EOH 2504: Principals of Environmental Exposure

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Home of Course Materials-CHEC Website

All course materials will be posted on my Center for Healthy Environments and Communities (CHEC) website at http://www.chec.pitt.edu , click under **Info for Experts** and then click on **Academic Courses** and finally **EOH 2504: Principals of Environmental Exposure.** To see academic presentations and publications regarding human and aquatic receptor exposure assessments please use the CHEC website and scan under **Info for Experts and Topics**. Soon the CHEC website will be presenting exposure gradients to modeled criteria pollutants in Southwestern PA, Toxic Release Inventory mercury release models and models of total particulate from the Bruce Mansfield Coal Fired Power Plant (CFPP) using CalPuff software and Kriging interpolation. This will be under **GIS MAPS**.

Location and time: EOH 2504 - Principles of Environmental Exposure
Fall Term, 2009-2010
Tuesdays & Thursdays
3-4:25 pm, Room A719 Crabtree Hall, GSPH

Course Description: We will explore the methods, models, concepts, calculations, statistics and theory necessary for the assessment of human and ecological exposure to contaminants and physical factors. Contaminants can include inorganic as well as organic species like elements, metals and metalloids, simple hydrocarbons, persistent organic pollutants (PCB's, DDT). Physical factors include heat, and ionizing radiation. We will be particularly interested in understanding human exposure modes-inhalation, skin absorption and ingestion for toxic and carcinogenic substances-either through each mode separately or through each combination of exposure modes and also the modes of exposure for ionizing radiation-penetrating ionization paths or internal dose. We will explore the monitoring choices for exposure characterization in all environmental media, including air (personnel and area sampling), water and food sampling, soil and Superfund sampling and the use of human and ecological biomonitoring and biomarkers. Methodologies used to estimate exposure from these monitoring methods will be explored in depth. Students will be taught to understand the exposure sequence from source term, rate of release, transport through environmental media, concentration and

mode(s) of exposure, internal dose and dose to specific organs. Finally ways to reduce exposure to both chemical contaminants and physical factors will be described.

Course Rationale: Exposure assessment methodologies and concepts form the basic building blocks for the practice of environmental health. Accurate exposure assessment is necessary for the justification of appropriate concentrations of contaminants to be used in cell culture or basic toxicological studies, proper assessment of health risk, connection of exposure to health outcomes in epidemiology studies and the development of engineering, institutional and administrative occupational or environmental controls to contaminants from one or all modes of exposure or from physical factors.

Course Objectives The objectives of the course are to combine didactic teaching, reviews/presentations of actual exposure literature and case studies by students to help students:

- Understand standard occupational and environmental health hazards and appreciate the incremental policymaking protecting the public and workers, respectively.
- Explain the term exposure assessment and identify all variables that can affect internal dose and thus health effect(s) including the source, source release rate, environmental media, media transport mechanisms, exposure scenarios, absorption, pharmacodynamics, elimination rates, population groups, special sub-population group dynamics.
- Understand the modes of human and ecological exposure.
- Explain the primary methods to assess airborne dusts, mists, fumes, gases and vapor concentrations to estimate exposure including area and personnel sampling.
- Understand water-sampling methods for pathogens, metals and elements, and organic and inorganic compounds.
- Apply EPA Exposure Guidelines for assessment of sites contaminated by regulated substances including soil sampling.
- Explain the term biomonitoring in both humans and ecological species; understand what it can tell us concerning source identification and exposure mechanisms.
- Explain the term biomarkers and what they can tell us about human and/or ecological exposure.
- Understand physical exposures including ionizing and non-ionizing radiation and noise.
- Explain the difference and significance of indoor versus outdoor environmental health exposures.
- Apply appropriate statistical methodologies to the preparation for and analysis of human exposure.
- Explain the importance of geographical information and spatial systems in the estimation of exposure, apply geostatistical analysis packages to estimate exposure, and risk and help explain environmental public health disease patterns.
- Explain and prepare conceptual site models.
- Identify and explain exposure categories that are emerging in importance such as pharmaceutical estrogens and xenoestrogens.
- Explain exposure issues that are unique to different age classes including children.

- Identify methods to eliminate or decrease exposure in both occupational and environmental settings. To include product or process elimination and substitution, administrative and institutional controls, use of personal protective equipment and the institution of engineering control systems.

Course Structure The course is designed to have 3 classroom hours and twice this amount of class preparation and reading per week. Classroom lectures will be used to present essential vocabulary and concepts in occupational and environmental exposure assessment for; airborne dusts, mists, fumes, gases and vapors; surface and ground water waterborne pathogens, chemicals, metals, pH disturbances and persistent organic pollutants; physical hazards such as ionizing and non-ionizing radiation and noise; and Class readings will include reading case histories and up to date literature to learn exposure assessment application and practice. Each student will be expected to present and analyze topical peer reviewed papers (at least 2 papers each over the course of the semester, approximate presentation time 10 minutes with 5-10 minutes of questions and answers), pertaining to the major theme of the lecture (these presentations will be class led discussions without the use of PowerPoint presentations). Students may choose the paper to present but Dr. Volz must approve it before presentation. Dr. Volz will suggest papers to students having difficulty finding appropriate peer reviewed literature for class room discussion.

Text: While there are several texts pertaining to exposure assessment there is no text that unifies the sampling and analysis of contaminants from all environmental media and presents underlying preliminary concepts such as conceptual modeling. Primary course materials are attached as pdfs at the **Center for Healthy Environments and Communities (CHEC)** Website http://www.chec.pitt.edu. Go to the site and click **Info for Experts and Academic Courses** then click on and choose **EOH 2504: Principals of Environmental Exposure** then choose **Primary Course Materials**. Other required readings will be handed out in class. Extensive use of UNITED NATIONS ENVIRONMENT PROGRAMME INTERNATIONAL LABOUR ORGANISATION WORLD HEALTH ORGANIZATION
INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY
Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT by MacIntosh and Spangler will be made over the semester and it should be considered the primary text for this class.

Office Hours: Dr Volz will hold office hours by appointment only on Wednesday mornings from 9am until noon. Schedule appointments by contacting:
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Grading: Letter grades (A, B, C, D, F) are based on attendance, quality of in-class peer reviewed literature presentations and class participation (20%), a midterm examination (40%), a final examination (40%).

Academic Integrity Each student is expected to do her/his own work in class. Credit for ideas that are not your own must be given to their originator. Plagiarism is a violation of not only your own intellectual integrity, but also the rights of others to be recognized for their contributions. Plagiarism is a violation of University policies and will not be tolerated. Any work that is not your own will receive a failing grade and may result in suspension from the University.

Students with Disabilities If you have a disability that requires classroom or testing accommodations, you need to notify both the instructor and the Office of Disability Resources and Services, 216 William Pitt Union (412) 648-7890.

Syllabus

Week	Date	Topic	Readings
1	**9/1**	**Review of Occupational/ Environmental Health-Regulations and History-Philosophical Roots of Exposure Assessment**	**Gochfeld, M., Chronologic History of Occupational Medicine JOEM, Volume 47, Number 2, February 2005** **Hatch Papers in Advances in Modern environmental Toxicology, Volume III, Occupational and Industrial Hygiene Concepts and Methods, Esmen and Mehlman Editors, Princeton, 1984** **-Conditions of Work and Mans Health, Tomorrows Problems.** **-Significant Dimensions of the Dose Response Relationship.** **-Criteria for Hazardous Exposure Limits.** **-Priorities in Preventative Medicine.**
1	**9/3**	**Conceptual Site Models-Methodologies to Depict and Evaluate Important Exposure Modes, from Source –to Media-to Receptor**	**ASTM Standard Guide for Developing Conceptual Site Models for Contaminated Sites** **Burger, Mayer, Greenburg, Powers, Volz and Gochfeld, Conceptual site models as a tool in developing Ecological**

			Health: The case of the Department of Energy's Amchitka Island Nuclear Test Site. **Modeling Munitions and Explosives of Concern (MEC) CBRN Hazards: Novel Tools and Approaches for Strengthening the Conceptual Site Model for Public Health Preparedness; Tomjanovic and Volz**
2	**9/8**	**Uses of Human Exposure Data; Relationship of Exposure Assessment to the Risk Assessment Paradigm; and Exposure and Dose Defined (1)**	**Paustenbach, Human and Ecological Risk Assessment- pages 189-213** **Environmental Health Criteria 214, Introduction; Chapter 1; and Chapter 2 HUMAN EXPOSURE ASSESSMENT UNITED NATIONS ENVIRONMENT PROGRAMME, INTERNATIONAL LABOUR ORGANISATION WORLD HEALTH ORGANIZATION, INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY** **Lioy et al., Defining Exposure Science Journal of Exposure Analysis and Environmental Epidemiology (2005) 15, 463. doi:10.1038/sj.jea.7500463**
2	**9/10**	**Exposure and Dose Defined (2)**	**Complete all above readings**
3	**9/15**	**Strategies and Design for Exposure Assessment Studies**	**Section 3, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
3	**9/17**	**Statistical Methodologies for Exposure Assessment**	**Chapter 4, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**

4	**9/21**	**Time-Activity Patterns in Exposure Assessment/ Qualitative Exposure Assessment and the Use of Questionnaires**	**Section 5, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
4	**9/24**	**Introduction to Non-Human Receptor Monitoring/Biomonitoring**	**Volz et al.,, Channel Catfish Estrogenicity is Related to the Density of Sewer Overflows, 3rd National Conference on Environmental Science and Technology, 2009 paper.**
4	**9/25**	**Rachael Carson Homestead, Endocrine Disruptors Conference, Bidwell Training Center**	**Extra Points for Attendance-Registration Paid for by Center for Healthy Environments and Communities-See CHEC website www.chec.pitt.edu – early registration required.**
5	**9/29**	**Introduction to Exposure Measurements**	**Chapter 7, 8 Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
5	**10/1**	**Estimating Exposure via Inhalation**	**Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
6	**10/6**	**Estimating Exposure via Skin Uptake**	**Paustenbach, Human and Ecological Risk Assessment-pages 213-230.**
6	**10/8**	**Estimating Exposure via Ingestion**	**Paustenbach, Human and Ecological Risk Assessment-pages 230-249.** **Section 7.3,,7.4 Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
7	**10/13**	**No Class University Holiday**	
7	**10/15**	**Microenvironmental Monitoring and Estimating Exposure via Microenvironmental Data**	

8	**10/20**	**Presentation of Assigned Exposure Science Manuscripts by Students**	

8	**10/22**	**Completion of Above Topics; Review for Midterm Examination**	
9	**10/27**	**Midterm Examination**	
9	**10/29**	**Assessing Exposure with Biological Markers**	**Chapter 10, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
10	**11/3**	**Assessing Exposure with Biological Markers- Continued**	**Chapter 10, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
10	**11/5**	**Quality Assurance and Control for Exposure Studies**	**Chapter 11, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
11	**11/10**	**Arsenic and Other Metal/Metalloid Sources, Exposure Routes and Health Effects- Dr. Barchowsky**	
11	**11/12**	**Ionizing Radiation Exposure, Basic Principals; External Radiation Hazards and Internal Exposure via Radionuclides**	
12	**11/17**	**Introduction to Fate and Transport of Environmental Contaminants- Advection and Fickian Transport; Preparation for Exposure Modeling**	**Chapter 6, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT** **Review Lectures 1, 6, 12, 14, 15, 16 for Fate and Transport of Environmental Contaminants- www.chec.pitt.edu**
12	**11/19**	**Human and Ecological Receptor Exposure and Dose Modeling**	**Chapter 6, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT** **Review Lectures 1, 6, 12, 14, 15, 16 for Fate and Transport of Environmental**

			Contaminants- www.chec.pitt.edu
13	**11/24**	**Geostatistical Modeling- Case Studies**	**Start Reading EPA Exposure Assessment Guidelines**
13	**11/26**	**No Classes – Thanksgiving Recess**	**EPA Exposure Assessment Guidelines**
14	**12/1**	**Indoor Environmental Health Exposure**	**Chapter 9, Environmental Health Criteria 214 HUMAN EXPOSURE ASSESSMENT**
14	**12/3**	**Exposure Assessment for Contaminated Sites- The EPA Exposure Assessment Guidelines**	**Updating the EPA Guidelines for Exposure Assessment, Bangs, 2006 pdf.** **EPA Guidelines for Exposure Assessment pdf (All) Published on May 29, 1992, Federal Register 57(104):22888-22938** **The Role of the Exposure Assessment in Ensuring Sustainably Protective Containment of Residual Contamination Vikram M. Vyas Conrad Volz and Charles W. Powers (Student Paper Discussion)** **Chapter 1, 3, 6; EPA Risk Assessment Guidelines** **EPA Document on Considerations for Exposure Assessment**
15	**12/8**	**Control of Environmental Exposures; Using Risk Based End States for Contaminated Site Remediation**	
15	**12/10**	**2nd Student Manuscript Presentations/Review for Final Examination**	
16	**12/15**	**Final Examination**	