



Moral responsibility in the era of computers and new technologies

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My background

- 1992-1993 Process engineer
- 1993-1994 Plant engineer
- 1993 BS in Chemical Engineering (UNAM, Mexico)
- 1997 MS in Process Systems Engineering (Tokyo Institute of Technology)
- 1998-2005 Assistant Professor
- 1999 PhD in Process Systems Engineering (Tokyo Institute of Technology)
- 2001-2002 Visiting Researcher (Institut Français du Pétrole)
- From 2005 Associate Professor (TUT)

“A president’s hardest task is not to do what is right, but to know what is right” —Lyndon Johnson

An engineer's “hardest task is not to do what is right, but to know what is right”

The need for moral responsibility

- Computer-related tragedies
 - Therac-25
- Biomedical engineering
 - Nazi experiments on human subjects
 - Thalidomide tragedy
- Safety and environmental disasters
 - Bhopal accident
 - Seveso accident
- Labor conditions
 - Forced labor in I. G. Farben
 - Slave workers in Chinese factories



The Therac-25 tragedy

During the 1980s, Atomic Energy Commission Limited (AECL) designed a cancer radiation treatment machine called Therac-25. Eleven Therac-25 were sold and installed in US and Canada. The machine relied on computer software to control its operation. Between 1985 and 1987, three patients died and 3 others suffered serious injuries because of problems in the Therac-25.

Source: Loui, M. C., K. W. Miller. Ethics and Professional Responsibility in Computing

The Therac-25 tragedy: Who was responsible?

- The machine?
- The technician/physician that operated the machine?
- The software developers who wrote the control software that contained several serious errors?
- The system engineers that neglected to install the backup hardware safety mechanisms that had been used in previous models?
- AECL?
- Government agencies?

Moral responsibility

- Several philosophical issues
- Several definitions
- Definition used in this workshop:

Moral responsibility is the use of free will in accordance to a code of ethics

Free will

■ Deniers of free-will

- *“All people are products of two things, and two things only—their heredity and environment”*

—Clarence Darrow

■ Proponents of the existence of free-will

- Acknowledge that heredity and environment influence human behavior
- Human beings can overcome bad environments

Viktor Frankl on free will

“We who lived in concentration camps can remember the men who walked through the huts comforting others, giving away their last piece of bread. They may have been few in number, but they offer sufficient proof that everything can be taken from a man but one thing: the last of the human freedoms—to choose one’s attitude in any given set of circumstances, to choose one’s way.” —Viktor Frankl

Codes of ethics

- Created in response to actual or anticipated ethical conflicts
- Definition used in this talk

A code of ethics describes the principles and obligations that guide the ethical behavior of professionals in their roles as members of a profession, members of an organization, and members of society.

Codes of Ethics in Medicine

Maimonides code of ethics (12th century)

The eternal providence has appointed me to watch over the life and health of Thy creatures. May the love for my art actuate me at all time; may neither avarice nor miserliness, nor thirst for glory or for a great reputation engage my mind; for the enemies of truth and philanthropy could easily deceive me and make me forgetful of my lofty aim of doing good to Thy children.

May I never see in the patient anything but a fellow creature in pain. Grant me the strength, time and opportunity always to correct what I have acquired, always to extend its domain; for knowledge is immense and the spirit of man can extend indefinitely to enrich itself daily with new requirements.

Today he can discover his errors of yesterday and tomorrow he can obtain a new light on what he thinks himself sure of today. Oh, God, Thou has appointed me to watch over the life and death of Thy creatures; here am I ready for my vocation and now I turn unto my calling.

Maimonides code of ethics

Based on the Torah (1313 BCE)

“Love your neighbor as yourself”
(Leviticus 19:18)

Probably influenced by the Talmud

*“What is hateful to you, do not do to
your fellow”*
(Hillel, some 2000 years ago)

Hippocratic oath (ca. 460 BCE– ca. 370 BCE)

- I will not give a lethal drug to anyone if I am asked, nor will I advise such a plan; and similarly I will not give a woman a pessary to cause an abortion.
- But I will preserve the purity of my life and my arts.
- I will not cut for stone, even for patients in whom the disease is manifest; I will leave this operation to be performed by practitioners, specialists in this art.
- In every house where I come I will enter only for the good of my patients, keeping myself far from all intentional ill-doing and all seduction and especially from the pleasures of love with women or with men, be they free or slaves.
- All that may come to my knowledge in the exercise of my profession or in daily commerce with men, which ought not to be spread abroad, I will keep secret and will never reveal.
- If I keep this oath faithfully, may I enjoy my life and practice my art, respected by all men and in all times; but if I swerve from it or violate it, may the reverse be my lot...

Codes of Ethics in Science

Russell–Einstein Manifesto

- Issued in London on July 9, 1955
- Highlighted the dangers of nuclear weapons
- Called for world leaders to seek peaceful solutions to international conflicts
- Signatories included pre-eminent scientists (M. Born, P. Bridgman, A. Einstein, L. Infeld, F. Joliot-Curie, H. J. Muller, L. Pauling, C. F. Powell, J. Rotblat, B. Russell, H. Yukawa)
- *“Above all remember your humanity”*— Joseph Rotblat

Codes of ethics for scientists

- Standards for Ethics and Responsibility in Science – an Empirical Study
 - 115 codes of ethics for scientists
 - The International Council for Science (ICSU) (2001)
- Report to the UN Secretary by the General Policy Working Group on the United Nations and Terrorism (2002)

Standards for Ethics and Responsibility in Science – an Empirical Study

Individual Traits

Honesty
Openness
Fairness

Truthfulness
Accuracy
Conscientiousness

Respect
Collaboration
Loyalty

Collective/Societal Traits

Social responsibility
Environmental responsibility
Sustainable development
Socio-economic development
Social welfare
Socio economic equity

Gender equality
Scientific freedom
Peace
Democratic development
Human rights

Report by the Working Group on the UN and Terrorism (Recommendation 21)

“Relevant UN offices should be tasked with producing proposals to reinforce ethical norms, and the creation of codes of conduct for scientists, through international and national scientific societies and institutions that teach sciences or engineering skills related to weapons technologies, should be encouraged. Such codes of conduct would aim to prevent the involvement of defense scientists or technical experts in terrorist activities and restrict public access to knowledge and expertise on the development, production, stockpiling and use of weapons of mass destruction or related technologies.”

Oath of a computer scientist

- I want to live and work honestly and sincerely and always do my best to follow my vocation (in the sense of this oath).
- I am aware of my responsibility as a computer expert to process and safeguard all information in a correct way. I will work in an ecological consciousness of information to prevent the "information-sphere" from pollution by faulty programs and wrong data.
- I will act in a holistic and interdisciplinary way. I will be cautious not to separate subject and object, environment and interior system, or developers, users and uses, as all consequences of my actions in turn affect myself. I take responsibility for myself, for my thinking, feeling, speaking and acting, and I will only promise what I can keep.
- I do not serve any egoistic interests, I will not allow misuse of information techniques nor falsification of information, and I will give nobody the possibility to influence me adversely.
- I will not use power to control others, and I shall not develop or distribute any destructive software. I will make public any unjust practice and any problem. I will do my best to find reasons of my own faults, and I will forgive others and correct mistakes. I will be open for suggestions and any constructive criticism.
- I respect the human rights, the privacy of individuals and the democratic freedom of information. I accept myself and all human beings as they are, regardless of sex, religion, nationality and birth. I will stand up for keeping nature alive.
- I respect my teachers and continue their work, in an evolutionary sense. I will work to increasing my knowledge and to a further global development.

Source: <http://courses.cs.vt.edu/~cs3604/lib/WorldCodes/Loeffler.Oath.html>

An Engineer's Oath

- I solemnly pledge myself to consecrate my life to the service of humanity.
- I will give to my teachers the respect and gratitude which is their due
- I will be loyal to the profession of engineering and just and generous to its members
- I will lead my life and practice my profession in uprightness and honor whatever project I shall undertake, it shall be for the good of mankind to the utmost of my power
- I will keep far away from wrong, from corruption, and from tempting others to vicious practice
- I will exercise my profession solely for the benefit of humanity and perform no act for a criminal purpose, even if solicited, far less suggest it
- I will speak out against evil and unjust practice wherever I encounter it
- I will not permit considerations of religion, nationality, race, party politics, or social standing to intervene between my duty and my work
- even under threat, I will not use my professional knowledge contrary to the laws of humanity
- I will endeavor to avoid waste and the consumption of non-renewable resources. I make these promises solemnly, freely, and upon my honor.

Source: <http://courses.cs.vt.edu/~cs3604/lib/WorldCodes/Hippocr.Oath.html>

NSPE Code of Ethics

- Authored by members of the National Society of Professional Engineers (NSPE)
- Composed of three parts:
 - Fundamental Canons
 - Rules of Practice (expanded descriptions of the first 5 fundamental canons)
 - Professional Obligations (expanded descriptions of the last fundamental canon)

Fundamental Canons

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

Strength of responsibilities

- “shall”
 - implies a requirement
- “should,” “are encouraged”
 - implies a recommendation

Exercise: Write your own Engineer's oath

Use the template below to write your own engineer's oath.

I, [Your Name], do solemnly swear that I will practice my profession according to the best of my knowledge and ability, and that I will not compromise safety or quality for cost or convenience.

I will not discriminate against anyone based on race, gender, ethnicity, religion, or any other factor.

I will always act in the best interest of my clients and the public.

I will not engage in any illegal or unethical practices.

I will always strive to improve my skills and knowledge.

I will always treat others with respect and dignity.

I will always act with integrity and honesty.

I will always prioritize safety and quality over cost and convenience.

I will always act in the best interest of my clients and the public.

I will always strive to improve my skills and knowledge.

I will always treat others with respect and dignity.

I will always act with integrity and honesty.

Did you include the following traits?

- Judging others fairly
- Gratitude
- Respect
- Control of anger
- Avoiding humiliating others
- Hatred
- Responsibilities for the environment

Examples of moral responsibility issues

Suppose a software engineer neglects to carry out enough tests on a new module for a telephone switching system and the module fails (causing telephone outages).

Source:

Loui, M. C., K. W. Miller. Ethics and Professional Responsibility in Computing

Examples of moral responsibility issues

Suppose a software engineer neglects to carry out enough tests on a new module for a telephone switching system and the module fails (causing telephone outages).



The software tester is morally responsible for the harm caused by the telephone outages.

Source:

Loui, M. C., K. W. Miller. Ethics and Professional Responsibility in Computing

Examples of moral responsibility issues

Suppose a hardware engineer notices a design flaw that could result in a severe shock to someone who opens a computer to replace a memory card. The engineer is not specifically assigned to check the electrical safety of the computer.

From:

Loui, M. C., K. W. Miller. Ethics and Professional Responsibility in Computing

Examples of moral responsibility issues

Suppose a hardware engineer notices a design flaw that could result in a severe shock to someone who opens a computer to replace a memory card. The engineer is not specifically assigned to check the electrical safety of the computer.

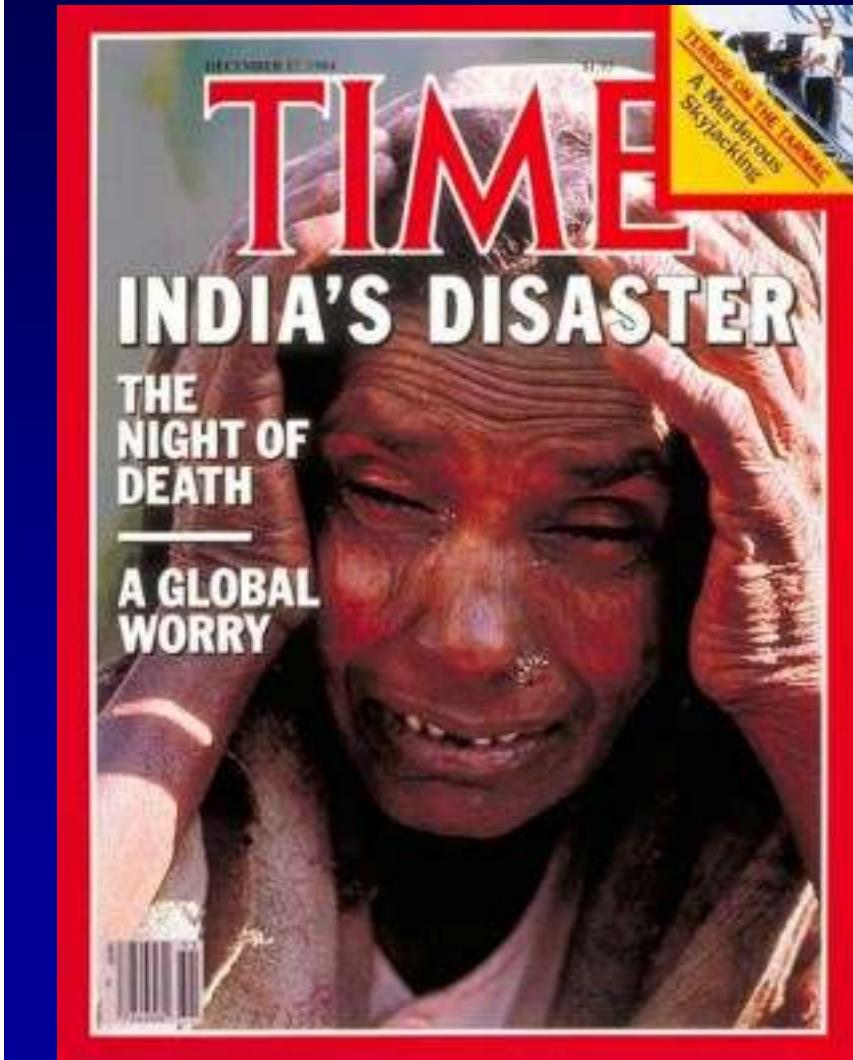


From the point of view of moral responsibility the hardware engineer is accountable for failing to call attention to the design flaw.

From:

Loui, M. C., K. W. Miller. Ethics and Professional Responsibility in Computing

Exercise: Bhopal disaster

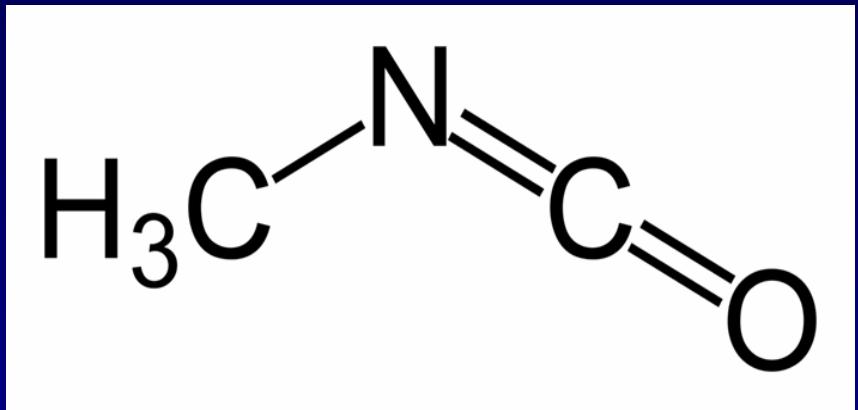


Description of the Bhopal disaster

- What? Water leaks into a tank containing methyl isocyanate (MIC) causing a runaway reaction that produces the release of MIC to the atmosphere
- When? December 3rd, 1984 (just after midnight)
- Where? Bhopal (capital of Madhya Pradesh, India)
- Causalities
 - 3000 fatalities

Hundreds of thousands of injuries
Exportation of Risk: The Case of Bhopal. Online Ethics Center for Engineering
4/7/2006 National Academy of Engineering. Accessed: November (2009)
<http://www.onlineethics.org/Resources/Cases/Bhopal.aspx>

Methyl Isocyanate (MIC)



- Colorless low-boiling liquid
- Flash point: 32 °C
- Highly toxic
- Violent reaction with water

Source:

<http://www.inchem.org/documents/icsc/icsc/eics0004.htm>

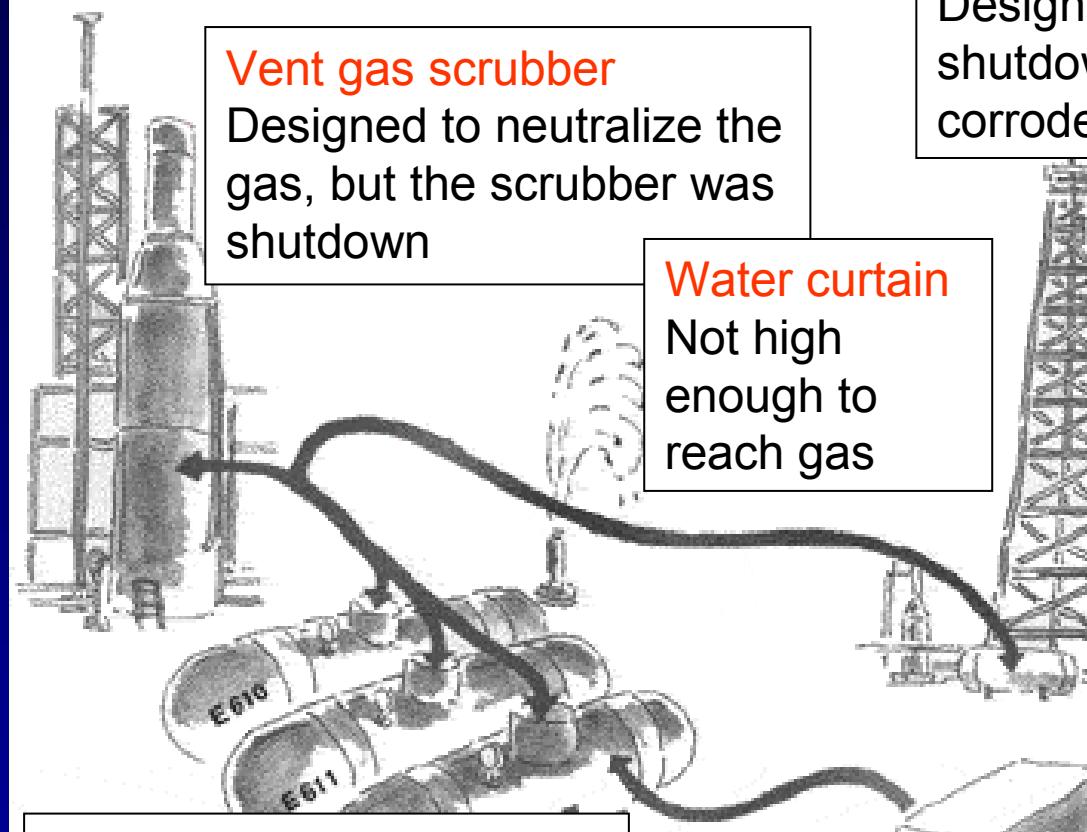
Workshop activity 1

- You are a design engineer at UCC headquarters and have worked on the design of safety systems of the Bhopal and West Virginia plants. You are very conscious of the fact that for Bhopal Union Carbide dropped the safety standards well below those it maintained at a sister plant in West Virginia. New computerized data loggers, which are standard safety systems in the U.S., were available after the plant opened, but they were not incorporated at the Bhopal Plant. Furthermore, there has been no attempt to follow up and implement the safety recommendations of the Operational Safety survey conducted by the UCC safety team in 1982. Instrumentation at the Bhopal plant is so unreliable that it is common for gas leaks of various types to be detected by workers reporting tearing and burning sensations in their eyes.
- When you informally approach management with this information, you are sternly rebuffed and told that the regulations of India do not dictate the same measures as those in the U.S. and economically, these safety upgrades are inconceivable at present. You feel uncomfortable at the lack of safety standards at Bhopal, but are keenly aware of the management's reaction to your feelings.
- How should you address this concern?
- Is it morally acceptable for management to adopt different safety standards for the Indian plant than for the American plant based on legal grounds?

Workshop activity 2

- The government of Madhya Pradesh and the Indian government have lax safety and environmental laws and regulations.
- You are also concerned that the existing safety measures are not being upheld.
- Union Carbide is able to continue operating the Bhopal Plant despite its deterioration
- One of the supervising technicians recently made you aware of the problems shown in the next slide.

The problems



Vent gas scrubber

Designed to neutralize the gas, but the scrubber was shutdown

Water curtain

Not high enough to reach gas

MIC storage tanks

E610 exceeds the recommended capacity.
Reserve tank already contains MIC.

Flare tower

Designed to burn off gas, but it is shutdown. Its connecting pipe is corroded.

Warning system to the community

Turned off

Instrumentation

Temperature and pressure sensors are not reliable.

Refrigeration system

Freon system to cool liquid MIC was shutdown in June 1984. Freon shipped to other plants

(Source: *Bhopal Medical Appeal, 2002*)

Workshop activity 2 (the decisions)

- Due to personnel reduction, remaining technicians at the plant are poorly trained and inexperienced and have little understanding of the plant and its operation. This has resulted in several accidents to date; yet management have largely ignored complaints by union officials. You know that this is a disaster waiting to happen, but are being stonewalled by management.
- What options are available to you at this point?
- Are there any outside groups you should contact?

Workshop activity 3

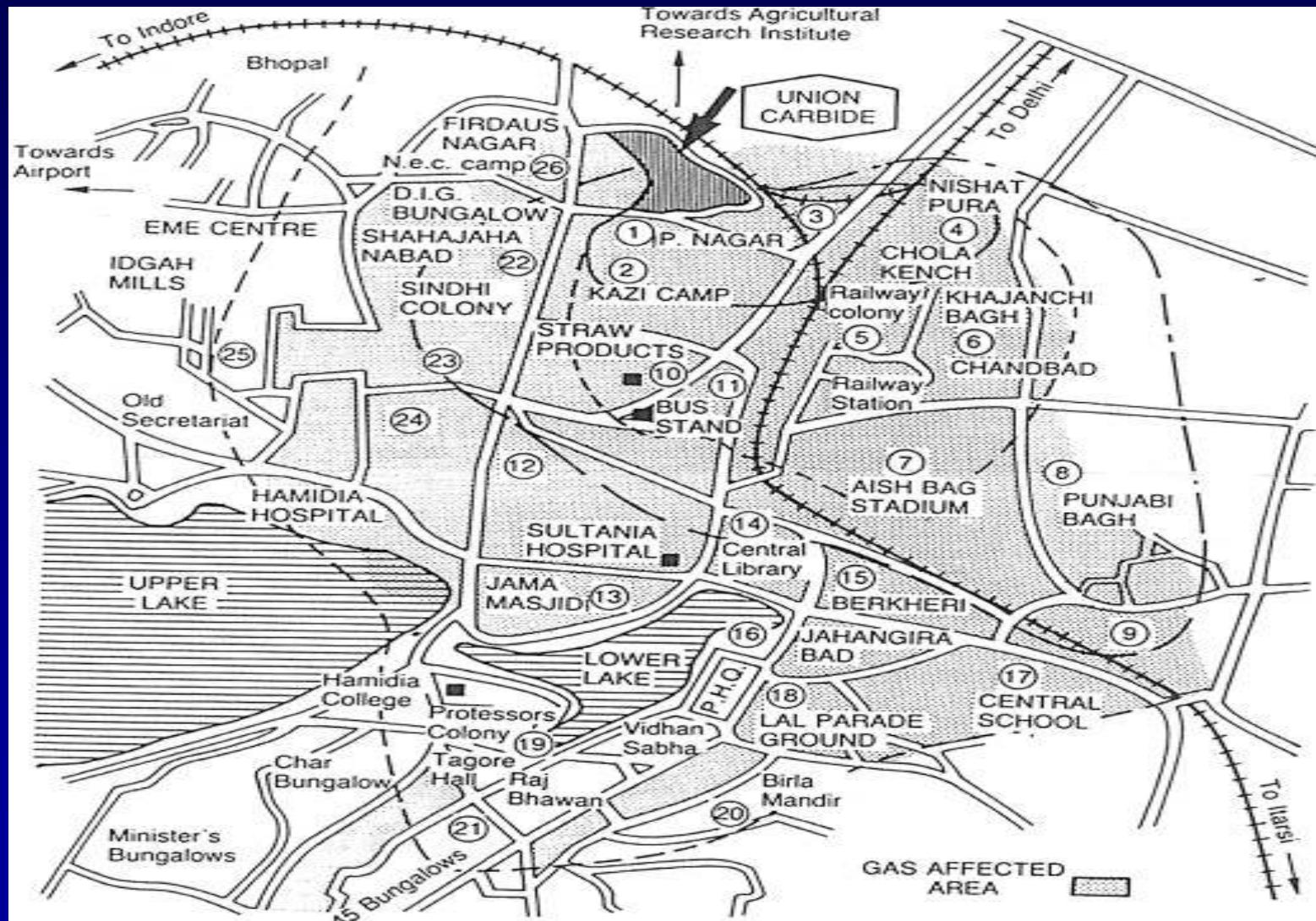
As a safety inspector for UCIL, you are concerned that the densely populated shanty towns which surround the plant may be in danger.



Workshop activity 3

- Local newspaper articles recently tried to warn the people living close to the plant of the potential hazards involved with being in such close proximity to the plant, but many residents are either illiterate or could not conceive of the dangers. The company itself has made no effort to communicate the risk to the public and you are sure that potential hazards are not understood. You are also aware that there are no emergency response plans to cope with community reaction.
- All of these issues have been formally reported, yet nothing has been done to inform the surrounding community. When you approached the general manager, he asserted that there were no regulations surrounding the communication of risk to the population and that morals had no place in economics.
- Is the general manager acting ethically?
- Do UCIL (or UCC) have any moral responsibility to communicate the potential hazards of the plant to the community?
- What should you do about your concerns?

Affected Area



Question: To whom engineers should hold paramount the safety, health and welfare?

- The public?
- Their employer?
- The government?

Further resources

The screenshot shows the homepage of the CSEP website. At the top, there's a navigation bar with links for IIT.EDU HOME, PROSPECTIVE STUDENTS, ALUMNI, BUSINESS & INDUSTRY, and VISITORS. The main content area features a large banner for "Center for the Study of Ethics in the Professions". On the left, a sidebar lists various programs and resources under "PROGRAMS". The main content area has tabs for Programs, Library, About Us, and Publications, with "Programs" currently selected. Below the tabs, there's a section titled "Codes of Ethics Online" which includes a detailed description of the collection and links to "Navigating the Codes Collection", "Guide to Codes of Ethics Collection", "Introduction", "Index of Codes", "Using Codes of Ethics", "Authoring a Code", and "Bibliography". A "Print | Email" link is also present in this section.

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Codes of Ethics

- Introduction
- Index Of Codes
- Using a Code of Ethics
- Authoring a Code of Ethics
- Function and Value of Codes of Ethics
- Bibliography
- Other Codes of Ethics Collections
- > Ethics Across the Curriculum
- > Ethics Bowl
- > IIT Code of Ethics
- > NanoEthicsBank
- > Software Engineering Archive
- > Ethics Education Library

Codes of Ethics Online

In June 1996, the Center received a grant from the National Science Foundation to put our extensive collection of codes of ethics on the web. We included those codes of ethics of professional societies, corporations, government, and academic institutions, of the over 850 codes we have in our paper archive, who gave us permission to include their code. Earlier versions of codes of ethics of some organizations represented are available to allow researchers to study the development of codes. A literature review, an introduction to the codes, and a user's guide are included.

Navigating the Codes Collection:

Browse the Index of Codes by professional category

Search the codes using our customized Google search engine.

Browse our Compilation of Codes. This includes codes available through our online collection and our archive of paper codes of ethics. Copies of these codes can be made for a nominal fee.

Guide to Codes of Ethics Collection

Introduction
An introduction that covers the debate about the function and value of codes of ethics, and the history of the Codes of Ethics Online Collection.

Index of Codes
Codes of ethics organized by professional category.

Using Codes of Ethics
This guide offers a context for using a code of ethics by considering a sample case.

Authoring a Code
Observations on process and organization This paper was written by Andrew Olson, who worked on the project just after completing his undergraduate degree.

Bibliography
Online and print materials on writing a code of ethics, the authority and purpose of a code of ethics, and further materials, many of which offer case studies (that can help you use your profession's code).

Need help? Ask a Librarian

Search Advance Search

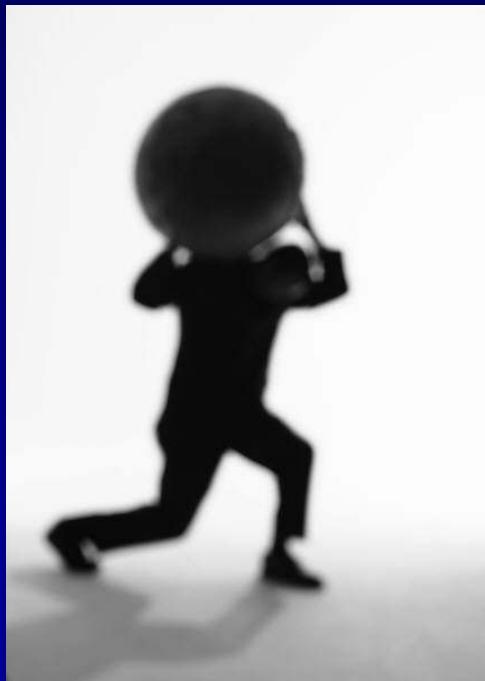
CSEP News

Come Watch the APPE Upper Midwest Regional Ethics Bowl!

Thanksgiving Hours

Developed an ethics case study? Share it with us!

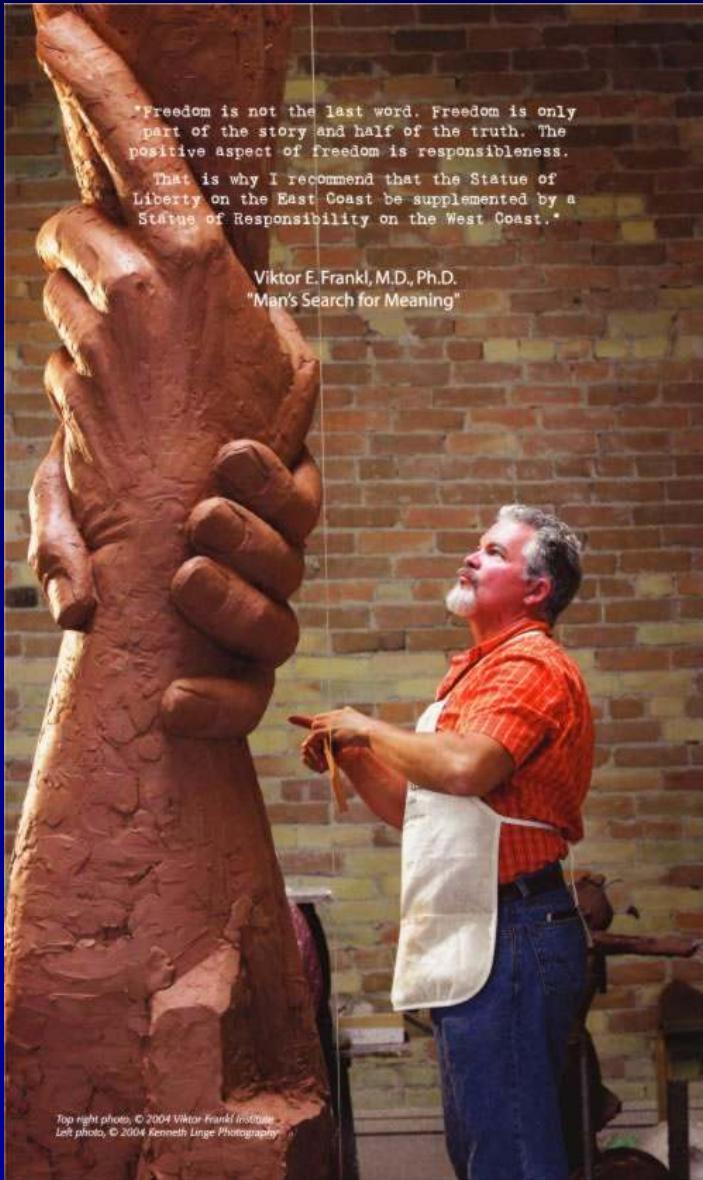
Thank you!



The statute of responsibility

The statute of liberty

Statue of Responsibility



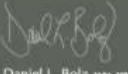
"Freedom is not the last word. Freedom is only part of the story and half of the truth. The positive aspect of freedom is responsibility. That is why I recommend that the Statue of Liberty on the East Coast be supplemented by a Statue of Responsibility on the West Coast."

Viktor E. Frankl, M.D., Ph.D.
"Man's Search for Meaning"

Top right photo, © 2004 Viktor Frankl Institute
Left photo, © 2004 Kenneth Linge Photography

There comes a time in a nation's history when its core values must be re-visited, re-energized, and re-enthroned, in order for that nation to endure.

"We are pleased to announce that Gary Lee Price has been awarded the commission as the official sculptor for the Statue of Responsibility. A clay study for the 300 foot tall, stainless steel monument, has been finalized."


Daniel L. Bolz, M.B.A.
President & CEO, Statue of Responsibility Foundation


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www.statueofresponsibilityfoundation.org