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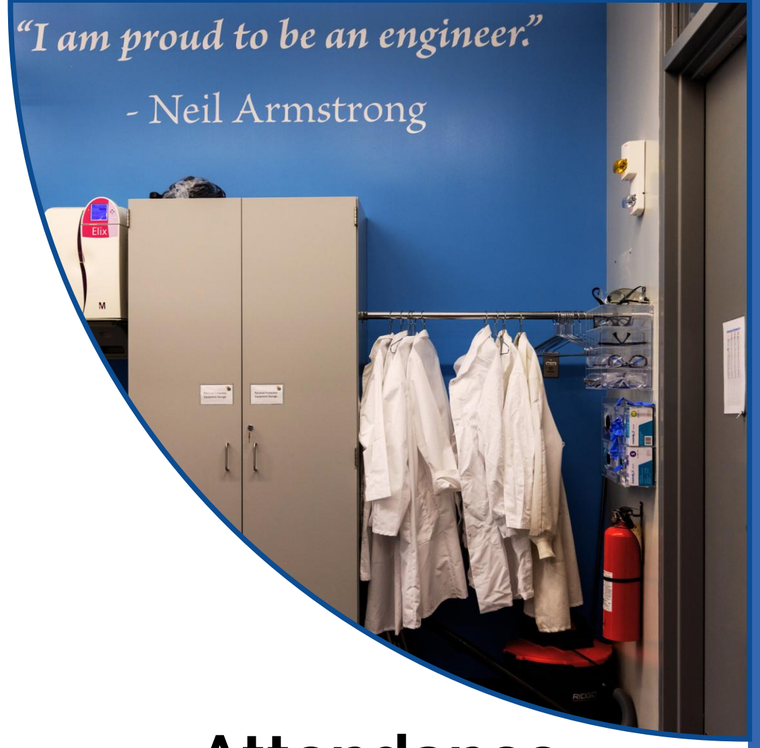

Safety Ethics & Responsibilities

Attendance Check-In

WEDNESDAY, FEBRUARY 18 AT 9:00AM

Presented by: Nick Gorschak | Morais Lab

2026 Spring

wise.ku.edu

Wonderful Institute for Sustainable Engineering

2026 Spring

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Safety in Engineering

Definitions

- **Safety** = the condition of being protected from or unlikely to cause danger, risk, or injury
  - Types of Safety:
    - **Occupational Safety** = all aspects of health and safety in the workplace
    - **Public Safety** = everything else, safety at home or in public spaces

- The ACS Institute defines **safety culture** as “a reflection of the actions, attitudes, and behaviors of its members toward safety”

Professional Responsibility & Rights

- **Professional responsibility** is defined as the obligation of individuals in a professional role to take accountability for their actions and decisions, ensuring they adhere to ethical standards and report any unethical conduct observed among peers.
- **Safety rights**: Federal law entitles you to a safe workplace. Your employer must keep your workplace free of known health and safety hazards.

- The **Higher Education Act** mandates that institutions provide a safe learning environment and keep students informed about security measures.

Ethics Principles

*[NSPE Code of Ethics for Engineers]

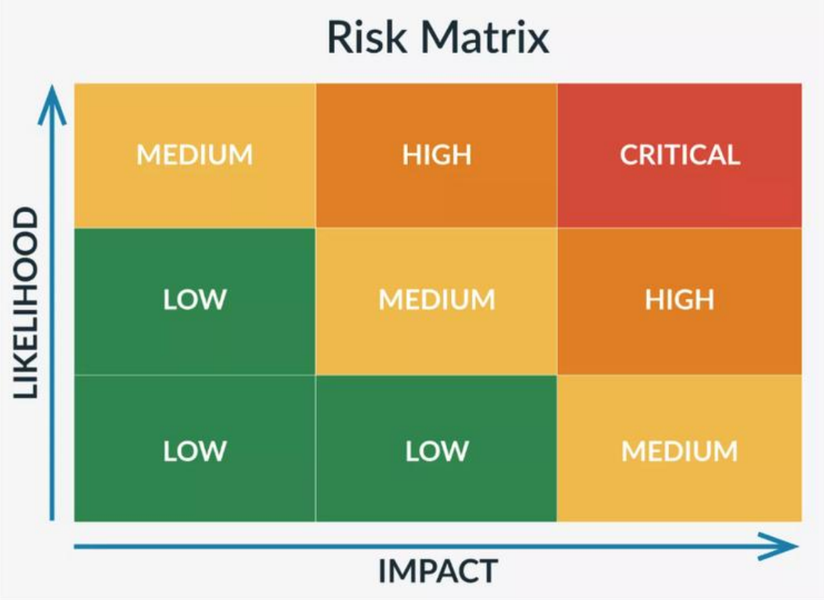
1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves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

**National Society of Professional Engineers*

Safety vs. Risk

Professionals must balance safety and risk in ethical decision-making.

- Safety is the proactive prevention of harm.
- Hazard is the source of potential harm.
- Risk is the probability of harm due to hazards.

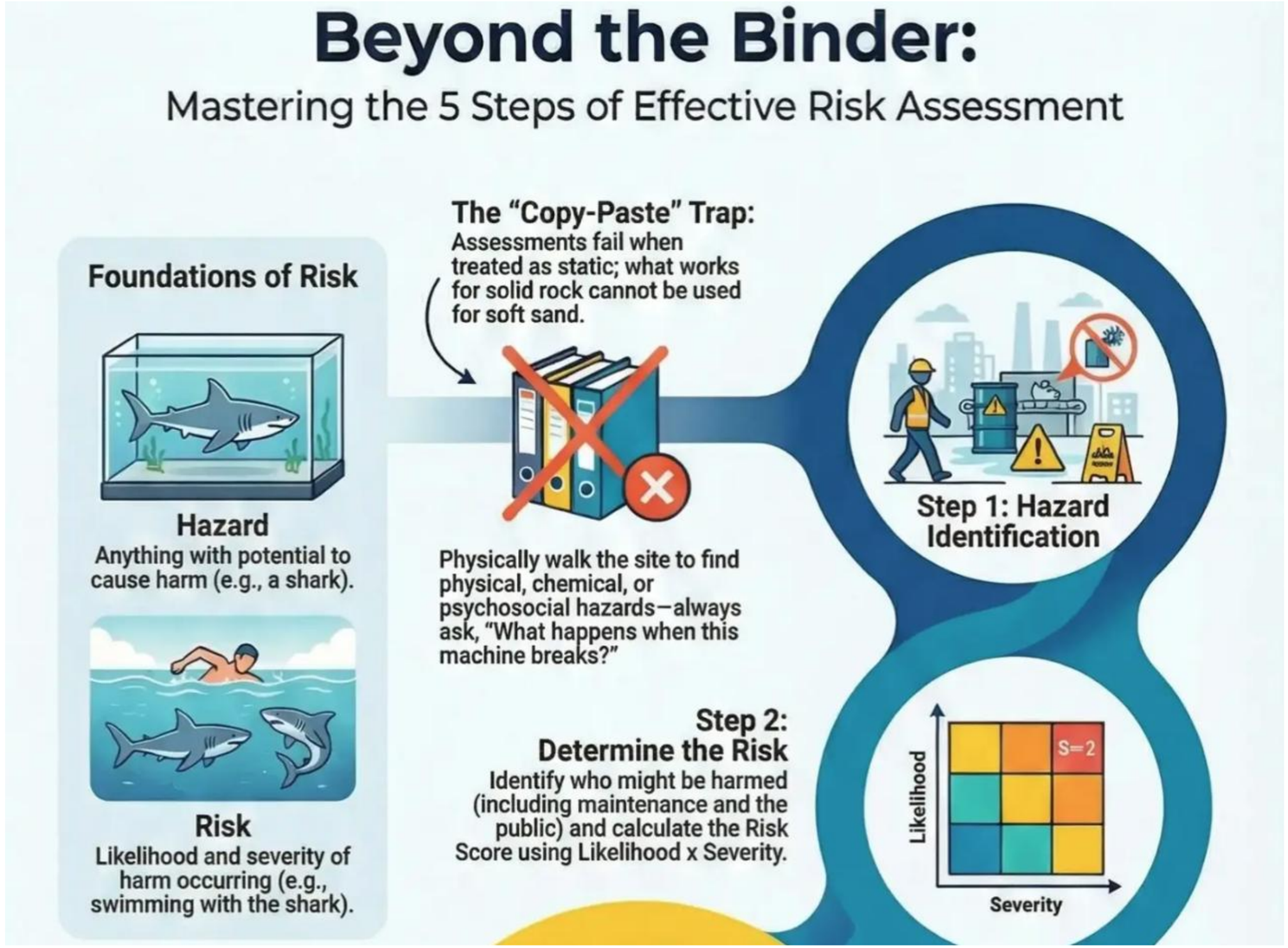


- **Likelihood**: How probable is it that the harm will occur? (Rare to Certain)
- **Impact/Severity**: If the harm occurs, how bad will it be? (First Aid to Fatality)

IV Risk Assessment

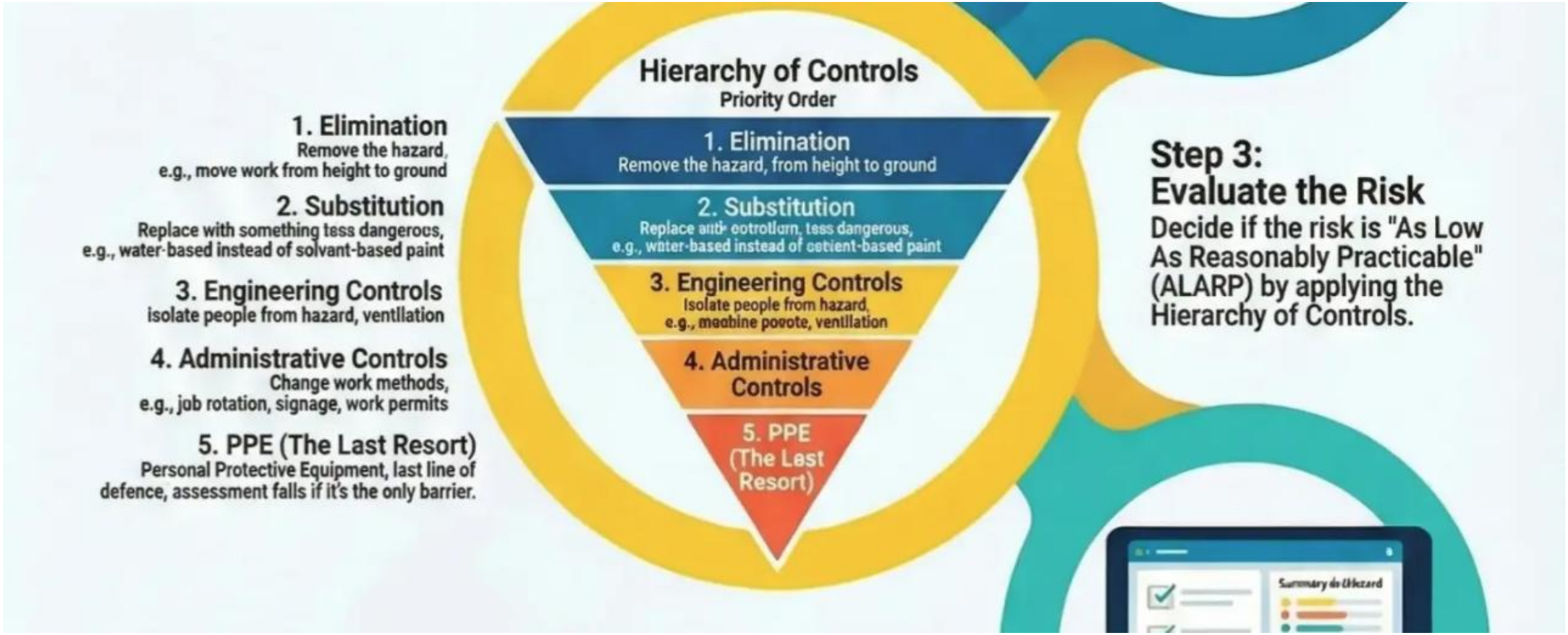
- **Risk Assessment** = a systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking. In practical field terms, it is a structured look at your workplace to identify the things, situations, processes, etc., that may cause harm, particularly to people.

Steps:	1. Hazard Identification	2. Risk Estimation
3. Risk Evaluation & Management	4. Risk Communication	5. Review & Update



*Occupational Health, Safety and Environment Blog

1. **Hazard identification**
   a. Physical Hazards
   b. Chemical/Biological Hazards
   c. Psychosocial/ Ergonomic Hazards
2. **Risk Estimation**
   a. Identify who might be harmed and calculate the risk score using likelihood x severity of the impact.



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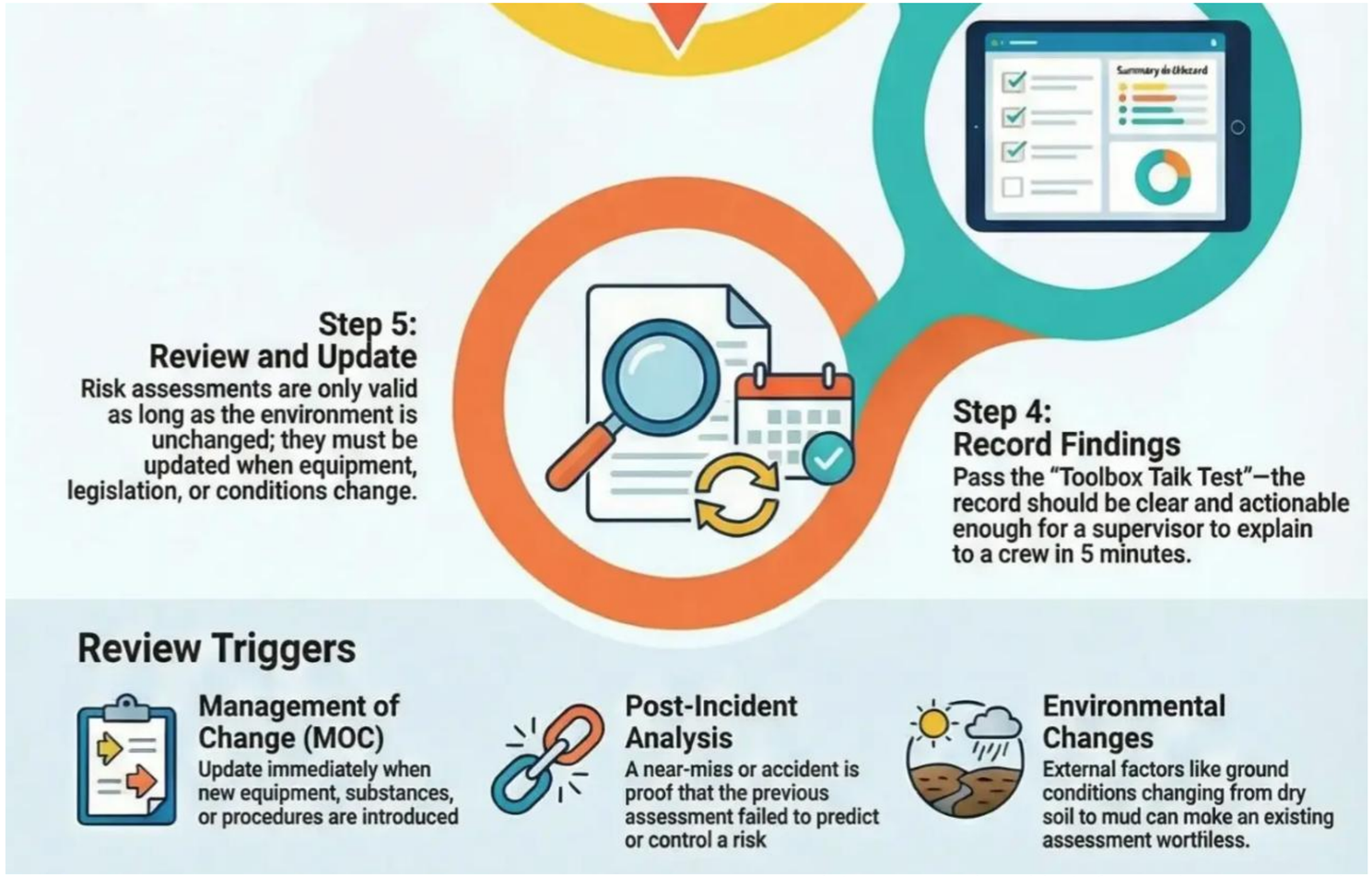
3. Risk Evaluation

a. Decide if the risk is “as low as reasonably practicable” by applying the hierarchy of controls.



*Occupational Health, Safety and Environment Blog

4. **Risk Communication**
   a. Include: Hazards identified, people at risk, existing controls, additional actions required, who is responsible.
5. **Review & Update**
   a. Update assessment when equipment, legislation, or conditions change.

Risk-Benefit Analysis

Compare expected benefits vs. potential risks

In chemical engineering, public benefit vs. environmental impact

Ethical balancing ensures risks are not unfairly distributed

Other methods of reducing risk include...

- Preventative Design
- Regulatory Compliance
- Training and Awareness
- Monitoring and Auditing
- Emergency Preparedness

Case Study: Three Mile Island

- The Three Mile Island incident was a partial nuclear meltdown of one of the reactors present at the site
- The incident began at 4:00 a.m. on March 28, 1979
- The primary failure occurred in the water filtration system. The lack of cooling water caused the reactor to overheat.
- The partial meltdown occurred due to poorly designed interfaces, inadequate operator training, and the complexity of the system
- Ultimately, there were no injuries, but radioactive gases and radioactive iodine were released into the environment

Case Study: Three Mile Island

There were several organizational and ethical failures involved

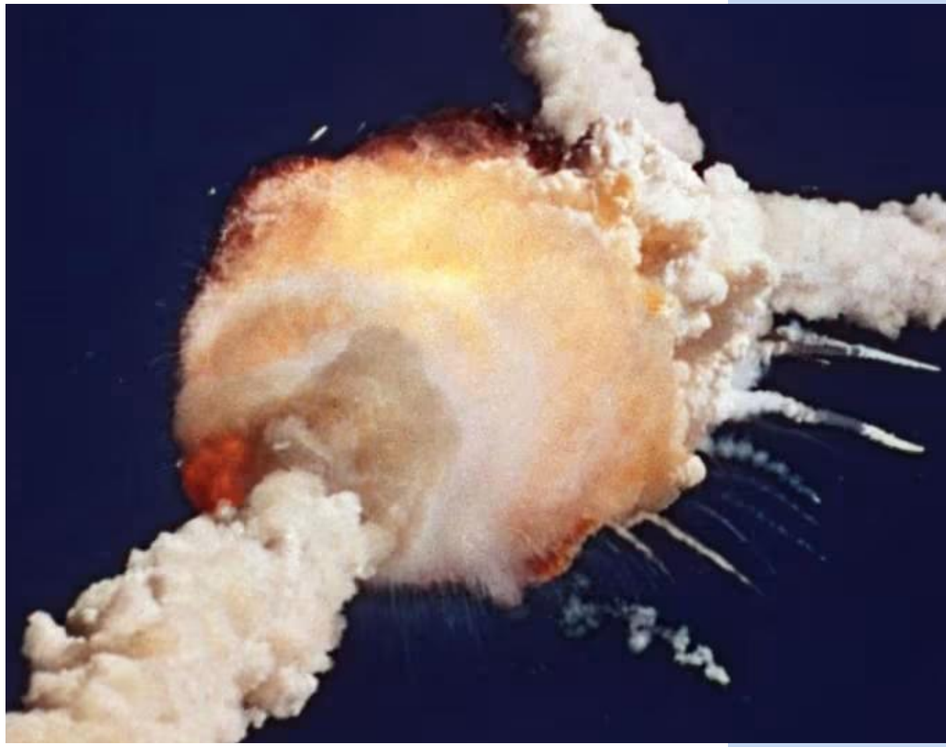
1) Poor human design factors
   - Over 100 alarms sounded at once
   - No prioritization hierarchy
   - Control room indicators showed command status only (couldn't know a valve was stuck open

2) Poor training
   - Operators were primarily trained to fix equipment
   - Did not fully understand how the reactor worked

3) Lack of Transparency
   - Did not properly communicate the risk to the public as the incident was occurring
   - Less than 25% of people evacuated a potential nuclear meltdown

Case Study: Challenger Disaster

- Occurred in Jan 28th, 1986 when Space Shuttle Challenger disintegrated killing all 7 crew members.
- The disaster was caused by the failure of the primary and secondary O-rings sealing a joint in one of the solid rocket boosters.
- Their failure was caused by record low temperatures on the morning of the launch.
- These O-rings had been a known safety issue, especially at low temperatures.
- The Morton Thiokol engineers had initially recommended to postpone the launch due to this concern, stating they did not have the data to be sure the O-rings would hold.
- This decision would ultimately be reversed by their leadership team telling them to prove it will fail instead of prove it is safe.



Case Study: Challenger Disaster

There were three core ethical failures involved

1) Burden of Proof Reversal

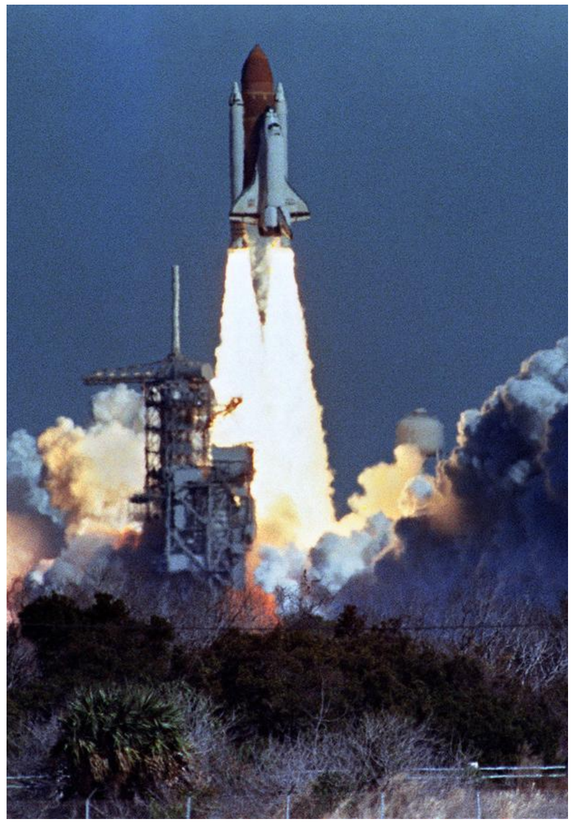
- A system must be proven safe — not merely unproven dangerous.

2) Scheduling and Political Pressure

- Launching on time was perceived as more important than safety
- Multiple issues regarding the O-rings were raised to management
- Maintenance of the company's reputation/public image for keeping schedule was perceived as more important than safety

3) Normalization of Deviance

- Since previous launches had damaged O-rings, this was accepted as the baseline



Common Ethical Dilemmas

- **Safety vs. Cost Considerations**
  - One of the most common ethical dilemmas involves balancing safety requirements with cost constraints. Engineers must navigate these competing demands to ensure that projects are both economically viable and safe for users.

- **Intellectual Property and Confidentiality Issues**
  - Protecting intellectual property and maintaining confidentiality are critical in engineering. However, this can sometimes conflict with the need to share information for collaborative projects or to address safety concerns.

*Engineer CEU

VI

Common Ethical Dilemmas

- **Environmental Impact Concerns**
  - Engineers must consider the environmental impact of their projects. This involves assessing the potential effects on ecosystems and communities and making decisions that minimize harm.

- **Conflicts of Interest**
  - Conflicts of interest can arise when personal or financial interests influence professional decisions. Engineers must be vigilant in identifying and managing these conflicts to maintain the integrity of their work. This includes providing transparency and disclosing possible conflicts of interest.

*Engineer CEU

What would YOU do?

Consider the following ethical scenarios:

- Scenario #1
  - A grad student orders a potentially explosive chemical with a NFPA reactivity rating of 4 for a set of experiments. The university requires a specific training to handle this chemical. It takes 3 weeks until the training is scheduled and completed, but they have a research proposal due in 4 weeks. What would you advise this grad student to do?

What would YOU do?

Consider the following ethical scenarios:

- Scenario #2
  - A chemical engineer is designing a new process and has decided to use dichloromethane (DCM) as a solvent. One of their peers raised a concern citing that they could be using ethanol instead with little decreased effectiveness. The designer decided that they want to keep moving forward using DCM because of the work they already put into the design using DCM. Would you recommend that engineer switch solvents or not?

What would YOU do?

Consider the following ethical scenarios:

- Scenario #3
  - A student is working on a confidential research project in a shared lab space. Part of a new set of experiments they need to run will require introducing hazards into the shared space that are not normally present. These include high pressure equipment and a toxic gas. What information should the student disclose to the other workers in the lab?

Occupational Crimes

- **Occupational Crime** = illegal acts committed by individuals abusing their professional position for personal benefit
- Includes fraud, embezzlement, and falsifying safety reports
- Results in harm for the organization and endangerment of public safety

- Example:
  - **Deepwater Horizon Disaster (2010)** – Engineers and management prioritized cost and speed over safety, disregarding warnings, contributing to a catastrophic oil spill. The explosion on the well killed 11 workers and injured 17, and the sinking of the rig triggered one of the most severe environmental crises in U.S. history.

VIII Safety Rights

- **Right to safety**
  - Under the Occupational Safety and Health Act (OSHA), employers must provide a workplace free from known hazards
- **Right to fair compensation**
  - The Fair Labor Standards Act (FLSA) prohibits wage theft and provides mandates governing overtime pay.
- **Right to freedom of expression**
  - The First Amendment and whistleblower protections allow employees to report unsafe or illegal practices without retaliation.

Reference: Occupational Safety and Health Administration; U.S. Department of Labor

VIII Safety Rights

- **Right to career growth**
  - Workers have the right to pursue career advancement opportunities or join labor unions and engage in collective bargaining.
  - Collective bargaining is a way for employees to ensure fair wages, working conditions, and safety.

- Rights are balanced with professional responsibilities. **Authority** should be based on expertise, not coercion, which means that individuals have a moral imperative to question unethical directives.

Reference: Occupational Safety and Health Administration; U.S. Department of Labor

Discrimination

- **Discrimination** = Unfair treatment based on race, color, religion, sex, national origin, age (40 or older), disability, or genetic information.
- The **Equal Employment Opportunity Commission (EEOC)** and states enforce discrimination and harassment laws.
- Discrimination is also a violation of professional ethics.

- The NSPE Code of Ethics for Engineers states that:

> *"Engineers shall be guided in all their relations by the highest standards of honesty and integrity.... Engineers shall treat all persons with dignity, respect, fairness, and without discrimination."*

Reference: U.S. Equal Employment Opportunity Commission; National Society of Professional Engineers

IX Conclusion

- Safety, responsibilities, and rights are ethical backbones to the professional field of chemical engineering.
- Real-world case studies highlight the dangers of neglecting public safety and occupational safety.
- Professionals must balance duties, rights, and ethics for the welfare of society.

- Safety is EVERYONE's responsibility. If you see something, say something.
- **If you don't feel comfortable reporting a safety concern within your research group, then you can speak to anyone in the safety committee.**

IX Additional Resources

- American Institute of Chemical Engineers (AIChE) Code of Ethics
- Board of Certified Safety Professionals (BCSP) Code of Ethics
- American Society of Safety Professionals (ASSP) Free Learning Resources
- National Safety Council (NSC) Training
- American Industrial Hygiene Association (AIHA) Resources

- This safety presentation and more are available on wise.ku.edu

Discuss with your group:

Questions to consider...

- How do you mitigate risk in your labs? Or in your everyday life?
- What is an example of an occupational safety hazard or ethical dilemma in your field of study/research?
- What is an example of a public safety hazard or ethical dilemma in your field of study/research?

Thank you for listening!

Questions?

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