**SS289 - UNINTENDED CONSEQUENCES, INDUSTRIAL ACCIDENTS,**

**AND OTHER ANTHOPOGENIC DISASTERS**

**Fall, 2016**

**Location TBA**

**TR 11:00-12:15**

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**Course Description:**

Examples of unintended consequences, industrial accidents, and other disasters resulting from human technological decision making are legion. Contrary to predominant techno-utopian strains of thought within Western culture, near catastrophic errors and the failure to adequately prepare for mistakes are frequently the norm rather than the exception. Managers and technical experts routinely overestimate their own knowledge and capacity for foresight, failing to either adequately account for the uncertainties and complexities of reality or subject their designs to sufficient critical scrutiny.

This course, in response, aspires to help instruct budding scientists and engineers on how to be more thoughtful and prudent through an examination of a number of cases studies of unanticipated consequences, design errors, systemic failures, and other anthropogenic (i.e., human produced) disasters. We will explore the cognitive, organizational, and technical sources of error as well as proposals developed within decision theory for more intelligently steering innovation so as to minimize harms and (hopefully) avert catastrophe. More broadly, we will evaluate different approaches to risk as political arrangements, seeing each as providing a different answer to the question: “Who shoulders which risks, when, and how?”

**Pre-requisites/Co-requisites:** None

**Place in Curriculum**: General Education Core requirement, Area 4 – Social Sciences

**Course Learning Outcomes**:

This course explores the decisions, thinking processes, technical structures, and forms of organization that lead to technoscientific mistakes. Course assignments will help students hone their analytical, writing, and oral presentation skills. By the end of the course, students should be able to: (1) Characterize the unintended consequences occurring in historical cases and the risks entailed by emerging innovations, (2) Describe risky technologies as constituted by the coupling of sociotechnical systems, (3) Evaluate historical and contemporary instances of technoscience in terms of how well “intelligent trial and error” was pursued, (4) Propose mechanisms for lessening the risks posed by emerging technologies and lowering the barriers to more responsible innovation.

**Program Learning Outcomes**:

Students will:

1. Identify, describe, and explain human behaviors and how they are influenced by social structures, institutions, and processes within the contexts of complex and diverse communities.

2. Articulate how beliefs, assumptions, and values are influenced by factors such as politics, geography, economics, culture, biology, history, and social institutions.

3. Describe ongoing reciprocal interactions among self, society, and the environment.

4. Apply the knowledge base of the social and behavioral sciences to identify, describe, explain, and critically evaluate relevant issues, ethical dilemmas, and arguments.

**Course Requirements**:

**Required Texts:**

1) Scherden, William A. 2011. *Best Laid Plans.* Santa Barbara, CA: ABC-CLIO

2) Sagan, Scott D. 1993. *The Limits of Safety.* Princeton, NJ: Princeton University Press.

3) Steinberg, Ted. 2000. *Acts of God*. New York, NY: Oxford University Press.

**Note:** Case study readings will be emailed (or placed on Cavnas) by the instructor as a pdf. It is strongly encouraged that students print out and annotate electronically received readings.

**Assignments**

The structure of this course requires careful reading in preparation for engaged class discussion. Students will be expected to have extracted the main arguments and evidentiary basis for claims within the readings, taking notes, prior to that day’s class. Doing so will help ensure that more class time can be devoted to going beyond the readings rather than merely reviewing them.

Students missing more than two classes will incur a significant attendance grade penalty (full letter grade per day). Absences will also negatively affect the student’s participation grade. Penalties can be avoided by completing a writing assignment on a reading provided by the instructor.

This course consists of readings, class discussions, reading notes, short personal reflections, film review, book review, and a final group project.

**Participation:** Students will be graded on their appearing prepared to discuss and respond to questions regarding that day’s reading, which entails comprehending the author’s main claims, logic, and evidentiary bases. Periodically, students will be asked to be prepared to discuss the following day’s readings at length so as to ensure a broad distribution of participation.

**Students on their laptops or otherwise preoccupied with a digital device will receive a zero for that day’s participation grade**. Students are encouraged to take handwritten notes so as to avoid the alluring pull of computerized distractions. Listening attentively but otherwise not participating will earn students a non-zero (but also non-passing: e.g., <50%) participation grade. Finally, students should put their phones on vibrate and keep them in their book bags or pockets.

**Midterm:** The midterm will evaluate the student’s understanding of the cases and arguments presented in the required readings for the class. The test will consist of a number of short answer and brief essay questions.

**Presentations:** Pairs of students will be responsible for preparing and giving a presentation that reports on a relevant case study. Presentations will be 20-30 minutes and outline the background of the case as well as its connection to course readings. Basic source material for these presentations will be provided to the students, who will only perform outside research only if absolutely necessary to put together a cohesive presentation.

**Disaster Review:** Pairs of students will produce a 1500 word analysis of a technical/engineering disaster, using “Seconds from Disaster” as a starting point and supplementing with online research.

**Research Project**: Students will be divided into small groups and dedicate the last four weeks of the course to researching a case of emerging technoscience and characterizing it using relevant course concepts. Considerable in-class time will be set aside for groups to conduct outside research, peer review, and assist one another in improving their thinking and analysis. This research will culminate in a 15-20 page paper as well as 20-30 minute presentation. Fairness in grading will be assured through self and peer evaluations.

**Course Schedule**:

**Section I: Unintended Consequences**

**Tue Aug 23 –** Review of Course & Syllabus – How to Read - Introduction

**Thu Aug 25 –** Unintended Consequences I

Sherden. Ch. 2 & 4. “The Web of Life” and “The Vicious Cycle”

**Tue Aug 29 –** Unintended Consequences II

Sherden Ch. 5 & 7. “The Bandwagon Effect” & “Perverse Adaptations”

**\*\*\*Choose Round I Presenters**

**Thu Sep 1 –** Unintended Consequences III

Sherden Ch. 8-9. “Coming into Being” and “Breaching the Peace”

**\*\*\*Choose Disaster Analysis Topics**

**Tue Sep 6 – Student Presentations**

**Thu Sep 8 – Student Presentations**

**Section II: Intelligent Trial and Error Learning and Avoiding Unintended Consequences**

**Tue Sep 13 –** Nuclear Energy

Morone & Woodhouse, “Democratic Control of Technology” and Collingridge, “Nuclear Power” **On Canvas**

**Thu Sep 15–** Wetmore, “Amish Technology: Reinforcing Values and Building Community” **On Canvas \*\*\*Choose Round II Presenters**

**Tue Sep 20–** **Student Presentations**

**Thu Sep 22–** Disaster Analysis Workshop Day – Features of Good Writing – Bring Rough Drafts

**Tue Sep 27–** Film: A is for Atom **[Disaster Analysis Paper Due at 5pm]**

**Section III: Normal Accidents/High-Reliability Organizations**

**Thu Sep 29 -** Sagan, Ch. 1 “The Origins of Accidents”

**Tue Oct 4 –** More on Normal Accidents and HRO’s **[Start Reading Ch. 2]**

**Thu Oct 6 –** Sagan, Ch. 2 “Nuclear Weapons Safety during the Cuban Missile Crisis” **[LONG! Start Early!] \*\*\*Choose Round III Presenters**

**Tue Oct 11 –** Sagan, Ch. 4 “Redundancy and Reliability: The 1968 Thule Bomber Accident”

**Thu Oct 13** – Sagan, Ch. 5 “Learning by Trial and Terror”

**Tue Oct 18 – Student Presentations**

**Thu Oct 20 – Student Presentations**

**\*\*\*Assign discussion leads for Steinberg chapters**

**Section IV: “Natural” Disasters and the Politics of Risk**

**Tue Oct 25 –** Discussion Day I – Steinberg, “Acts of God” Chapters 1-5

**Thu Oct 27 –** Discussion Day II – Steinberg, “Acts of God” Chapters 6-9

**Tue Nov 1 –** Review for Exam

**Thu Nov 3 –** **Exam**

**Tue Nov 8 –** Review Exam; Pick Groups/Projects

**Section V: Application**

**Thu Nov 10 –** Open Work Day; Assemble Research Materials

**Tue Nov 15 –** Workshop I: Background; Politics of Risk

**Thu Nov 17 –** Workshop II: Potential for Unintended Consequences

**Tue Nov 22 –** Workshop III: Complexity and Coupling

**Thu Nov 24 –** **[Thanksgiving]**

**Tue Nov 29 –** Workshop IV: Intelligent Trial and Error

**Thu Dec 1 –** Final Project Presentations

**Tue Dec 6 –**Final Project Presentations

**Thu Dec 8 –** Final Project Presentations

**[Final Paper Due Friday at 5pm]**

**Grading**:

A = 100-94%; A- = 93-90%: B+ = 89-87%; B = 86-84%; B- = 83-80%; C+ = 79-77%; C = 76-74%; C- = 73-70%; D = 69-60%; F=<60%

**Breakdown:**

Attendance and Participation 20%

Case Study Presentation 15%

Disaster Review 15%

Midterm Exam 25%

Final Project 25%

**Counseling and Disability Services:**

**Reasonable Accommodations**

New Mexico Tech is committed to protecting the rights of individuals with disabilities. Qualified individuals who require reasonable accommodations are invited to make their needs known to the Office of Counseling and Disability Services (OCDS) as soon as possible. To schedule an appointment, please call 835-6619.

**Counseling Services**

New Mexico Tech offers mental health and substance abuse counseling through the Office of Counseling and Disability Services. The confidential services are provided free of charge by licensed professionals. To schedule an appointment, please call 835-6619.

**Academic Honesty**: New Mexico Tech’s Academic Honesty Policy for undergraduate students is found starting on page 60 of the NMT Undergraduate Catalog, <http://www.nmt.edu/images/stories/registrar/2014-2015_UNDERGRADUATE_Catalog_FINAL.pdf>

New Mexico Tech’s Academic Honesty Policy for graduate students is found starting on page 59 of the NMT Graduate Catalog, <http://www.nmt.edu/images/stories/registrar/2014-2015_GRADUATE_Catalog_FINAL.pdf>.

You are responsible for knowing, understanding, and following this policy.

**Respect Statement:** New Mexico Tech supports freedom of expression within the parameters of a respectful learning environment. As stated in the New Mexico Tech Guide to Conduct and Citizenship: “New Mexico Tech’s primary purpose is education, which includes teaching, research, discussion, learning, and service. An atmosphere of free and open inquiry is essential to the pursuit of education. Tech seeks to protect academic freedom and build on individual responsibility to create and maintain an academic atmosphere that is a purposeful, just, open, disciplined, and caring community.”

**Presentation Topics**

Unintended Consequences

Introduction and Strengthening of Pests

Effects of New Sports Technologies

Natural and Manmade Environmental Disasters

Automation and Pilot Performance

Is Google Making Us Stupid? Digital Devices and Mental Life

Suburbanization

Unintended Consequences of Green Technologies

Normal Accidents/High Reliability Organization

Petrochemical Plants

Financial Meltdowns

Aloha Flight 243

Big Data and Normal Accidents

US Air Traffic Control

US vs. Soviet Submarine Programs

Intelligent Trial and Error

Wind Energy (Denmark vs. US vs. Germany)

Hurricane Katrina

Space Shuttle

North Sea Oil

Channel Tunnel

**Disaster Review Topics – “Seconds from Disaster” Episodes Found on YouTube**

Air Disasters

Crash of the Concorde

Florida Swamp Air Crash (ValuJet)

Plane Crash in Queens (AA Flight 587)

Collision on the Runway (Tenerife)

Trains, Submarines, Space Shuttles, Aircraft Carriers

Space Shuttle Columbia

Russia’s Nuclear Sub Nightmare (Kursk)

Space Shuttle Explosion (Challenger)

Derailment at Eschede

Aircraft Carrier Explosion (USS Forrestal)

Infrastructure/Industrial Disasters

Meltdown at Chernobyl

Flood at Stava Dam

Mountain Tsunami (Vajont Dam disaster)

Bhopal Nightmare (Union Carbide plant toxic gas leak)

The Deepwater Horizon (BP Oil Spill)

Explosion in the North Sea (Piper Alpha oil platform disaster)

Building Collapses

Superstore Collapse (South Korea)

Skywalk Collapse (Hyatt Regency Hotel in Kansas City)

Other

Black Hawk Down (Battle of Mogadishu)

Kaprun Disaster (Austrian furniclular)

**Possible Research Topics**

Driverless Cars

Fossil Fuel Driven Climate Change

Industrial Toxins

Super Intelligent Artificial Intelligence

Agricultural Crops Modified Through rDNA (and Similar) Techniques

Biotechnological Research Focused on Recreating or Modifying Deadly Diseases

Human Cognitive Enhancement

Companion Robots and Other Social Surrogates

Burying of Alaskan Way Viaduct

Or any other risky or potentially catastrophic instance of technoscience