

The Johns Hopkins University
Krieger School of Arts and Sciences

Advanced Academic Programs:
Environmental Science and Policy Program
Fall Term 2019
Syllabus

AS 420.651.51 FA19 -- Risk Assessment and Management

September 4-December 15

Course Instructor: Art Koines

Class Communications

Please call me Art. If you're interested, look at my on-line biographical sketch either on the JHU Website or LinkedIn. I've done many things over the course of my career and would be happy to talk with you about them.

My Availability

I am generally available seven days a week by e-mail at akoines1@jhu.edu or by phone at 240-461-3130. I'll make every effort to respond to e- and v-mails within 24 hours of when I receive them. I can usually schedule to meet with you in person on three days' notice.

Course Goal and Learning Objectives

This course is about the role of science in environmental decision making. While acquiring a basic understanding of the science is important, I don't expect anyone to become an expert on science issues in this class. I'm no science expert myself. Rather, my goal for you is to understand how the science is used, what its strengths and weaknesses are, and how to ask good, penetrating questions if you're ever involved in an environmental risk assessment. I'd like you to leave the course with the confidence that you could assemble and lead a team of specialists to conduct a risk assessment. That's a very attainable goal for you. The environmental field needs people who can work comfortably at the intersection of environmental policy and science.

By the end of this course you will:

Understand:

- The general scientific methods and processes used to conduct human health and ecological risk assessments.
- How an environmental risk, properly framed, can provide powerful insights into possible risk management strategies.
- How the limitations of available science and information affect the risk assessment and management process, and communications with public.

Know:

- What questions to ask to gain a systematic understanding the causes of environmental problems, their effects on human health, public welfare and the natural environment.
- What shapes public perception of environmental risks and how the use of better information can sometimes be used to reshape those perceptions.

Be able to:

- Develop and explain a basic risk assessment on an environmental problem of your choice using readily available information.
- Present, describe and critique a risk management strategy based upon a clear understanding of the risk it was designed to mitigate and the uncertainties that remain.

Be familiar with:

- Basic sources of information used to develop human health and ecological risk assessments.
- Arguments for and against relying on risk assessment as the basis for establishing environmental priorities, setting regulatory standards and making site specific management decisions.

How You Will be Assessed

Your final class grade will be determined as follows:

- Two individual student presentations (20% + 20% = 40% of class grade)
- Two group exercise (15% of class grade)
- Posts providing and responding to student comments on each of two individual presentations (5% and 5%= 10% of grade)
- Posts related to weekly class discussions (35% of grade).

For your overall grade, I'll use the standard JHU grading schema as follows:

Total Point Score of ...	Will Equal...
98 to 100	A+
94 to 97	A
90 to 93	A-
88 to 89	B+
84 to 88	B
80 to 84	B-
70 to 80	C
0 to 70	F

Student Presentations

Each student is required to write two presentations composed of text and graphics totaling no more than 10 pages in length. Students can choose their own topics, but all topics must be approved by me.

- In the first presentation, **due on November 3**, you will develop a risk assessment of an environmental problem. The organization and content of the presentation will be clear after the fourth class.
- The second presentation, **due on December 15**, will build on the topic of the first presentation by conducting a risk management analysis of possible options for mitigating the risks identified in the first presentation.

Presentations must be submitted on time unless you have contacted me in advance and received an extension. Students will be penalized two points (out of a total of 30) weekly until their presentation is submitted.

Individual Presentation

Each student will present the approach and findings for the first (risk assessment) presentation. The presentation will be a concise summary composed of 8-10 presentation slides and taking approximately 15 minutes.

Group Projects

You'll complete two group projects

- A comparative risk assessment of all the individual student presentation topics.
- A small group analysis of a risk case study adapted from an OSHA workplace health and safety policy.

You and your group members will all receive the same grades on your group projects.

Presentation Topic Preview

Three weeks before your first presentation assignment is due, I'll ask you to come to class prepared to give a short, informal overview of your presentation topic. You'll discuss the cause of the human or ecological health risk you're addressing in your presentation, information sources you'll use to assess the risk, and any problems you may have encountered in locating the information you'll need to complete your presentation. I'll be looking for thoughtful commentary from your classmates. I have great respect for good questions by both presenters and audience, so long as they promote learning by all parties involved.

Access to Course Readings and Lecture Presentations: Links to class readings and presentations are available on our Blackboard site. I expect you to be able to answer questions, provide critical insight, and effectively participate in class discussions. Doing so will depend on you having read and absorbed the assigned readings.

Johns Hopkins University Policies – Please Read Carefully

Getting Help

You have a variety of methods to get help on Blackboard. Please consult the help listed in the "Technical Help" link for important information. **If you encounter technical difficulty in**

completing or submitting any online assessment, please immediately contact the designated help desk listed on the [AAP online support](#) (<http://advanced.jhu.edu/online/help/>). Also, contact your instructor at the email address listed atop this syllabus.

Late Policy

Unless circumstances are exceptional, written assignments not submitted by the due date will be docked one letter grade; not submitted within a week after the due date will be graded "F," not submitted by the end of the course will be graded "0." If a student is unable to complete the final assignments by the last week of class an Incomplete request may be necessary.

Grades and Feedback

Student contributions to weekly discussion boards will be scored and posted on a weekly basis. Student grades on individual presentations will be posted within 14 days of their due dates and each student will receive an e-mail with my review comments. Group assignments will be graded and posted within seven days of their due dates.

University Policies

General

This course adheres to all University policies described in the academic catalog. A few to pay close attention to are noted below. JHU Ethics Statement: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor.

Plagiarism

Read and adhere to JHU's policy: <http://advanced.jhu.edu/students/plagiarism/>

Dropping the Course

You are responsible for understanding the university's policies and procedures regarding withdrawing from courses found in the current catalog. You should be aware of [the current deadlines](#).

Students with Disabilities

Johns Hopkins University is committed to providing reasonable and appropriate accommodations to students with disabilities. Students with documented disabilities should contact the coordinator listed on the [accommodation request page](#). Further information and a request for accommodation form can be found at: <http://advanced.jhu.edu/students/disability-accommodations/>

Class Schedule and Outline

Sept 4-8 (Class 1)

Introduction

In this class, we'll begin talking about risk as a public policy issue. While our focus will be on environmental risk, it's worth noting that most regulatory policy addresses some type of risk -- whether to human health, property, finance and the economy or other areas of public concern. These different types of risk have basic features in common. More to the point of this course, environmental risks have common features that allow us to define, measure and compare them. I hope that by the conclusion of this class you'll appreciate the power and importance of risk assessment in environmental decision making.

Class Objectives

- Clarify course objectives and syllabus, assignments, responsibilities, grading.
- Survey the topic of risk in public policymaking and in the popular press.
- Enjoy an "Ice Breaker" activity.

Readings

The first three readings below are taken from the popular press. All three are excerpted from best-selling books. They were selected to give you a sense of the range of risk topics receiving widespread attention by the general public. The second set of titles focus on environmental risk. They should give you a sense for the range of topics we'll discuss in the course.

Read one of the following:

What the Dog Saw, "Blow-up: Who Can Be Blamed for the Disaster Like the Challenger Explosion? No One, and We'd Better Get Used to It," Malcolm Gladwell, 2009, adapted from New Yorker Magazine article, 1996.

Against the Gods: The Remarkable Story of Risk, Chapters 6-11, On the Nature of Man. Peter Bernstein, 1996.

The Black Swan, "The Apprenticeship of the Empirical Skeptic," Nassim Nicholas Taleb, 2007.

Read one of the following:

"Mapping the Cancer Genome", Francis S. Collins and Anna D. Parker, Scientific American, March 2007.

"China's Children of Smoke", Dan Fagin, Scientific American, August 2008.

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Sept 9-15 (Class 2)

Introduction

In this class, we'll learn about the fundamentals of human health risk assessment, as prescribed by the National Academy of Sciences three decades ago. We'll begin with the seminal

documents and then use more recent ones to show how risk assessment in the federal government has evolved gradually to reflect practitioner experience and new scientific developments.

Class Objectives

- Evaluate the strengths and weaknesses of the NAS four-step process for human health risk assessment: hazard assessment, dose-response evaluation, exposure assessment, risk characterization.
- Trace emerging developments in risk assessment practices
- Identify possible environmental issues for your first presentations.

Readings

The first title below was developed by NAS in response to a call for consistency in risk assessment practices by industry, the scientific community and quarreling bureaucrats. The second title describes (in tedious bureaucratic language, sorry) how EPA translated the NAS guidance into Agency practice. The third title provides some background on the science that EPA drew on to develop its cancer risk assessment guidelines. Read the NAS report and Scientific American article carefully. Skim the cancer guidelines. I'll highlight the important developments detailed there in our class discussion.

Risk Assessment in the Federal Government: Managing the Process, National Academy of Science, 1983, Chapter 2: The Nature of Risk Assessment.

Guidelines for Carcinogenic Risk Assessment, EPA, Federal Register, March 2005

"What Causes Cancer?" Dimitrios Trichopoulos, Scientific American, September 1996.

"Uncovering New Clues to Cancer Risk", Frederica P. Perera, Scientific American, May 1996

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Sept 16-22 (Class 3)

Introduction

In this class, we begin talking about risk management. As we saw last week, risk management is on the other side of the risk assessment and management ledger. It addresses the non-scientific issues that arise in environmental decision making, e.g., economic cost, technical feasibility, law, politics and public opinion. Risk management provides the framework for an orderly "weighing of factors" necessary in good environmental decision making. We'll also begin discussion of White River, our first case study, by looking at the facts of the case and profile of the human health risks.

Class Objectives

- Assimilate the principles of risk management into our risk assessment and management framework: construct the anatomy of an environmental risk; develop and evaluate risk management options
- Compare the four different types of health information that may be used in a hazard assessment.

Readings

The White River case study involves a hypothetical situation that will allow you to grapple with many of the issues and problems in using risk assessment to characterize and environmental problem. You'll get the most out of this case study if you take the time to answer the questions at the end of each section.

Read risk assessment chapters of White River case study.

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Sept 23-29 (Class 4)

Introduction

In this class, we'll explore ecological risk assessment by looking at its basic process and comparing it with the human health risk assessment process we've already seen. As we'll see, eco risk assessment is different in ways that reflects multi-dimensional nature of ecological concerns and values. We'll also continue to discuss the White River case study by developing and selecting among options for reducing human health risks

Class Objectives

- Evaluate the strengths and weaknesses of ecological risk assessment.
- Develop and evaluate a set of risk management options.

Readings

I hope you'll agree that EPA's ecological risk assessment guidelines are a user-friendly resource for technical and lay readers alike. Those of you who select an ecological risk topic for your first presentation will find the document to be very useful. Continue reading the White River case study and answering the questions it asks you. You'll find the extra effort to be time well spent. The Scientific American article is slightly off our critical path. It reveals the insidious effects of climate change on the marine ecology.

Guidelines for Ecological Risk Assessment, Risk Management Forum, EPA, 1998.

Risk Management chapters of White River case study.

"Threatening Ocean Life from the Inside Out", Marah J. Hardt and Carl Safina, Scientific American, August 2010.

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Sept 30-Oct 6 (Class 5)

Introduction

Risk communication is a very diverse field of study. This week we'll explore two perspectives that bound the range of theoretical inquiry. We'll also read an account of EPA's response to the World Trade Center disaster that was literally torn from the front page of the country's major newspapers. You'll wonder how smart, well-intentioned environmental professionals could communicate so poorly.

Class Objectives

- Identify the important features of a good risk communication strategy.
- Present and review first presentation topic previews. Seek to resolve student presentation issues, e.g., possible sources of hazard, dose-response and exposure data (e.g., Integrated Risk Information System, or IRIS); risk characterization in the face of data deficiencies and uncertainty.

Readings

The first two readings are from preeminent members of the risk communication community. The first advocates a qualitative, intuitive approach; the second, a more quantitative approach that reveals the counter-intuitive nature of risk perception. The third reading about the WTC may re-open old wounds, but the lesson to be learned is a valuable one.

Responding to Community Outrage: Strategies for Effective Risk Communication, Peter Sandman, American Industrial Hygiene Program, 1993, Chapter 2: Components of Outrage.

Communicating Risk to the Public: International Perspectives, Klutner Academic Publishers, 1991, Risk Comparisons and Risk Communication, Vincent Covello.

EPA's Response to the World Trade Center Collapse: Challenges, Successes, and Areas for Improvement. Adapted from EPA Office of Inspector General Report No. 2003-P-00012, August 21, 2003.

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Oct 7-13 (Class 6)

Introduction

This week we begin work on the Dan River case study. Dan River will give us a first-hand look at the complexities of conducting ecological risk assessment in a typical real-world situation. The

many, varied and often competing public concerns raised in the case study demand some method of choosing among ecological values for study and protection. As we approach your first presentation completion deadline, it's increasingly important that you settle on a topic, let me know what it is, and begin work.

Class Objectives

- Develop and evaluate the strengths and weaknesses of a conceptual model in an eco-risk problem formulation
- Resolve student presentation topics and issues.

Readings

As you'll recall from our earlier discussion of ecological risk assessment, the problem formulation phase creates the organization of your risk assessment. This class reading should be great practice for those of you who select eco risk topics for your first presentation.

Dan River, Problem Formulation

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Oct 14-20 (Class 7)

Introduction

This week we'll use the Chernobyl nuclear reactor accident to gain a longer-term perspective on the predictive power of risk assessment. You'll read two assessments of the human health effects from radiation exposures completed ten and twenty years after the accident. We'll also continue our work in the more tranquil setting of Dan River.

Class Objectives

- Synthesize the results of ecological exposure and effects assessments to characterize an ecological risk.
- Resolve student presentation topics and issues

Readings

Risk Assessment is predictive tool. The only way to judge the accuracy of risk assessment predictions is to compare them with observed health effects -- years and sometimes even decades later. The successive studies of the Chernobyl disaster offer a poignant example of how predicted health effects may unfold over time.

The Dan River Risk Characterization raises into high relief the challenges of providing "actionable" ecological risk assessment findings.

Dan River, Analysis and Risk Characterization

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

October 21-27 (Class 8)

Introduction

This week we'll walk right into the teeth of the controversy surrounding the science of environmental risk. Two readings, both drawing on respected science and opinion, lead to diametrically opposing views about the current state and future of our environment. If you read them carefully, one or the other will frustrate and annoy you, but hopefully you'll enjoy the learning experience. We'll also move ahead with a risk management discussion in Dan River. Try to think broadly here about steps that could be taken to alleviate problems and reduce risks, without setting the many public interests in Dan River against each other.

Class Objectives

- Examine the range of interpretations that experts may give to essentially the same body of environmental risk information.
- Make a reasoned eco risk management decision in the face of incomplete information and inadequate time.

Readings

The two new readings for this week may be read as point-counterpoint discussions. Look for places where they draw on essentially the same science to draw different conclusions.

Our Stolen Future, Theo Colborn, Diane Dumanoski, John Peterson Myers, 1996, Chapter 1: Omens, Chapter 7: A Single Hit.

Apocalypse Not: Science, Economics and Environmentalism, Ben Bolch and Harold Lyons, 1993, Chapter 2: Rationality, Morality and Environmentalism, Chapter 4: Chemophobia in America.

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Oct 28-Nov 3 (Class 9)

Introduction

My advice for completing the work for this week's assignment is to raise any questions you may have before the clock runs down too far. Be thorough and honest in your review of other people's work. You'll be helping them and yourself.

Class Objectives

- Complete a risk assessment presentation.
- Provide positive critical review and comment on risk assessment presentations presented by your classmates.
- Finalize your risk assessment presentations and e-mail them to class instructor.

Readings

Our last case study, Red Dragon, demonstrates these very strengths and weaknesses of B-C analysis. As you read it ask yourself where's (no, not where's Waldo) the risk assessment in this analysis?

Risk Characterization chapters of Red Dragon case study.

Assignments Due

- Post your draft risk assessment presentation on your peer group discussion forum no later than 9:00pm Monday evening.
- Review and post comments on draft presentations for each member of your peer review group no later than 9:00pm Thursday evening
- Revise your presentations based on comments received and submit your final presentation to me no later than 9:00pm Sunday evening.

Nov 4-10 (Class 10)

Introduction

This class is an opportunity to learn more about the many environmental topics addressed by your classmates. If you work at it, you'll come away with a thumbnail sketch understanding of each one and a relative sense of how important they are as environmental issues. You'll also have a chance to enjoy yourselves. From my point of view, you'll have earned it.

Class Objectives

- Evaluate the strengths and weaknesses of comparative risk assessment methods.

Readings

The following readings are foundations of the comparative risk movement that occurred in the late 1980's and early 1990's.

Worst Things First? The Debate Over Risk-Based National Environmental Priorities, Resources for the Future, 1994, Chapter 2: Rationalism and Democratization: Time for a Truce, Alice Rivlin; and Chapter 5: Integrating Science, Values and Democracy Through Comparative Risk Assessment, Jonathan Lash

Five-Hundred Life-Saving Interventions and their Cost Effectiveness, Tammy O. Teng et al, 1994

Assignments Due:

- Post topic list and ranking criteria no later than 9:00pm Tuesday evening.
- Complete group comparative risk assessment exercise no later than 9:00 Sunday evening.

Nov 11-17 (Class 11)

Introduction

In this class, I'll ask you to look under the hood of benefit-cost analysis to appreciate its strengths and weaknesses as an analytical framework for assessing environmental policy options. The argument in favor of using B-C analysis is that it is comprehensive in its reach and scope. Its weakness is that by being comprehensive, the B-C analysis must make a variety of heroic assumptions that are sometimes controversial.

Class Objectives

- Compare the strengths and weaknesses of benefit/cost analysis.
- Identify the role of risk assessment in an analysis of environmental benefits.

Readings

How do attitudes, opinions and even personal ethics color our use of B-C analysis? Both of this week's readings lay bare their inseparable role in quantitative analysis.

Risk Characterization chapters of Red Dragon case study.

Readings in Risk, "Benefit-Cost Analysis: An Ethical Critique", Steven Kelman

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Nov 18-24 (Class 12)

Introduction

This week we'll finish up with Red Dragon. The decision framework for options selection is both demanding and a little deceiving, so be careful as you review the information provided and choose the "best" set of controls for the power plant. We'll also check in on your group progress toward completing the Risk Tool Critique.

Class Objectives

- Determine why benefit-cost analysis is both a powerful and unpopular decision-making tool.

Readings

Red Dragon is an economist's dream: Lots of benefit and cost information presented in elegant graphs with appealing curve intersections suggesting optimal policy choices. Think carefully about what the intersection points of the curves mean. Don't forget what you've learned

already about the underlying data used to plot the curves. Don't hold back with your interpretations. I give credit for having the courage to speak up in this exercise.

Read cost and benefit discussions in Red Dragon case study.

Assignments Due: Post responses to forum questions no later than 9:00pm Saturday evening.

Nov 25-Dec 1 -- Thanksgiving Break – No Class Assignments

Dec 2-8 (Class 13)

Introduction

Consulting makes strange bedfellows. In 2013, I found myself working for the construction industry to scrutinize the requirements in a worker safety rule proposed by the Occupational Safety and Health Administration. The "Silica Rule" as it was nicknamed established limits on worker exposure levels to silica dust, a common air pollutant at construction sites. OSHA had published a regulatory impact analysis running over 1,200 pages documenting its basis for the proposed rule. In those pages were vast amounts of information about compliance costs and a thorough review of available studies on the health effects of silica dust exposures. Sadly, though, OSHA made no attempt to combine the cost and risk information into a formal risk-cost analysis. Our construction industry clients chose to follow suit -- attacking the OSHA cost estimates as unrealistically low and the health information as inadequate. My involvement with the rule making ended without ever learning about the merits of the proposed OSHA rule as a risk-cost trade-off.

This week you'll help me achieve some degree of intellectual satisfaction by evaluating selected information from the OSHA RIA and giving me your opinion about whether the rule is good public policy.

Class Objectives

- Evaluate limited information about the costs and risks for an OSHA worker exposure rule.
- Decide on how best to make use of government-provided information to judge the merits of a public policy action.
- Create a context for comparing the OSHA worker exposure rule with risk management decisions made by other the federal government agencies.

Readings

The Woodstone Homes Construction Company: A Risk-Cost Case Study

Assignments due: Post responses to discussion questions no later than 6:00pm Friday evening.

Dec 9-15 (Class 14)

Introduction

Finish Line. The process for this class is identical to the one we followed for your first presentation in Class 9. So once again, read the instructions carefully, ask questions early and give your group members your best effort.

Class Objectives

- Design and create a risk management presentation
- Provide critical, positive peer review and comment on draft risk management presentations posted by members of your work group.
- Finalize your own risk management presentations and submit them to class instructor.

For additional instructions and details please see Class Requirements.

Readings: None

Assignments Due:

- Post your draft risk management presentation on your peer group discussion forum no later than 9:00pm ET Monday evening.
- Review and post comments on draft presentations for each member of your peer review group no later than 9:00pm ET Thursday evening
- Revise your presentations based on comments received and submit your final presentation to me no later than 9:00pm ET Sunday evening.