EHS 572 / SNRE 514 ENVIRONMENTAL IMPACT ASSESSMENT

Tuesdays, 3-5, 1152 SPH2

Professor: Stuart Batterman
Professor, Environmental Health Sciences
SPH2-6075, 763-2417; stuartb@umich.edu.

Office hours: Anytime by email or telephone. I will keep drop-in office hours on most Mondays (2:00 - 3:00), Tuesdays (1:00-3:00), and Wednesdays (1:00 -3:00). You are welcome to drop in at these times or at other times though it is best to confirm a meeting time via email.

Graduate Student Instructor: NA

Course Description: This 2-credit course develops a comprehensive framework for evaluating and predicting environmental impacts of manmade projects. Case studies of ongoing or recent environmental assessments are used to illustrate contemporary practice. The underlying theory and application of techniques to predict and understand contaminant transport, fate and impacts in air, surface water, ground water, and soil are presented. The selection, application, integration and evaluation of models are emphasized.

Course Materials: CTools website

Pre-requisites: Chemistry and/or physics, calculus. Also helpful is toxicology, exposure assessment, risk assessment, statistics or probability.

Course Goals

1. To understand the nature and practice of environmental impact assessment, including the procedures used under the National Environmental Policy Act in the USA and similar policies in other countries.
2. To develop a comprehensive framework for predicting concentrations of contaminants in the environment, and for evaluating the resulting exposures, impacts, and human health risks.
3. To introduce techniques and tools, including computer models, for assessing and predicting environmental impacts, and to understand the formulation, roles and limitations of these techniques.
4. To understand the multimedia and interdisciplinary nature of environmental impact analysis, including an appreciation of the social and institutional context.
5. As possible, to integrate material from other courses, including toxicology, exposure assessment, risk assessment, computer applications, toxicology and statistics.

Competencies:

1. To understand the terminology, scoping, evaluation and other procedures defined and used in the environmental impact statement process under the US National Environmental Policy Act and similar statues.
2. To be able to describe and quantify environmental impacts via indicators for air, water and soil pathways.
3. To understand the fundamental principles, applications, strengths, and limitations of assessment tools and approaches.
4. To be able to understand and critique assessment and modeling studies, including sensitivity and uncertainty analyses.
5. To be able to critique assessments and integrate model results.

Course Requirements:

Quizes	45%	
Assignment 1	25%	
Assignment 2	25%	
Optional Final Exam		(25% - can replace one assignment)
Class Participation	5%	
	100%	

Grading Approach: I am using a blended, spaced, interleaved approach intended to encourage retention and learning (via encoding, consolidation, retrieval and reflection).

Quizzes. The 10 short quizzes, to be completed on-line during the specified period (nominally 6 days after the corresponding lecture). These are low-stakes quizzes based on lectures and reading materials. Quizzes are counted and scored. The completion of a quiz is worth 1 point, for a total of **10 points**. Quizzes are graded for an additional 5 points each. The 3 lowest quizzes are dropped. Thus, the 7 graded quizzes are worth a total of **35 points**. The quizzes are conducted on-line using Ctools, and are to be completed individually. In cases, you may be able to take the same or similar quiz a second time, in which case only the higher grade will count. Immediate scoring will be provided for objective questions, and/or solutions will be available or discussed after the close of the quiz period.

Quizzes are designed to aid retention, reinforce takeaway points from lectures and readings, and to anticipate the next lecture.

Assignments. The class will include 2 assignments, and you will have approximately 3 weeks to complete each assignment. Each assignment is scored and worth 25 points, for total of **50 points**. Assignments are progressive, not cumulative. They will draw heavily on class lecture notes and case studies. They will include several problems and essays and will require understanding of case study materials. Assignments should be individual efforts. Use of well-labeled figures and tables that are incorporated into your response is encouraged. Do not cut and paste, but express your own thoughts. Citations should be provided, and should include page numbers where appropriate. It is suggested that you type the text component of your assignment. Any mathematical or statistical equations can be written out by hand. Please provide a hard copy by the indicated day and hour.

Each assignment will have a Q&A session about one week before it is due. Be prepared with questions. These are free form and interactive sessions.

Optional Final Exam. The course has an optional final exam. If you decide to take the exam, then the lower assignment score will be dropped. The exam will emphasize lectures and lecture notes, required reading materials, and case studies. The optional readings provide helpful explanation and depth. The exam covers the entire course and is closed book. Some of the quiz questions may be used. You may use a calculator. The exam duration is 2 hours. Exams emphasize the understanding of concepts and processes. They do not emphasize number crunching. A number of numerical problems may be given, but my intention is to evaluate your understanding of indicators, problem formulation, the selection of qualitative and quantitative tools, evaluation of results, trends, strengths and limitations, etc. Copies of old exam questions may be distributed. Working through these questions is excellent preparation.

Class attendance and participation. Anticipated, desired, and in outstanding cases, a maximum bonus of 5 additional points may be awarded.

Classroom Expectations/Etiquette:

Class attendance: Attendance and participation is expected.

Use of Electronic Devices Including Cell Phones, Tablets, and Laptops During Lectures. I have adopted a policy to minimize the use of these other devices during lectures. There are two exceptions: (1) Laptops and tablets may be used to follow course notes, if necessary or helpful to you; and (2) if you have a particular situation in which these devices are essential or helpful. If electronic devices are used for emailing, texting, web browsing/surfing, or other purposes not related to the lecture, I will ask you to discontinue their use as a courtesy for the me and the entire class. My rationality for this simple policy is simply that these electronic devices and connectivity are not the point of the classroom experience. Normally they are not needed in the classroom. I encourage questions and dialogue that are public, and I think that collectively we can benefit greatly from public interactions. Conversely, inappropriate use of cell phones, laptops and other electronic devices during lectures can detract from learning, interactions, and the overall classroom experience.

Academic Integrity:

The faculty and staff of the School of Public Health believe that the conduct of a student registered or taking courses in the School should be consistent with that of a professional person. Courtesy, honesty, and respect should be shown by students toward faculty members, guest lecturers, administrative support staff, community partners, and fellow students. Similarly, students should expect faculty to treat them fairly, showing respect for their ideas and opinions and striving to help them achieve maximum benefits from their experience in the School.

Student academic misconduct refers to behavior that may include plagiarism, cheating, fabrication, falsification of records or official documents, intentional misuse of equipment or materials (including library materials), and aiding and abetting the perpetration of such acts. Please visit http://www.sph.umich.edu/academics/policies/conduct.html for the full SPH Code of Academic Integrity and further definition of these terms.

Student Well-being:

SPH faculty and staff believe it is important to support the physical and emotional well-being of our students. If you have a physical or mental health issue that is affecting your performance or participation in any course, and/or if you need help connecting with University services, please contact the instructor or the Office of Academic Affairs.

Please visit http://www.sph.umich.edu/students/current/#wellness for more information.

Student Accommodations:

Students should speak with their instructors before or during the first week of classes regarding any special needs. Students can also visit the Office of Academic Affairs for assistance in coordinating communications around accommodations.

Students seeking academic accommodations should register with Services for Students with Disabilities (SSD). SSD arranges reasonable and appropriate academic accommodations for students with disabilities. Please visit http://ssd.umich.edu/accommodations for more information on student accommodations.

Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities. It is the obligation of students to provide faculty with reasonable notice of the dates of religious holidays on which they will be absent. Please visit http://www.provost.umich.edu/calendar/religious_holidays.html#conflicts for the complete University policy.

ENVIRONMENTAL IMPACT ASSESSMENT
EHS 572 / SNRE 514
Course Topics/Reading List/As of 9/8/15

Week 1. Sept. 8

INTRODUCTION: Overview, measurement, prediction, evaluation of impacts, requirements

Req. Readings: The National Environmental Policy Act of 1969, as Amended, Pub. L. 91-140 (1 Jan. 1970), amended 94-83 (9 Aug. 1975). 8 p. **Read All**

US EPA, Student Text for Principles of Environmental Impact Assessment Review, 1998, 226 p. **Read Chap 2-EIS Process, Appendix E-Road Maps**

CEQ. A Citizen's Guide to the NEPA: Having Your Voice Heard. Dec. 2007. https://ceq.doe.gov/nepa/Citizens_Guide_Dec07.pdf

US Dept. of State, Final Supplemental Environmental Impact Statement for the Keystone XL Project. Executive Summary, Jan. 2014. 44 p. **Read All**

Optional US Dept. of State, Final Environmental Impact Statement for the Keystone XL Project. Executive Summary, Aug. 2011. 27 p.

Week 2. Sept. 15

EIS legislation/regulation, legal/political/implementation aspects of EIAs, cumulative impacts, case study

Req. Readings Smith, MD, Cumulative Impact Assessment under the National Environmental Policy Act: An Analysis of Recent Case Law, Env. Practice, 8, 4, 2006. **Read All**

Jay S, C Jones, P Slinn, C Wood. Environmental impact assessment: Retrospect and prospect. *Env. Impact Assess Rev*. 27, 287-300, 2007**. Read All**

Katz, D, C Manson, The National Environmental Policy Act. The Heritage Foundation, 2012. 6 p. **Read All**

Abt. Assoc. Public Release Draft Restoration Plan and Programmatic Environmental Impact Statement for Restoration Resulting from the Kalamazoo River Natural Resource Damage Assessment. Aug. 2015. **Read Executive Summary, and Chap 1 Environmental Laws and Regulations, pages 1-5 to 1-18.**

Optional: Canadian Environmental Assessment Agency, Cumulative Effects Assessment Practitioners Guide, 1999. 134 p.

CEQ. Collaboration in NEPA: A Handbook for NEPA Practitioners, Oct. 2007. https://ceq.doe.gov/nepa/nepapubs/Collaboration_in_NEPA_Oct2007.pdf

CEQ. Considering Cumulative Effects Under the National Environmental Policy Act, 1997, 171 p.

Quiz 1 by Sept. 21

Week 3. Sept. 22

EIS Regulations and Policy, Environmental Indicators, Trends

Req. Readings: Christensen P, et.al. EIA as Regulation: Does it Work? J. of Env. Planning and Reg., 48, 3, 393-412, **Read All**

State of Michigan, State of Michigan's Environment 2011, DEQ, 2011. **Read programmatic measures 43-61**

US EPA. EPA's Report on the Environment (ROE). 2015. Draft on-line version available only on web: http://cfpub.epa.gov/roe/index.cfm. **SCAN**

GEO-5, movie introduction http://www.unep.org/geo/geo5.asp **Watch All**

GEO-5, Global Environmental Outlook., 2012. 555 p. In 3 parts due to size. **Read 4-21, 26** in electronic file part 1. Also look at **main messages** in each chapter

Optional US EPA. EPA's Report on the Environment 2008. 366 p.

Quiz 2 by Sept. 28

Week 4. Sept. 29

MODELS AND SYSTEMS - Indicators, unit operations, environmental systems, PBPK models, Monte Carlo models, modeling issues, assessment of performance

Req. Readings: National Research Council. Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academy of Sciences. Washington DC, 2007. **Read 1-17, 26-7. 31-37, 104-112, 170-172**

Optional: US EPA, Guiding Principles for Monte Carlo Analysis, EPA/630/R-97/001, Washington DC. March, 1997

Below are standard references, not on web.

Schnoor, J.L., Chemical Fate and Transport in the Environment," Chapter 1, Fate of Pesticides and Chemicals in the Environment, J. Wiley, NY 1992, p.1-24

Hemond, H.F., E.J. Fechner, Chemical Fate and Transport in the Environment, Academic Press, NY, 1994

Quiz 3 by Oct. 5

Week 5. Oct. 6

SURFACE WATER - Assessment of water quality impacts, modeling applications, river models, nonpoint pollution

Req. Readings: Baron, Jill, N. LeRoy Poff, Paul L. Angermeier, et al., Sustaining Healthy Freshwater Ecosystems, *Issues in Ecology*, 10, 2-16, 2003, **Read All.**

Stephen Carpenter, Chair, Nina F. Caraco, et al., Nonpoint Pollution of Surface Waters with Phosphorus and Nitrogen, *Issues in Ecology*, 10, 2-12, 1998

Levin et al. (2002) U.S. Drinking Water Challenges in the Twenty-first Century, *Env. Health Persp.*, 110, Sup. 1, 43-52. **Read All**

Optional: EPA National Water Quality Inventory: 2004 Report to Congress, 2009. **Read 6-25.**

IJC, A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, International Joint Commission, Feb. 2014

IJC, 16th Biennial Report of Great Lakes Water Quality, International Joint Commission, April. 2013

IJC, 16th Biennial Report of Great Lakes Water Quality - Technical Reports - International Joint Commission, April. 2013

Quiz 4 by Oct 12

Week 6. Oct. 13

Small lake models, mass balance processes, time-varying models, Statistical models of dispersion, parameter estimation, case studies

Req. Reading Rates, Constants and Kinetic Formulations in Surface Water Quality Modeling, 2nd Ed., US EPA/600/3-85/040 1985 **Read 3-20, 90, 101-102, 135-139**

Abt. Assoc. Public Release Draft Restoration Plan and Programmatic Environmental Impact Statement for Restoration Resulting from the Kalamazoo River Natural Resource Damage Assessment. Aug. 2015. **Chaps. 1-3, Scan Chaps 4-5.**

Quiz 5 by Oct. 22

Oct 20. Study break

Week 7. Oct. 27

Case study review
Assignment 1 Q&A

Week 8. Nov. 3

Assignment 1 Due by 5 pm

GROUND WATER - Introduction to hydrogeology, drinking water, hydrologic cycle, aquifers

Req. Reading EPA National Water Quality Inventory: 1998 Report to Congress – Chapter 7 - Ground Water Quality. 34 p. **Read All**

DOE (1986) Basic Ground Water Hydrology, Chapter 2, Washington State, Department of Ecology, Ground Water Resource Protection Handbook, 7 p. **Read All**

Optional: USGS (R Health) Basic ground Water Hydrology, USGS, 1983, 10th printing, 2004.

Quiz 6 by Nov. 9

Week 9. Nov. 10

Ground water contamination, media properties, contaminant fate & transport, flow nets
Numerical modeling

Req. Reading Pederson DT (2000) Fundamentals of Groundwater Contamination. 18 p. **Read All.**

Optional: Hsieh P (2001) Topodrive and particleflow—two computer models for simulation and visualization of ground-water flow and transport of fluid particles in 2D. USGS.

Saxton, KE, Soil Water Characteristics Hydraulic Properties Calculator, University of Washington (with computer program)

Barcelona, M, JP Gibb, JA Helfrich, EE Garske, Practical guide for ground-water sampling, Illinois state water survey Champaign, IL, ISWS report 374, 1985, 107 p.

Quiz 7 by Nov. 16

Week 10. Nov. 17

AMBIENT AIR QUALITY - Introduction, regulations, trends, pollutant types

Req. Readings US EPA, Our Nation's Air, Status and Trends Through 2010, EPA, 2012. 32 p. **Review All**

WHO, Guidelines for Air Quality, 3nd Ed, 2007, Geneva, 496 p. **Read 9 -29**

Optional State of Michigan Air Quality Screening Levels

Quiz 8 by Nov. 23

Week 11. Nov. 24

Air pollution meteorology, modeling, impact analysis, case studies

Req. Readings: US EPA, US NOAA, Air Quality Meteorology: A Developmental Course, http://www.shodor.org/metweb

Case study - TBD

Quiz 9 by Nov. 30

Week 12. Dec. 1

OTHER ENDPOINTS AND ASSESSMENT TYPES, health impact and sustainability and the future of EIA & NEPA

Req. Readings: Cole BL, et al., Prospects for health impact evaluation in the US: new and improved environmental impact assessment or something different? J. Health Politics, Policy & Law, 29, 6, 2004. **Read all.**

Steinemann, A., Rethinking human health impact assessment, Env. Impact Assessment Rev., 20, 627-645, 2000. **Read all.**

Others, TBD

Quiz 10 by Dec. 7

Week 13. Dec. 8

Case study review
Assignment 2 Q&A

Week 14. Dec. 14 (Monday, 5 pm)

Assignment 2 Due

Week 15. Dec. 21 (Monday, 1:30 pm - 3:30 pm)

Optional Final Exam