# PROFESSIONAL ETHICS

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# Risk and Safety

# Risk

- A risk is the potential that something unwanted and harmful may occur.
- *Risk* = product of the probability of an undesirable event and the effect of that event
- With this definition the term ‘risk’ is a measure for the expected number of fatalities per time unit.
- Other definitions of risk are used too, like:
  - The probability of an undesirable event taking place;
  - The maximum negative effect of an undesirable event.

# Safety

- Safety is sometimes defined as the absence of risk and hazards.
- A technological product cannot be made absolutely safe.
- Safety therefore also often refers to the situation in which the risks have been reduced in as far that is reasonably feasible and desirable.
- Thus, safety is related to the notion of ***acceptable risk***.

# Safety and Risk

- "A thing is safe if its risks are judged to be acceptable." William W. Lowrance.
- Common understanding of Safety:
  - Under estimate the risk
  - Over estimate the risk
  - No judgment on whether the risk is acceptable.
- Safety is a matter of how people would find risks as acceptable or unacceptable if they knew the risks and the implications of those risks.

# Categories of Risks

- Experimental risk connected with the introduction of new technology.
- Risk associated with new or expanded applications of familiar technology.
- Risks arising from misapplied attempts at disaster control.

# Acceptability of Risk

- William D. Rowe says that "a risk is acceptable when those affected are generally no longer (or not) apprehensive about it."
- Apprehensiveness depends on how the risk is perceived.
- Elements of Risk Perception:
  - Is the risk assumed voluntarily?
  - Effect of knowledge
  - Job related pressures
  - Are potential victims identifiable before hand

# Elements of Risk Perception

- Voluntarism and Control
- Voluntary Risk:
  - People take up the risk fully knowing the hazards involved.
  - Motor racing, living near a chemical plant are some examples
- Level of Control:
  - People display unrealistic confidence when they believe hazards to be under their control.
  - Riding motorbikes, Skiing, bungee jumping, hang gliding are examples where people indulge in these hazardous sports under the assumed level of control.

# Elements of Risk Perception

- **Effect of Information – Case Study**
  - Two groups of 150 people were told about the strategies available for combating a disease.
  - Group1 was given the following description:
    - Imagine that US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the program are as follows:
    - If Program A is adopted 200 people will be saved.
    - If Program B is adopted there is 1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved.
    - Which of the two programs will you favor?

# Elements of Risk Perception

- Results of the survey
  - Program A – 72%
  - Program B – 28%
- Inference
  - Vivid prospect of saving 200 people led many of them to feel adverse to taking a risk of possibly saving all 600 lives.

# Elements of Risk Perception

- Group2 was given the same problem and same two options but the options were worded differently.
  - If Program C is adopted 400 people will die.
  - If Program D is adopted there is 1/3 probability that nobody will die and 2/3 probability that 600 people will die.
  - Which of the two programs will you favor?
- Results of the survey
  - Program C – 22%
  - Program D – 78%
- Inference
  - People tend to be more willing to take risks in order to perceive firm losses than they are to win only possible gains.

# Job Related Risks

- Exposures to risk on a job is in a sense voluntary.
- Often employees have little choice other than to stick with what is for them.
- Engineers who design and equip work stations must take into account the attitude towards safety shown by other co workers.

# Magnitude and Proximity

- Our reaction to risk is affected by a dread of possible mishap in terms of magnitude and proximity.
- Friends being affected is more keenly looked upon than a risk affecting strangers.
- Misperceptions of numbers can easily make us overlook losses that are far greater than the numbers reveal by themselves.

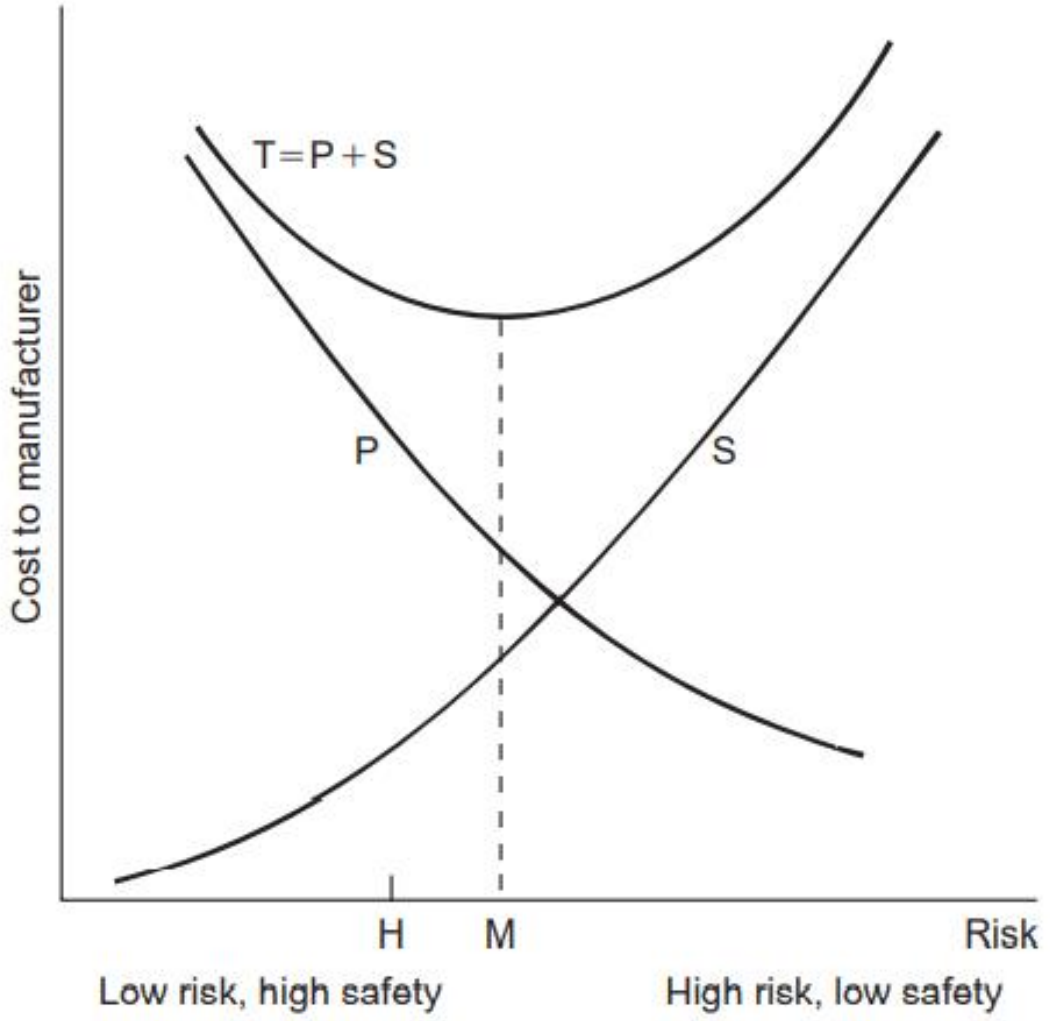
# Lessons for the Engineers

- Engineers face two problems with public conceptions of safety:
- Overly optimistic attitude – things that are familiar presents no real risk.
- Overly pessimistic attitude – dread people feel when an accident kills in large numbers, even though such accidents occur infrequently.
- This is a misperception of legitimate concern expressed publicly by thoughtful citizens.
- Barrier to education attempt is that people's beliefs change slowly and are extraordinarily resistant to new information.

# Assessment of safety and risk

- Improvement to safety is accomplished by an increase in cost.
- Primary Cost – Production Cost
- Secondary Cost – Warranty expenses, Losses of customer goodwill etc.
- High Safety(Low Risk) – High Primary Cost- Low Secondary Cost.
- High Risk (Low Safety) – Low Primary Cost – High Secondary Cost

# Assessment of Safety and Risk



# Uncertainties in Design

- Engineers have traditionally coped with such uncertainties about materials or components.
- A product may be said to be safe if its capability exceeds its duty.
- The stress calculated by the engineer for a given condition of loading and the stress which ultimately materializes at that loading may vary quite a bit.
- The stress exposure varies because of differences in load, environmental conditions or the manner in which the product is used.

# Testing for Safety

- What can an engineer do to ensure safety?
  - Rely on experience
  - Experience gained by one engineer should be passed to other engineers
  - Another way of gaining experience is through tests
  - More usual procedure is to subject prototypes to testing
  - There should be routine “Quality assurance” executed for ensuring safety.
- Problems Faced
  - Time Pressure
  - Duplication of Test Data
  - Outright Fraud – Testers are bribed to pass faulty items.

# Risk Benefit Analysis

- Is the product worth the risk connected with its use
- What are the benefits?
- Do the benefits overweight the risks?
- We should multiply the magnitude of potential loss by the probability of its occurrence and similarly with the gain.
- We are willing to take certain level of risk as long as the project promises certain range of benefits.

# Risk Benefit Analysis

- An engineer must keep in mind the following ethical questions while doing a risk benefit analysis:
- Under what conditions is someone entitled to impose risk on someone.
- Is anyone’s rights violated?
- Are people provided with safer alternatives?

# Personal Risk and Public Risk

- Personal Risk:
- An individual decides whether or not to participate in a risky activity.
- One could possibly respond by the amount of life insurance taken out by the individual.
- Public Risk:
- More easily determined because individual differences tend to even out as larger number of people are concerned.

# Incentives to reduce Risk

- Engineers should give top priority to product safety.
- Engineers should realize that reducing risk is not an impossible task even under financial and time constraints.
- Engineers should have a different perception on design problem, focusing on the safety.

# Liability

- Engineers should be aware of strict liability.
- Although it is impossible to test every product the engineer must weight the chances of a defect causing a serious injury against the cost of eliminating or minimizing defects in the product.
- Adhering to accepted practices and observing standards is just not sufficient. They must be used creatively and judgmentally.
- There is a great need to take safety and emergency measures seriously in large scale engineering ventures.

# Ethics of technological risks

ASIA PACIFIC

## Galaxy Note 7 Catches Fire in China

By CHE CHENG | Oct. 18, 2016 | 0:47

Zhang Sitong, a former firefighter, said he threw the phone on the ground when it started to vibrate and smoke.

Related: Article: Samsung's Uneven Handling of Galaxy Note 7 Fires Angers Chinese

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# Reasons Why the phone exploded

- Putting a lot of pressure on the battery design to make it smaller and smaller.
- So when the phone got under any kind of pressure, it would catch fire.
- **At a human level:**
- It's because the designers of the phone were under a lot of pressure to use existing technologies and to optimize them to squeeze them into an even smaller and more appealing design.

# Reasons Why the phone exploded

- **At a organizational level:**
- We see a company that is under some political pressure because they're so closely aligned with the fate of South Korea, and they are trying to put as much pressure on existing technology as possible without really investing in long term innovations.

# Conclusion

- Did Samsung expose people to a more than equal distribution of risk through the use of the smartphone?
- Not a voluntarily exposure to risk.

# Case Study

- I was having an informal lunch-time chat with Steve, a 60-year-old worker at a recycled oil and solvent refining company where I was evaluating the exhaust ventilation system. He had recently been told in a personal medical exam that he had early-stage chronic kidney disease (CKD). He wondered whether he was at risk for faster CKD progression because of his continuing work with solvents. And he was also worried that if he told his employer about his kidney deficiency, he might be forced into early retirement.
- I knew that poor kidney function was sometimes related to solvent exposures, but I was unsure at that time what exposure concentrations might be safe or harmful for Steve, in his situation, and I told him all that. Steve thanked me, but then asked me not to tell anyone about his problem. “I spoke to you in confidence,” he said. “I’ll just take my chances. Don’t worry about it.”
- What would you do in these circumstances? What is the ethical thing to do?

# Case Study

- The International Commission on Occupational Health (ICOH) Code of Ethics states that “the purpose of occupational health is to serve the health and well-being of workers.”
- But did I do the right thing? Did I handle the ethical problem in the best way? You can probably think of several different ways of handling it with potentially equal or better outcomes.

# References


- Mike Martin and Ronald Schinzinger, “Introduction To Engineering Ethics”, McGraw Hill, New York, 2010
- Miscellaneous Journals and Internet Resources.