Teaching Occupational Health and Safety in Engineering Schools – Best Practices, Support, and Opportunities

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Background

• Injuries due to Workplace Accidents cost the Canadian economy over $30B in direct and indirect costs

• Engineering skills include safe design for the public and safety design for workers using these designs.

• Teaching Occupational Health and Safety is a requirement of CEAB accreditation
The Problem

• There is an increasing gap between the knowledge level of recent grads and the needs of industry

• Today’s graduating engineers have more responsibilities and less time to gain knowledge and experience
1980’s Project MINERVA

• NIOSH initiative to introduce Health and Safety education into the business curriculum
• Chemical industry’s first push to have Safety Management added to engineering curriculum
Minerva Canada

- Only Project Minerva partner remaining
- Not-for-Profit organization focussed on promoting Health and Safety Education in post-secondary institutions
Chemical Process Safety
Accreditation

• An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
A Difference in Cultures

- Dupont – 1790’s Brandywine site produced gunpowder, and had buildings spaced apart, with light gauge roofs that directed blasts away from buildings and workers, as well as using redundant safety valves.
- 1900’s - instituted safe work instructions and safety commissions
- Irenée DuPont (1920) “practically all accidents are avoidable”, and established a goal of no accidents
Summer Institute

• “Train the Educators” - a 2 day session

• Provide resources (3 CDs this year)

• Create a network of educators
Hazards

• A hazard is a chemical or physical property or condition that has the potential of causing damage or any kind of harm to a receptor

• Common hazards include elevation, temperature, motion, electricity, pressure, and chemical energy
Risks

• is a measure of human injury, environmental damage or economic loss in terms of both the incident likelihood and the magnitude of the loss of injury

• hazard frequency * hazard consequences

• Fatalities/annum or $/annum
The ‘Swiss cheese’ model of organisational accidents

Probability & Statistics

- Probability of an event occurring in the interval (0, t)

\[ P(t) = 1 - e^{-\mu t} \]

- Probability of an event that is a series of independent events

\[ P = \prod_{i=1}^{n} P_i \quad \text{or} \quad P = \sum_{i=1}^{n} P_i \]
Buncefield, UK

- Motor fuel overfilled a storage tank in a depot
- Vapour cloud explosion
Chemical Engineering

- Source models involve fluid mechanics, heat transfer and thermodynamics

\[ Q_m = AC_0 \sqrt{2 \rho P} \]

\[ f_v = \frac{C_p (T_o - T_b)}{\Delta H_v} \]
Surpass, Albany, NY 1989

- Overpressurization of HCl tank due to blocked sparger
Small Changes

• A large change can be achieved with a series of small changes to existing courses

• Targeted lectures that tie two previously unrelated topics together

• Must avoid compartmentalization attitude
What We Can Do

• Provide resources and training

• Provide Industry, Government or Academic speakers for lecturing

• Build the network and best practices for teaching
Worksmart e-Campus

- MOL WORKSMART is for young workers
- E-campus is e-learning
  - Students register
  - Series of material with video clips
  - 100 question test at end
  - Certificate printed
Education Literature

• There is little in the engineering education literature on the teaching of EH&S in an undergraduate curriculum

• ASEE is quite active with 2 journals – but safety doesn’t seem to get attention
Minerva Canada: your partner in quality SHE education

- **Case Studies** on Health and Safety topics prepared by Canadian university faculty
- **Summer Institute and Mini Institutes**
  - 3-day and 1-day workshops introducing Professors to key SHE Management principles by industry, government, safety association representatives
- **Minerva James Ham Safe Design Award** for Engineering undergraduate students
  - Initiated between Minerva and the WSIB
- **Global Partner of R.W. Campbell Award**
  - Recognizes corporate international Health and Safety excellence