidemiology, toxicology, etc.) and ecological hazards.
2. Define risk assessment, describe the what, why and how of risk assessment, i.e., describing and differentiating the public health risks, benefits and costs of a particular action event or exposure and thereby developing a framework for decision-making in environmental health and safety.
3. Characterizing the public health risks of a specific hazard by accounting for variables, differing sensitivities and uncertainties of analysis.
4. Understanding a broader vision of hazards using an engineering, built environment or event context.
5. Identifying factors that contribute to the diversity of the response of human populations to environmental toxicants and physical factors.
6. Prepare and present a group risk assessment project that identifies, characterizes, and manages an environmental, ecological, or occupational risk.
7. Define risk management and identify means to control risk including intervention as well as use of legislative and regulatory guidelines. Understand decision analytic approaches.
8. Effectively communicate environmental and public health risks and prevention strategies to potentially affected communities including culturally diverse populations.
9. Identify social and economic factors that can affect vulnerabilities to environmental hazards.

Course Competencies:

Upon completion of this course, students shall be able to:

1. Describe and distinguish between risk assessment and management approaches.
2. Describe how risk information from core public health disciplines is integrated to identify potential health risks.
3. Describe how public policy and engineering controls can address and decrease vulnerabilities.
4. Describe and apply both qualitative and quantitative approaches to characterize the magnitude of environmental and public health risks.
5. Predict potential for health risks using the risk assessment framework.
6. Identify key areas of uncertainty in risk predictions.

7. Describe risk management approaches for addressing (controlling and preventing) predicted risks including identifying legislative, regulatory and risk communication options.
8. Perform an environmental or public health risk assessment.

Grading and Assignments

Course Breakdown:

Grade %	Assignment
	Graded Assignments:
25%	Final Exam
20%	Student Project: Oral Presentation and Critique
30%	Student Project: Paper
20%	Memo to the Governor
	Credit/No Credit Assignments
2%	Short Term and Biomarker Assay Review
2%	Quantitative Worksheet examples
1%	Class Participation (including discussion and breakout groups)

Memo to the Governor:

In this assignment, you will create a mini report for the governor explaining a key public health issue. This memo should:

1. Summarize the major conclusions of the studies. Be sure to cite specific scientific basis for identifying TCE contaminated groundwater as a potential human health hazard. What is the potential hazard?
2. Your memo should address the following questions
    a. Is there a problem for the Governor's constituents?
    b. Who is at risk?
    c. How big is the problem?
    d. What should be done? or How can we determine what should be done?
3. Anticipate questions about the current regulatory status that the Governor may want to have answered. Identify potential problems not dealt with in the regulations or even in the book, i.e., make your own suggestions for further actions.
4. Evaluate the author's views and potential biases.

Short term or Biomarker Assay Review:

Depending on your background, you should choose a short-term or biomarker assay to review. For those students with limited biological background, the instructors would suggest short-term assay #1, for those students that are more comfortable with their biological knowledge, please choose from the other assays. For those with an engineering background, you can choose a hazard index such as the

earthquake, tsunami or hurricane index. The instructors will provide the papers you are to review for each assay. You should not do an extra external literature search. Your review should include:

1. What is the indicator?
2. Brief description of experimental protocol
3. Biological or physical endpoints monitored
4. How was the assay or index characterized or determined to be reliable?
5. Usefulness: Cost, ease of methodology, space, time and laboratory requirement, etc…
6. Sensitivity (False negative- False positives; range of impact)
7. Disadvantages/ Advantages

Group Project:

Objective: To work as a transdisciplinary, group to prepare a risk assessment for one of the public and environmental health problems listed below.

Instructions: Your report should include an examination of the biological evidence of hazard, extrapolation of hazard data from various assessments to humans, analysis of possible epidemiological data for exposed humans, determination of potential hazards and possible "safe" exposure levels. Your presentation (both oral and written) should follow the framework for risk assessment that we have presented in class. You will need to develop an approach for communicating this risk information and present your risk management options. The project requires a 20 min. in-class oral presentation followed by a 15 min. discussion period. To facilitate discussion, each group will prepare a one-page summary giving nature of risk, magnitude of risk, and recommendations.

Text Books/Reading Materials:

Required texts:

1. ENVH 577 Readings (On Canvas site)
2. Harr, J., A Civil Action. Vintage Press, 1996 (on reserve at HS Library)

In some cases, you will be asked to select from 1 or more from a group of reading options and the selected reading are considered required assigned reading. However, in other cases readings listed are specified as optional or supplemental and are not considered required. Unless otherwise noted, readings listed serve as suggested readings that the student may wish to read if desired.

Lecture Recordings/Slide Posting:

All slides will be posted and we will use Zoom to record videos of all classes.

Zoom Breakout Rooms:

During our Zoom lectures, we will be encouraging discussion in randomly assigned breakout rooms of 5 students. These will be an opportunity to get to know your classmates while discussing material from the lecture and asking questions.

Classroom Climate

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

- To respect individual differences, which may include, but are not limited to, age, cultural background, disability, ethnicity, family status, gender, immigration status, national origin, race, religion, sex, sexual orientation, socioeconomic status and veteran status.
- 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.
- To encourage students with concerns about classroom climate to talk to their instructor, adviser, a member of the departmental or SPH EDI Committee, the Assistant Dean for EDI, or the program's director.

UW School of Public Health Equity Diversity and Inclusion Statement:
Our School of Public Health is committed to addressing the root causes of health inequities and promoting healthy and safe communities in our region and beyond. As the problem of racial and ethnic disparities in health outcomes continues to persist, policymakers and the general public increasingly look to health professional schools to address these urgent and unacceptable circumstances. As one of the few schools of public health in the Northwest, it is particularly important for us to be up to this challenge.

Underlying all public health research and training activities is an acknowledgement and deeper understanding of the effects that historical, cultural and socioeconomic factors have on the health of communities, especially those who are most underserved. Racism and race-based oppression is all too often a central driver of health disparities. We work to attract and retain students, faculty and staff from diverse backgrounds and perspectives, to build and sustain a positive climate for inclusion and community, and to engender multiple modes of approaching complex problems. We strive to create opportunities for education, research and collaboration that leverage our strengths, similarities and differences. We challenge ourselves to view problems and evaluate solutions through an equity lens. Through each of these efforts, we aim to foster a generation of public health professionals and academicians who are poised to transform health for the better in our communities.
Our historical logo, the SoulCatcher by Marvin Oliver, symbolizes the restoration of health and wellness and reminds us to align our work with the history, traditions, and practices while respecting and supporting the agency of individuals and communities to achieve their desired health outcomes. More information about our logo can be found here.

The work of equity, diversity and inclusion is the work of Public Health. We are committed to a future that is free of health inequities, that promotes the highest level of wellness that our communities aim for, and a diverse and inclusive public health workforce that embodies humility, respect, leadership and service on behalf of the diverse communities we are privileged to serve.

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. 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.

UW Disability Statement (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. 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.

Land Acknowledgment:
Washington State is home to 29 federally recognized and five unrecognized tribes. The University of Washington acknowledges the Coast Salish people of this land, the land which touches the shared waters of all tribes and bands within the Duwamish, Suquamish, Tulalip and Muckleshoot nations.

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/).

Bias Concerns:
The Office of the Dean has a student concern policy, a faculty concern policy and standard HR procedures for staff concerns. Our 2018 climate survey states that most people in SPH do not report bias incidents because they do not know where to go. Students are encouraged to report any incidents

of bias to someone they feel comfortable with, including instructors, advisers or department staff. They can email dcinfo@uw.edu for immediate follow up. Bias concerns can be anonymously and confidentially reported at this link https://sph.washington.edu/about/diversity/bias-concerns. Data is collected by the Assistant Dean for EDI and the Director of Program Operations for Student and Academic Services and tracked for resolution and areas are identified for further training.

Pronouns:
According to the UW First Year Programs, being an ally is not just about intention, it is also about behavior. We share our pronouns because we strive to cultivate an inclusive environment where people of all genders feel safe and respected. We cannot assume we know someone's gender just by looking at them. So we invite everyone to share their pronouns.

Course Schedule
Time: Tuesday/Thursday from 8:30am-10:20 AM
Location: REMOTE

Date	Class Session	Readings
Session 1 10/01/2020 Thursday	Introduction to Risk Assessment Issues and Approaches Course Requirements – Review and Discussion	1. Faustman EM, 2018 (required) 2. Cheehan MC, 2016 (required) 3. NRC, 1994, "Current Approaches to Risk Assessment" (optional)
Session 2 10/06/2019 Tuesday	Perceptions of Risk	1. Slovic P, 1990 (required) 2. Maibach E, 2016 (required) 3. Wong EY, 2003 (optional) 4. NRC, 1994, "Science and Judgment in Risk Assessment" (optional)
Session 3 10/08/2020 Thursday	Identification of Hazard I	1. Faustman EM, 2018 (required) 2. USEPA, 2005, "Guidelines for Carcinogen Risk Assessment" (optional (or choose a section)) 3. Pearce N, 2015 (required) 4. NRC, 2007, "Toxicity Testing in the 21st Century" (optional)
Session 4 10/13/2020 Tuesday	Identification of Hazard II **DUE: Choose short term biomarker assay or indicator to review**	1. Faustman EM, 2018 (required) 2. Hodgson E, 1987 (optional) 3. Omenn GS, 1988 (optional) 4. WHO, 2007 (optional)

Session 5 10/15/2020 Thursday	Identification of Hazard II cont. Breakout groups	1. UNEP, 2001 (optional) 2. Your short term biomarker assay or indicator review papers (required)
Session 6 10/20/2020 Tuesday	Identification of Hazard II cont. Discussion on use of Indicators Ecological Risk Assessment Bruce Duncan	No readings required
Session 7 10/22/2020 Thursday	Ecological Risk Assessment: Practical Approaches to Ecosystems Assessment cont. Bruce Duncan Identification of Hazard III: Epidemiology Faustman **DUE: Short term biomarker assay or indicator review**	1. USEPA, 1998 p.vi-viii, p.21-45, and p.116-119 (required) 2. Karr JR, 2001 (optional) 3. Bascietto J, 1990 (optional)
Session 8 10/27/2020 Tuesday	Integration of Human and Ecosystem Assessments Bruce Duncan, Pat Cirone, Faustman Ranking Hazardous Waste Sites Faustman	1. USEPA, 1989 (required) 2. Faustman EM, 2000 (optional) 3. Harris SG, 1997 (optional)
Session 9 10/29/2020 Thursday	Exposure Assessment	1. Checkoway H, 1994 (required) 2. Pearce N, 2015 (required)
Session 10 11/03/2020 Tuesday	Quantitative Risk Characterization I: Dose Response Assessment and Extrapolation to Low Dose Can Risk Assessment modeling be used for predicting public health impacts? BMD Modeling Program – Introduction to the Quantitative Worksheet Amy Leang	1. Faustman EM, 2018 (required) 2. USEPA, 2005, "Guidelines for Carcinogen Risk Assessment" (optional (or choose a section)) 3. NRC, 1994, "Science and Judgment in Risk Assessment" (optional) 4. Brown CC, 1987 (optional)
Session 11 11/05/2020 Thursday	Quantitative Risk Characterization II: Modeling Uncertainty Opportunities for Probabilistic Risk Assessment Modeling Suzy An	1. Hattis D, 1994 (optional) 2. Thompson KM, 1992 (optional)

Session 12 11/10/2020 Tuesday	Qualitative and Quantitative Microbial Risk Assessment **DUE: Quantitative Worksheet (we may need to push this later depending on when we release the assignment)**	1. Slovic P, 1990 (required) 2. Maibach E, 2016 (required) 3. Wong EY, 2003 (optional) NRC, 1994, "Science and Judgment in Risk Assessment" (optional)
Session 13 11/12/2020 Thursday	Risk Communication: Practical approaches for Learning Who, What, Where, and When Context for Risk Communication and Case Examples **DUE: Quantitative Worksheet (we may need to push this later depending on when we release the assignment)**	Slovic P, 1990 (required) Maibach E, 2016 (required) Wong EY, 2003 (optional) NRC, 1994, "Science and Judgment in Risk Assessment" (optional)
Session 14 11/17/2020 Tuesday	Civil Action TCE Case Study: Clash of the Titans Science vs. Regulation in the Courtroom **DUE: Memo to the governor**	No readings required
Session 15 11/19/2020 Thursday	Group Project Presentations: Fish Consumption group and Cyanobacteria group	No readings required
Session 16 11/24/2020 Tuesday	Group Project Presentations: Wildfires group and Particulates group	No readings required
11/26/2020 Thursday	Thanksgiving Holiday	No readings required
Session 17 12/01/2020 Tuesday	Group Project Presentations: Earthquakes group and COVID-19 group	No readings required
Session 18 12/03/2020 Thursday	Group Project Presentations: Hurricanes group and Infectious disease group	No readings required
Session 19 12/08/2020 Tuesday	Group Project Presentations: Agriculture group and Flooding group	No readings required
Session 20 12/10/2020 Thursday	Putting Risk Assessment and Risk Management into Context: What have we learned? Need to learn? Thinking about Risk Management as Critical Infrastructure	1. WHO, 2005 (1 required, option 1 of 2) 2. USDHHS, 2010 (1 required, option 2 of 2) 3. Hauschild MJ, 2005 (optional) 4. Ostrom EJ, 1999 (optional) 5. Wilson MP, 2009 (optional) Donatuto J, 2016 (optional)

	DUE: Student group risk assessment project papers	
12/15/2019 Tuesday	**Final Exam 10:30am-12:20pm**	