

NOTE: ATTENDANCE AT FIRST CLASS IS MANDATORY

Risk Analysis & Environmental Management (OID 261/761; BEPP 261/761/961; ESE 567)

Mondays and Wednesdays, 3:00 – 4:20 pm

Spring 2016

Room F-90, Huntsman Hall (JMHH)

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Course Description

This course is designed to introduce students to the complexities of making decisions about threats to human health and the environment when people's perceptions of risks and their decision-making processes differ from experts' views. Recognizing the limitations of individuals in processing information, the course explores how techniques such as decision analysis and cost-benefit analysis can incorporate risk assessments and risk perception in structuring risk-management decisions. It will also examine policy tools such as risk communication, incentive systems, third party inspection, insurance, regulations and standards in different problem contexts.

The problem contexts for studying the interactions between risk assessment, risk perception and risk management will include issues of risk communication, economic incentives for encouraging risk reduction measures, insurance and third-party inspections coupled with regulations and standards. Areas of application including climate change, pandemics, siting of noxious facilities, managing catastrophic risks including those from terrorism, natural disasters and industrial accidents. A course project will enable students to apply the concepts discussed in the course to a concrete problem.

Obtaining the Readings:

1. Log into www.study.net and proceed to "MY COURSES". On this page, click on the link to "PURCHASE OR ACCESS MATERIALS IN A NEW COURSE."

2. Select your course listing and click on "Add to Cart". Review the License Agreement and then continue shopping until you've added everything you need to your Cart; then open your Cart and complete the purchase process.

3. PLEASE NOTE that on the Cart page you have the OPTION of ordering a Wharton Reprographics Hard Copy for each course. Selecting this option will result in an additional charge. The Hard Copy is a printed version of everything you'll find online (that can be printed). All Hard Copy orders are assembled by Wharton Reprographics and take two business days to complete. You will be sent an email notification when your order is ready for pick up.

4. After you've completed the purchase process, you will be taken back to "MY COURSES". Please highlight a course name and click on "View Course" to view the materials in that course. Each material is available to view, print, or save to your local computer for personal use. Copyright protection limits file use to students who have purchased access.

Use of Canvas

All assignments, notices, and lecture notes will be posted on the class website available through Canvas. You will have access to this room as long as you are officially registered for the course on the previous business day. Please let Jamie Walter (jamiewa@wharton.upenn.edu) know if you are unable to access Canvas.

Use of the Discussion Board

The discussion board on Canvas is an opportunity to engage in participation outside of class. There will be two ways to participate.

- A) **Specific Topics:** The purpose of this discussion is to provide an outlet for you to apply course concepts to topics of current interest related to the course (e.g. Volkswagen scandal over false CO₂ emissions data; impact of the COP21 negotiations in Paris on climate change activities)
- B) **Posting an Article:**
- 1) Find a news article related to the specific topic The news can be from anywhere, related to any country, and involving any variety of risk issues. Post a link, date, and source of this article
 - 2) Write a short summary answering the following questions
 - a. What is the issue and the nature of the risk?
 - b. How does this relate to our classroom material?
 - 3) Pose one or two questions for your classmates to consider after reading the article

You are encouraged to respond to your classmates' questions with other news articles to further the conversation. Insightful comments and news will be discussed briefly during Mondays' classes

C) **General class discussion:**

Students are encouraged to create posts detailing their thoughts on any of the readings or recommend relevant articles that will assist with understanding the readings. Evaluation will be conducted based on the quality of the responses received. Please note that online participation via Canvas is a supplement, not a substitute for in-class participation.

Assignments

There will be assignments throughout the semester related to the topics discussed in class as well as the course projects. Unless otherwise specified, assignments are due at the beginning of class on the day they are assigned. An ***n-page write-up*** means a **double-spaced *n-page* document using 12 point font**. The *n-pages* do not include exhibits, but only pertain to the main text you submit.

Note that most assignments are described in the syllabus that follows (so please check it before each class).

Topical Articles

At the beginning of some classes there will be a 5-minute presentation of a topical newspaper or magazine article related to issues of health, safety, and the environment by student teams. For each article the team will:

1. Post a copy of your group's article on Canvas under "Topical Articles" in the Discussions tab. Also post questions for discussions based on your article. These questions will be discussed at the end of your presentation.
2. In your presentation, briefly discuss:
 - a) The main problem addressed. Who or what is at risk? Is this a new risk?
 - b) The nature, if any, of scientific risk analysis done on the problem. Are quantitative risk estimates given? If so, are they communicated clearly?
 - c) The nature of any social or political issues or dilemmas associated with the problem.
 - d) Their own personal reaction to the story. Does the story indicate a threat to any team member? Is appropriate action being taken to deal with the problem?
 - e) Formulate 2 or 3 questions based on the article for class discussion

Course Grading

Exam	25%
Course Project	30%
Assignments	25%
Class Participation and Class Attendance	20%

Tutoring Support

Undergraduate students experiencing difficulty in this course should seek assistance from the Penn Tutoring Resource Center. Refer to the Wharton Undergraduate homepage for the schedule of walk-in tutoring hours. Private tutors from the Tutoring Center can be obtained (without cost) through the recommendation of a professor or professional advisor in the Undergraduate Division. Students who wish to inquire more about tutoring should contact Patricia Briscoe-Cypress at the Tutoring Center by email at pbriscoe@exchange.upenn.edu or by phone at 215-898-0810. Students who wish to get more information on study skills, learning disabilities, test-taking strategies, time management, or reading/writing coaching should contact the Weingarten Learning Resources Center by email at lrcmail@pobox.upenn.edu or by phone at 215-573-9235.

Course Outline

Wed. Jan. 13 —Course Overview

I. Framework for Risk Analysis and Risk Management

Mon. Jan 18 No Class---Martin Luther King's Birthday

Wed Jan. 20 — Linking Risk Analysis and Risk Management

Read:

Kunreuther, H. "Risk Analysis and Risk Management in an Uncertain World" *Risk Analysis* August 2002

Baron, D. "The Market and Nonmarket Environments" Chap.1 in Business and the Environment (Prentice-Hall, 2000)

Due: Climate Change Survey, posted under Assignments in Canvas---complete by Jan. 20 class

Mon. Jan. 25—Value-Focused Thinking

Read:

Keeney, R. Chap. 1 Value-Focused Thinking (Cambridge: Harvard Univ. Press).

Viscusi, K. and Zeckhauser, R. "The Perception and Valuation of the Risks of Climate Change: A Rational and Behavioral Blend." *Climate Change* (2006) [Read just the results, no need to dwell on means and regression]

Reynolds, T. et al. "Now What Do People Know About Global Climate Change? Survey Studies of Educated Laypeople." *Risk Analysis* (October 2010) [Skim methods and data analysis, read from results onwards]

Ding, D. et al. "Support for climate policy and societal action are linked to perceptions about scientific agreement" *Nature Climate Change* (Nov 20 2011)

Wed. Jan. 27—Structuring a Decision Problem

Read:

Clemen, R. and Reilly R. Chap. 2 "Elements of Decision Problems" (pp. 21-36) in Making Hard Decisions with Decision Tools (Pacific Grove, CA: Duxbury)

Ginevan "Radon as an Indoor Air Pollutant" *Statistical Science* (1988)

Due: 1-2 Page Write-up on Chemcare's Problem (To be posted on Canvas)

Mon. Feb. 1—Making Choices Using Decision Analysis

Read:

Clemen, R. and Reilly R. Chap. 4 "Making Choices" (pp. 111-119) in Making Hard Decisions with Decision Tools (Pacific Grove, CA: Duxbury)

Morgan, G., "Choosing and Managing Technology-Induced Risk" in Readings in Risk (henceforth RR) (Resources for the Future, 2000)

Freemark Abbey Winery Case Study D

Due: Construct a decision tree for Mr. Jaeger based on the attached case study. (No Answer required)

Wed. Feb. 3 —Introduction to Benefit-Cost Analysis

Read:

Boardman, T. et al Chap. 1 in Cost-Benefit Analysis: Concepts and Practice (Upper Saddle River, NJ: Prentice-Hall) 2001

Lee, M. and Ermann, M.D “Pinto ‘Madness’ as a Flawed Landmark Narrative” An Organizational Network Analysis” *Social Problems* 46: 30-47 1999

Background Reading

Viscusi, K. and Aldy, J. “The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World” *Journal of Risk and Uncertainty* 27:5-76, 2003

Tengs, T. “Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness” *Risk Analysis* 1995

Due: Car Won’t Start Fault Exercise (To be posted on Canvas)

II. Risk Assessment and Risk Perception

Mon. Feb. 8 — Introduction to Technological Risk Assessment

Read:

“Introduction” of Perrow, C. Normal Accidents New York: Basic Books 1984

Morgan, G., “Risk Analysis and Management,” *Scientific American*, July 1993.

Hansson, S. and Aven, T. “Is Risk Analysis Scientific?” *Risk Analysis*, July 2014

Due: Each project group submits a 1-page description of the risk problem you will be considering for the project. Briefly indicate the key interested parties, the objectives in designing policies, two alternative programs you might consider, and the nature of the uncertainties and consequences to the key interested parties.

Wed. Feb. 10— Applications of Technological Risk Assessment:

Read:

Keeney, R. et. al., “Assessing the Risk of an LNG Terminal.” (in RR)

Arjen, T. and Renn, O. “The Role of Quantative Risk Assessments for Characterizing Risk and Uncertainty and Delineating Appropriate Risk Management Options with Special Emphasis on Terrorism Risk” *Risk Analysis* (2009)

Due: 1) Decision Analysis Problems (To be posted on Canvas)

2) Q. 3 and 4 in Keeney et al. p. 218 (2 pages)

Mon. Feb. 15 – Malaysia Airlines Role Play

Read:

Jamieson, A. (2014, November 23). Why Was Malaysia Airlines MH17 Flying Over Ukraine? Time, Money. NBC News. Retrieved from <http://www.nbcnews.com/storyline/ukraine-plane-crash/why-was-malaysia-airlines-mh17-flying-over-ukraine-time-money-n159161>

Shoichet, C. (2014, July 21). Should Malaysia jet have flown over Ukraine? CNN World. Retrieved from <http://www.cnn.com/2014/07/20/world/mh17-route/>

Due: Role-playing exercise on Malaysia Airlines

Wed. Feb 17 Health Risk Assessment

Read:

Wilson, R., “Ensuring Sound Science in the Courts,” *Technology in Society* (2004)

Gawande, A. “The Cancer-Cluster Myth” *New Yorker* Feb. 8, 1999

Levy et al. “Lay and Expert Interpretations of Cancer Cluster Evidence” *Risk Analysis* 2008

Rodricks, J. and Taylor, M., “Application of Risk Assessment to Food Safety Decision Making.” (in RR)

Due: Risk Perception Survey

Mon. Feb. 22—Introduction to Risk Perception

Read:

Slovic, P., Fischhoff, B. and Lichtenstein, “Rating the Risks.” (in RR)

Smith, P and Leiserowitz, A. “The Rise of Global Warming Skepticism: Exploring Affective Image Associations in the United States Over Time” *Risk Analysis* (2012)

Pineda-Solano, A. “The Fukushima Daiichi Accident and its Impact on Risk Perception and Risk Communication” *Chemical Engineering Transactions* (2013)

Myhrvold, N. “Irrational Fears” *MIT Technology Review* Apr 23, 2014

Nicholson, M. “The REAL reason some people hate nuclear energy” *Brave New Climate* Feb. 2014

Wed. Feb. 24—Precautionary Principle and Risk Perception

Read:

Sunstein, C. “The Paralyzing Principle,” *Regulation* (Winter 2002-2003): 32-37

Gregory, R. and Long, G. “Using Structured Decision Making to Help Implement a Precautionary Approach to Endangered Species Management” *Risk Analysis* (2009) pp. 518-32. [Focus on Intro and Conclusion]

Paulos, J. A. “The Way We Live Now: Mammogram Math” *New York Times* Dec. 13 2009

Due: Role playing exercise on mammogram testing

Mon. Feb 29 Risk Perceptions and Stigma

Read:

Gregory, Flynn, & Slovic “Technological Stigma,” *American Scientist*, (1995) 83, 220-223.

Kasperson, R., Jhaveri, N. and Kasperson, J. “Stigma and the Social Amplification of Risk” in Flynn, Slovic and Kunreuther *Risk Media and Stigma* Earthscan, 2001.

McClelland et. al., “The Effect of Risk Beliefs on Property Values: A Case Study of a Hazardous Waste Site,” *Risk Analysis*, December 1990.

III. Risk Management

Wed. Mar 2 --- Valuation Procedures

Read:

Boardman, T. et al Chap. 14 in *Cost-Benefit Analysis: Concepts and Practice* (Upper Saddle River, NJ: Prentice-Hall) 2001

Due: Provide preliminary documentation of the scientific evidence on the risk you are studying and its potential impact on society.

Spring Break Mar. 5-13

Mon. Mar. 14—Strategies for Dealing with Extreme Events

Read:

Camerer, C. and Kunreuther, H., “Decision Processes for Low Probability Events: Policy Implications, *Journal of Policy Analysis and Management*, September 1989.

Wed. March 16 Market-Like Incentive Approaches

Read:

Baron, D. “Environmental Protection: Economics, Politics and Management” Chapter 12 in *Business and the Environment*

Smith, B.W. “Stakeholder Reaction to Emissions Trading in the United States, the European Union and the Netherlands” (mimeo) 2009

Mon. March 21 Risk Communication: I

Read:

Center for Research on Environmental Decisions (CRED) *The Psychology of Climate Change Communication* October 2009. (Posted in Course Materials)

Flynn, J. Slovic, P. & Mertz, C.K. “The Nevada Initiative: A risk communication fiasco.” *Risk Analysis* 1993

Wed. Mar. 23 Risk Communication II: The Alar Case

Read:

Rosen, “Much ado about ALAR” *Issues in Science and Technology* (Fall 1990)

Keller, C., Siegrist, M. and Gutscher, H. “The Role of the Affect and Availability Heuristics in Risk Communication” *Risk Analysis* (2006)

Schmit, J. “U.S. food imports outrun FDA resources” *USA Today* (March 18, 2007)

Harris, G. “Recalls of Imported Foods Are Flawed, a Government Audit Reports” *NY Times* (June 21, 2011)

Due: Role Playing Exercise on Alar

Detail the policy instruments you plan to utilize for your risk management strategy including guidelines for communicating risk information (1-2 pages).

Mon. March 28 Summary of Class to Date

Wed. March 30 Exam

Mon. April 4 Guest Speaker: Cary Coglianese Professor Law School University of Pennsylvania and Director of the Regulation Center at Penn

Wed. April 6 Decision Making for Extreme Events in Organizations

Read:

Pate-Cornell, E. and Fischbeck, P. "Risk Management for the Tiles of the Space Shuttle" *Interfaces* January-February 1994 24:74-86.

Due: Analysis of Carter Racing

Mon. April 11 Case Study: Reforming the National Flood Insurance Program

Read:

Kunreuther and Michel-Kerjan "People Get Ready: Disaster Preparedness" *Issues in Science and Technology* Fall 2011.

Due: Role Playing Exercise on NFIP. Each group describes the policy instrument(s) it plans to utilize for managing the NFIP and provides a rationale for their use including guidelines for communicating information on the risks. (2 pages)

Wed. April 13 Guest Speaker: Roy Wright Deputy Associate Administrator for Mitigation Federal Emergency Management Agency (FEMA)

Mon. April 18 Case Study: Health Effects of Fracking

Read:

Boudet, H.; Clarke, C.; Bugden, D.; Maibach, E.; Roser-Renouf, C.; Leiserowitz, A.. "'Fracking" controversy and communication: Using national survey data to understand public perceptions of hydraulic fracturing.." *Energy Policy* 65 (2014): 57-67.

Brantley, S., & Meyendorff, A. (2013, March 13). The Facts on Fracking. New York Times: The Opinion Pages. Retrieved from <http://www.nytimes.com/2013/03/14/opinion/global/the-facts-on-fracking.html?pagewanted=all>

Fracking: Bad for water, air, health and the economy. Bad for New York! (2014, Jan 1).

Due: Role playing exercise on Health Effects of Fracking

Wed. April 20 Linking Risk Assessment, Risk Perception and Risk Management

This class will revisit the conceptual framework introduced at the beginning of the course in light of the material covered in the class and the group projects being pursued.

Mon. April 25 and Wed. April 27 Student Presentations of Group Projects

Wed May 4 Final Paper Due by 4 pm Please post a copy of your report in your *Group Project* folder in Canvas and a hard copy in my OPIM mailbox on the 5th floor of JMHH. **The report should be 10-15 pages (double-spaced 12 point font in WORD) and can be supplemented by Appendices**

Course Project

This project is designed to enable you to apply the concepts discussed in the course to a particular risk problem. Today there is considerable uncertainty as to which risks are really dangerous and which ones are relatively harmless. For many risks there are limited data for characterizing them, not to mention the long latency periods between exposure to a risk and the actual impact. Some risks are real; others are phantom risks. Some so-call “phantom risks” are of concern to the public but are not perceived to be dangerous by the scientific experts; other risks are -perceived to be dangerous by experts but not by the public. Experts and the public perceive other risks in the same manner. Some examples of risks you might consider are: alar, British beef, lead, radon, radioactive wastes, natural hazards, nuclear power risks, chemical threats, terrorism, endangered species, climate change and global warming, electric and magnetic fields, cellular phones (risk when driving), space shuttles and workplace safety. Groups of 3 or 4 will focus on a particular risk that is perceived by scientists and/or the public to cause health, safety and/or environmental problems. In structuring your analysis you should focus on the following specific questions:

- What is the particular risk you are studying and what are the perceptions of the public and scientific experts regarding the risk?
- Who are the major actors or stakeholders affected by the risk and in why ways?
- What does the scientific literature say about the degree of uncertainty about the nature of the risk (i.e. probability of negative outcome(s) and its impact?
- How can the private sector (business) and the public sector (government) communicate more effectively to the public about the nature of the risk if there are perception differences between the public and scientific experts?
- What policy tools should be utilized for managing the risk more effectively from a societal perspective (e.g. information provision, incentive-based systems, private market mechanisms, compensation regulations, standards, insurance, legal system)?
- In designing a risk management program indicate what role(s) the private and public sectors should play in dealing with the particular risk you are studying.

Course Project Timetable

Feb. 8 Submit a 1-page description of the risk problem you will be considering. Briefly indicate the key interested parties, the objectives in designing policies, two alternative programs you might consider and the nature of the uncertainties and consequences to the key interested parties.

Feb 29 Provide preliminary documentation of the scientific evidence on the risk and its potential impact on society. (1 page)

Mar. 23 Detail the policy instruments you plan to utilize for your risk management strategy including guidelines for communicating information on the risks. (1-2 pages)

Apr. 25 and 27 Present your Preliminary Project Report in class.

May 4 Final paper due (4 pm) Please post a copy of your report in your *Group Project* folder in Canvas and a hard copy in my OPIM mailbox on the 5th floor of JMHH. **The report should be 10-15 pages (double-spaced 12 point font in WORD) and can be supplemented by Appendices.**