

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

Graeme Norval

Vic Pakalnis

Tony Pasteris



UNIVERSITY  
of TORONTO

# 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

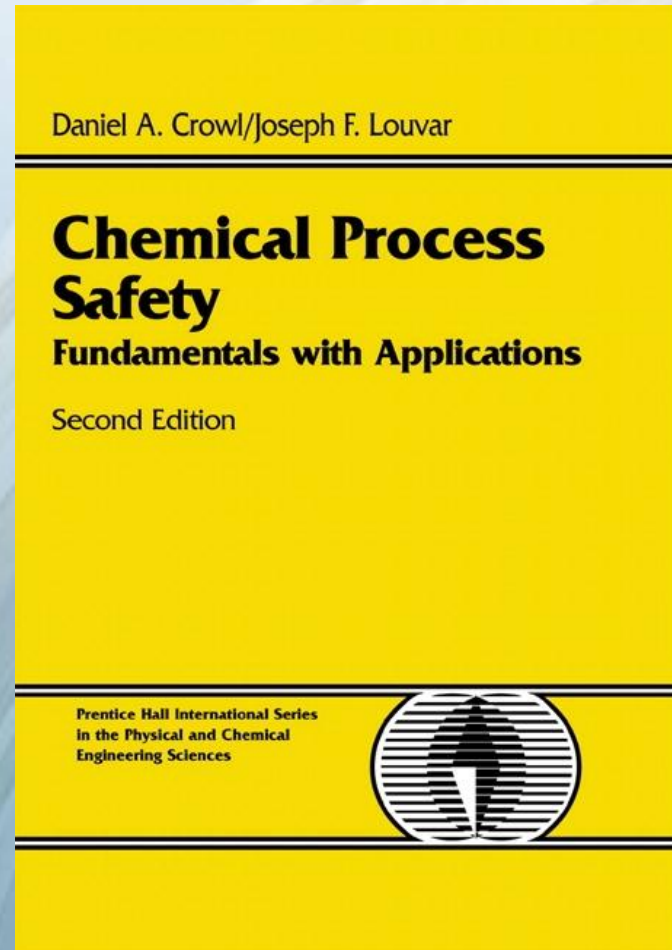
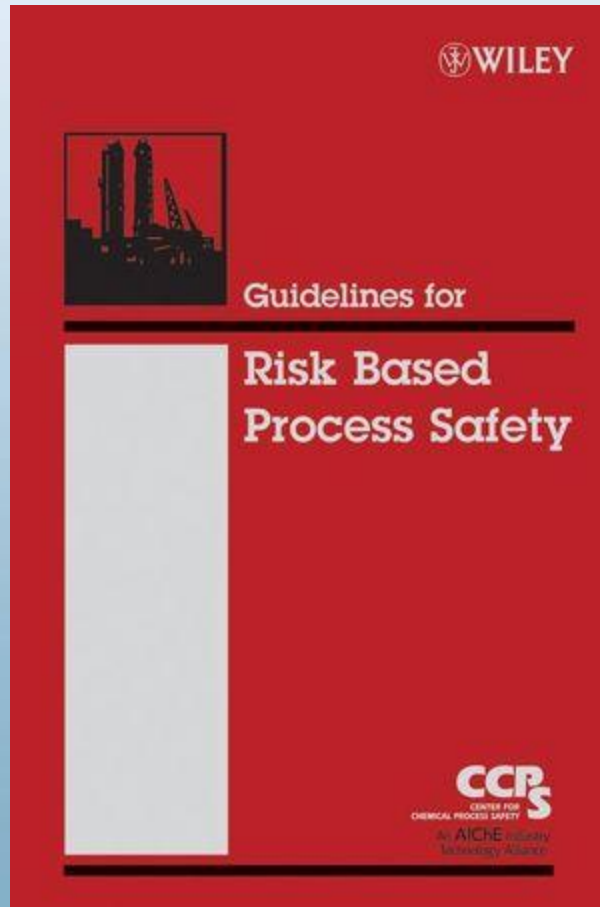


# Minerva Canada

- 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*



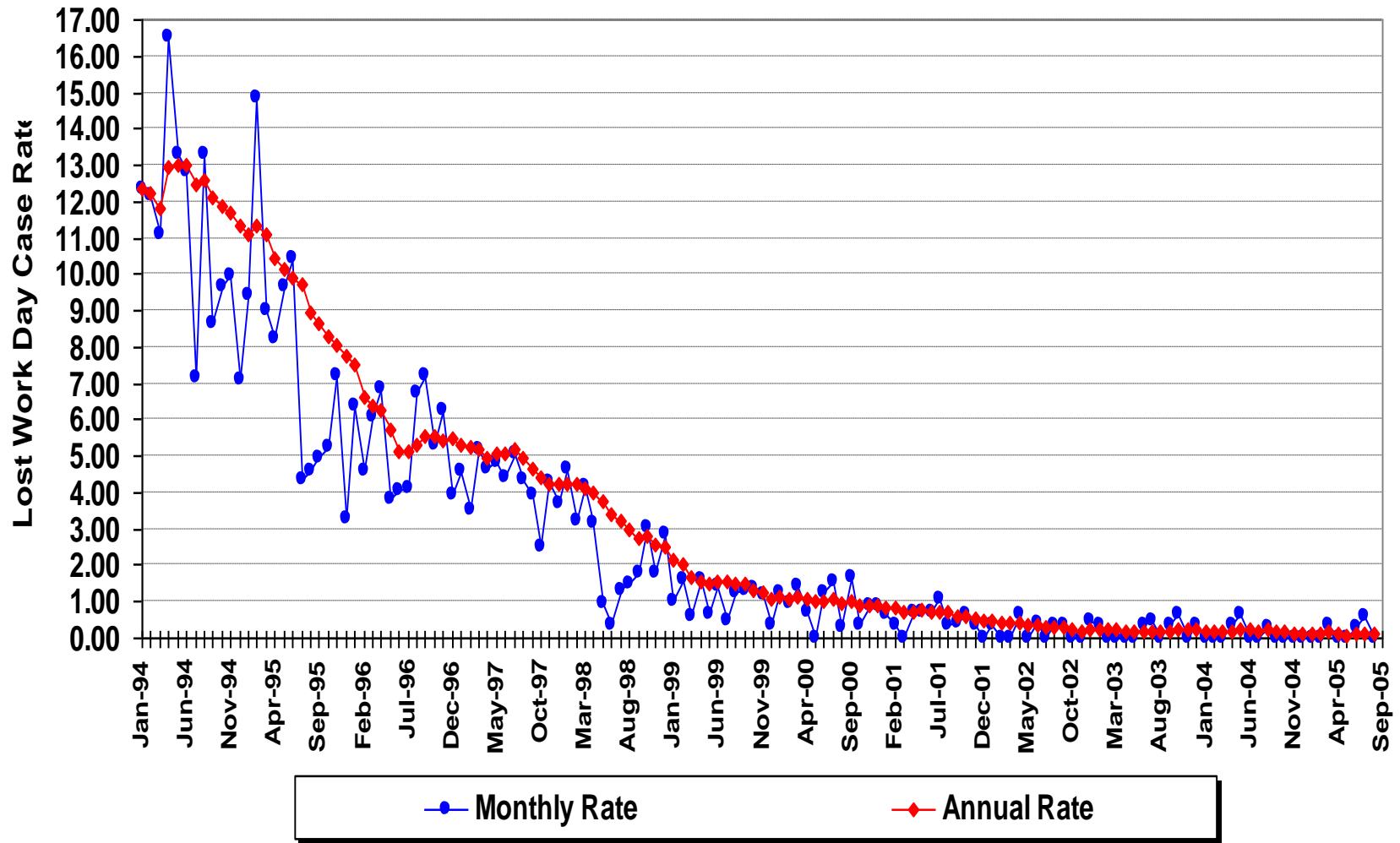
# A Difference in Cultures

- 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
- Irene DuPont (1920) “practically all accidents are avoidable”, and established a goal of no accidents





# Oshawa Truck Assembly Centre Lost Work Day Case Rate per 100 Employees



# 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



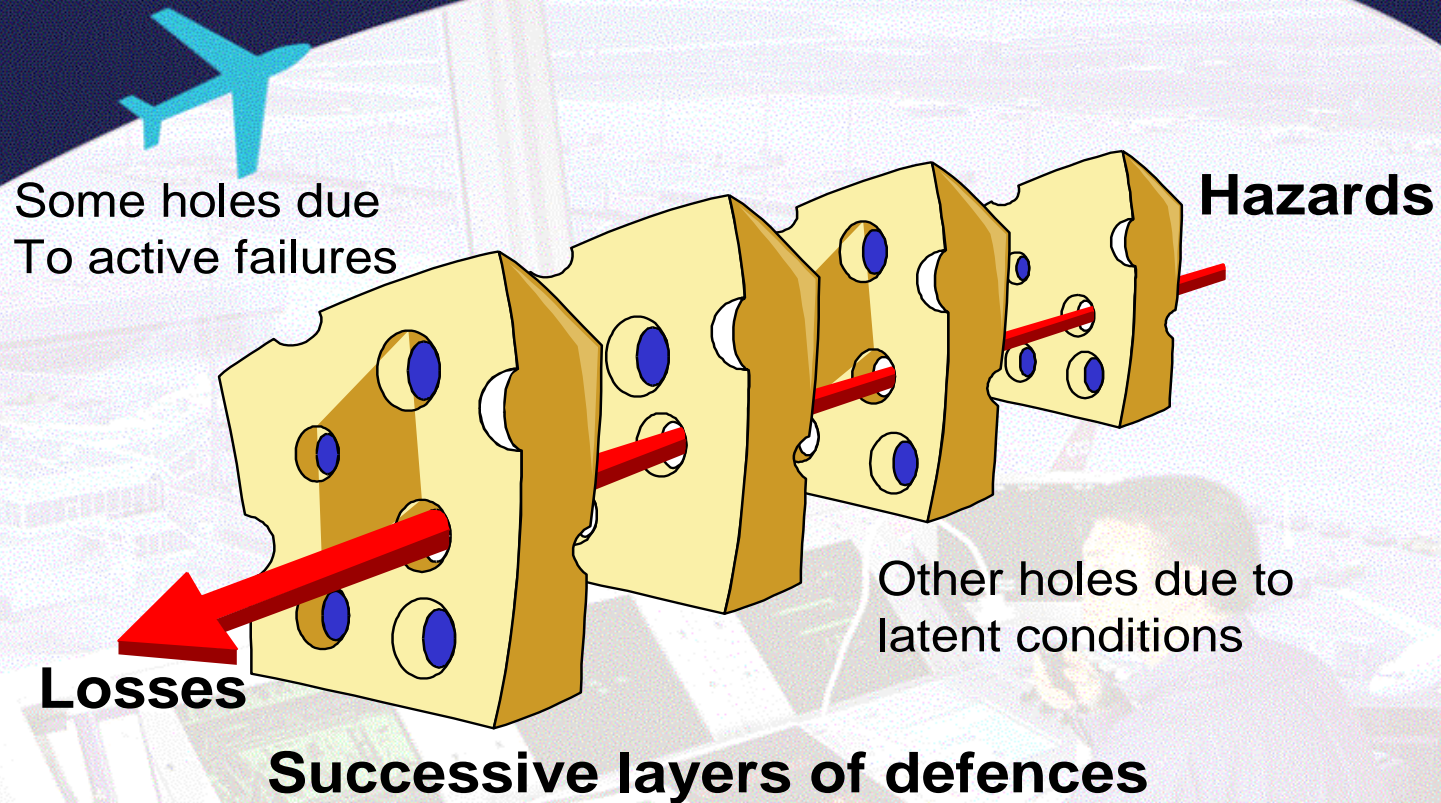
# Risks

- 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

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Reason, J., Hollnagel, E., and Paries, J., "Revisiting the Swiss Cheese Model of Accidents", EEC Note 13/06, 2006.



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# Probability & Statistics

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

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

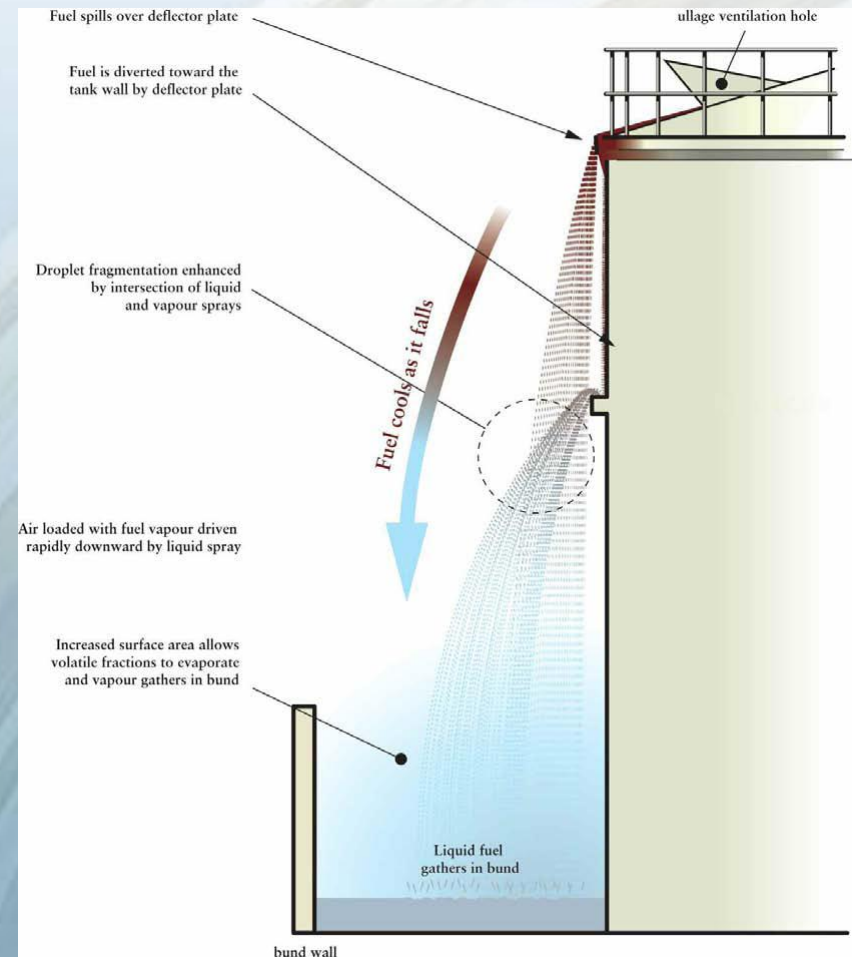
- Probability of an event that is a series of independent events

$$P = \prod_1^n P_i \text{ or } P = \sum_i^n P_i$$



# 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

$$Q_m = AC_o \sqrt{2\rho P}$$

$$f_v = \frac{C_p (T_o - T_b)}{\Delta H_v}$$







# 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

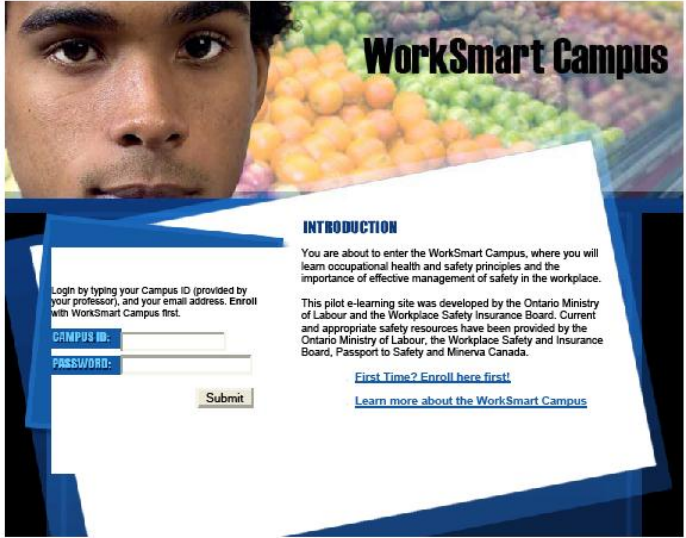
- Provide resources and training
- Provide Industry, Government or Academic speakers for lecturing
- Build the network and best practices for teaching



# 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

WorkSmart Campus :: Sign In http://www.worksmartcampus.com/chaccess/worksmar/



**WorkSmart Campus**

**INTRODUCTION**

You are about to enter the WorkSmart Campus, where you will learn occupational health and safety principles and the importance of effective management of safety in the workplace.

This pilot e-learning site was developed by the Ontario Ministry of Labour and the Workplace Safety Insurance Board. Current and appropriate safety resources have been provided by the Ontario Ministry of Labour, the Workplace Safety and Insurance Board, Passport to Safety and Minerva Canada.

[First Time? Enroll here first!](#)

[Learn more about the WorkSmart Campus](#)

Having Trouble Connecting to Your Course? ... [CLICK HERE](#) for More Information  
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# 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



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*Promoting Excellence in the Teaching of Health and Safety Management in Canadian Universities and Colleges*

- ◆ Minerva Summer Institutes for Academics
- ◆ Teaching Modules and Case Studies
- ◆ Workshops and Symposiums with Industry, Educational Institutions and Government
- ◆ Engineering Safe Design Awards for Students
- ◆ Robert W. Campbell Award Global Partner



- 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



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