

# Risk Analysis & Environmental Management

(OPIM 261/761; BEPP 261/761/961; ESE 567)

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**Mondays and Wednesdays, 10:30-11:50 am      Spring 2013**

Room F60 Huntsmann Hall (JMHH)

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**Office Hours: M 4:30-5:30; Tu: 2-3**

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**Office Hours: TBD**

**\*\*Please note that attendance to Day 1 is mandatory!!\*\***

## 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.

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## **Obtaining the Readings:**

1. Log into <http://wharton.instructure.com>, log in, and find OPIM261. Navigate to the "Study.net Materials" tab on the left and 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](mailto:jamiewa@wharton.upenn.edu)) know if you are unable to access Canvas.

## **Online Participation**

Canvas will also function as a proxy that will allow us to track and evaluate class participation. Students will be 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 substitute to, 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**

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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 the article for the class on Canvas.
2. 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 1 or 2 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, study skills, learning disabilities, test-taking strategies, time management, or reading/writing coaching should e-mail Hoi Ning Ngai ([hngai@wharton.upenn.edu](mailto:hngai@wharton.upenn.edu)) in the Wharton Undergraduate Division or contact by phone at 215-898-0287. A database of private peer tutors is also available. For information, including the tutoring fees, e-mail Hoi Ning Ngai after the second week of the semester.

## Course Outline

**Wed. Jan. 15 —Course Overview**

**I. *Framework for Risk Analysis and Risk Management***

**Mon. Jan 20 No Class---Martin Luther King's Birthday**

**Wed. Jan. 22 — 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 (Located under Assignments in Canvas )

**Mon. Jan. 27—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)

Reynolds, T. et al. "Now What Do People Know About Global Climate Change? Survey Studies of Educated Laypeople" *Risk Analysis* (October 2010)

**Wed. Jan. 29—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 (Posted on Canvas)

**Mon. Feb. 3 —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

### **Wed. Feb. 5 —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 Organizationald 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

## **II. Risk Assessment and Risk Perception**

### **Mon. Feb. 10 — 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.

#### **Due:** Car Won’t Start Fault Exercise

Each project group submits a 1-page description of the risk problem it will be considering for its 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. 12— 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:** Decision Analysis Problems

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

#### **Due: Fri. Feb 14 (5 pm)** Risk Perception Survey (Posted on Canvas)

### **Mon. 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

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

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

### **Wed.. Feb. 19—Introduction to Risk Perception**

#### **Read:**

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

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

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)

<http://www.aidic.it/cet/13/31/087.pdf>

Ropeik, D. “Why Are We Afraid of Nuclear Power?” (2010)

<http://www.project-syndicate.org/commentary/why-are-we-afraid-of-nuclear-power-#YWmBEPPxWjjUAbaE.99>

### **Mon. 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.

**Due:** Role playing exercise on mammogram testing

### **Wed. Feb. 26 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**

#### **Mon. March 3 --- 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.

**Wed. March 5 Guest Speaker Professor Robert Meyer**

**Spring Break Mar. 7-16**

**Mon. Mar. 17—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 19 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 24 Risk Communication: I**

**Read:**

Center for Research on Environmental Decisions (CRED) *The Psychology of Climate Change Communication* October 2009. **(to be distributed)**

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

**Wed. March 26 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” *NYTimes* (June 21, 2011)

[http://usatoday30.usatoday.com/money/industries/food/2007-03-18-food-safety-usat\\_N.htm](http://usatoday30.usatoday.com/money/industries/food/2007-03-18-food-safety-usat_N.htm)

[http://www.nytimes.com/2011/06/21/business/21recall.html?\\_r=2&](http://www.nytimes.com/2011/06/21/business/21recall.html?_r=2&)

**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 31 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

**Wed. April 2 Summary of Class to Date**

**Mon. April 7 Exam 6:00-7:30 PM**

**Wed. April 9 Guest Speaker: Erwann Michel-Kerjan**

**Mon. April 14 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 16 Guest Speaker: Roy Wright Deputy Associate Administrator for Mitigation Federal Emergency Management Agency (FEMA)**

**Mon. April 21 Interdependent Security and Social Dilemmas**

**Read:**

Heal, G. and H. Kunreuther, "You Can Only Die Once" in H.W. Richardson, P. Gordon and J.E. Moore II, (eds.), *The Economic Impacts of Terrorist Attacks*. Cheltenham, UK: Edward Elgar. 2005.

**Wed. April 23 Case Study: Keystone XL Project**

**Due:** Role playing exercise on Keystone XL Project

**Mon. April 28 and Wed. April 30 Student Presentations of Group Projects**

**Fri. May 9 Final Paper Due by 4 pm (10-15 Pages Long)**

## 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. 10** 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.

**March 3** Provide preliminary documentation of the scientific evidence on the risk and its potential impact on society. (1 page)

**Mar. 26** 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. 28 and 30** Present your Preliminary Project Report in class.

**May 9** Final paper due (4 pm)