



Professional Engineers  
Ontario

# ENGINEERING DIMENSIONS

JANUARY/FEBRUARY 2013



## MANAGING RISK

IN AN ERA OF

## CHANGE

BY VIC PAKALNIS, MENG, MBA, P.ENG.



# EDUCATING FUTURE ENGINEERS ABOUT HEALTH SAFETY

**ONE OF THE FUNDAMENTAL REASONS** that the engineering profession is regulated is to protect public safety. When professional engineers design bridges, tunnels, buildings or any structure using engineering principles, the public should be assured that those structures are safe.

This begins with how our future engineers are educated about health and safety. The Canadian Engineering Accreditation Board (CEAB) is tasked with establishing criteria that all engineering schools in Canada must meet, including those linked to health and safety. The following attributes are expected of engineering graduates with respect to health and safety (as extracted from the CEAB document):

1. Design—"ability to design solutions...with appropriate attention to health and safety risks..."
2. Professionalism—"...roles and responsibilities of professional engineers in society..."
3. Impact of engineering on society—"...understand implications related to social, health and safety, legal and economic aspects."
4. Economics and project management—"...ability to incorporate economics and business practices with risk and change management."

5. Ethics and equity—"...ethical obligation to health and safety..."

Queen's University, for instance, has a fourth-year course entitled Occupational Health and Safety in Mining Practice. The three dimensions explored in the course are health and safety technology, regulatory requirements, and principles of safety management. The mining engineering discipline, however, is not the model used in most engineering disciplines. Safety and risk management might be addressed in design courses in civil engineering, or process safety engineering may only be a module in chemical engineering.

## TEACHING HEALTH AND SAFETY

While the CEAB establishes the criteria, each university's engineering faculty decides how it will teach health- and safety-related subject matter—

whether it is covered as a stand-alone course or integrated into various courses.

Having served as a general visitor and a program visitor on five CEAB visits to various Ontario universities in the past decade, it's clear the subject of health and safety is dealt with in very different ways and, in some institutions, in quite a cursory manner. Institutions are required to be role models for managing occupational health and safety in classrooms and labs. Serious injuries and lost-time injuries are documented as indicators of compliance and whether a safety culture exists. Thankfully, most engineering faculties outperform their colleagues in other professional schools like medicine, arts and science. And that's how it should be. However, the role of the CEAB is to be a check on engineering programs—to ensure engineering students are properly prepared for their vocations as professional engineers. If compliance issues arise, these are quickly addressed and corrective measures are undertaken.

### MINERVA'S BEGINNINGS

Some 20 years ago, a group of volunteers, engineers and safety professionals formed to promote management occupational health and safety education among Canada's future leaders. Minerva Canada Safety Management Education Inc. was incorporated as a not-for-profit corporation in 1997. It targets educators of tomorrow's business and engineering leaders, both at colleges and universities. As the goddess of wisdom, Minerva is an apt icon for this unique organization's name. Funding comes mainly from industry—Imperial Oil, Dupont, GE, Bruce Power, Nova Chemicals, Shell Canada, Trimac Transportation, Nexen, Canada Post, General Motors Canada and the Workplace Safety and Insurance Board—and its board of directors consists of volunteers from industry, government, academe and various safety organizations.

Minerva has created over 20 business case studies that are available free of charge to business and engineering schools ([www.safetymanagementeducation.com](http://www.safetymanagementeducation.com)) but its most ambitious task to date is the development of over 20 engineering modules to be inserted in engineering curricula as engineering professors see fit. To assist engineering professors in teaching health, safety and risk management, Minerva Canada has sponsored Summer Institutes since 2004, where engineering professors can be taught best practices in teaching safety and risk management. They are provided with teaching materials, and there are speakers from industry, government and academe, and health and safety associations. Over 100 professors from across Canada have attended these sessions.

Through a partnership with MITACS, a national, not-for-profit research organization, and its industry partners, Minerva developed 10 modules in 2012, and a further 12 modules will be developed in 2013. In a meeting of the national deans of engineering and applied science in Edmonton

on November 9, 2012, the deans endorsed Minerva's work and suggested such additional improvements as making the modules available in French as well as English, and the addition of modules addressing bio-risks. The list of core and elective modules will grow over the years as new technology introduces new hazards and as new presentation and engineering strategies are introduced.

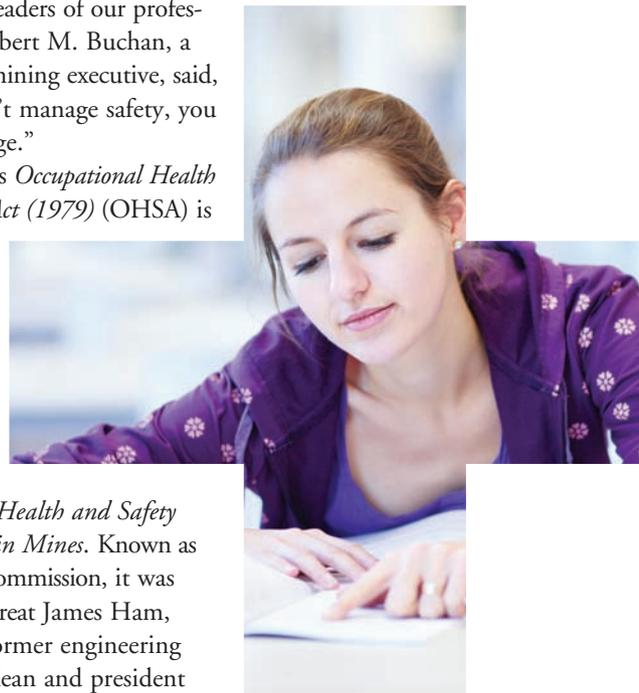
### EXPERIENCE REQUIRED

While industry leaders recognize that managing safety is a core competency, it is difficult to teach. It requires industrial experience to fully convey the principles and application of safety and risk management. Some instructors might have this and some might not. To bridge this potential gap, a partnership with industry, government and academe is required to develop the future leaders of our profession. As Robert M. Buchan, a legendary mining executive, said, "If you can't manage safety, you can't manage."

Ontario's *Occupational Health and Safety Act (1979)* (OHSA) is now over 30 years old. It had its root in the 1976 *Report of the Royal Commission on the Health and Safety of Workers in Mines*. Known as the Ham Commission, it was led by the great James Ham, P.Eng., a former engineering professor, dean and president of the University of Toronto.

He is arguably the father of occupational health and safety in Canada. His legacy in legislation such as the OHSA and in the safety management system he termed "the internal responsibility system," a strategy for health and safety oversight in workplaces, lives on as the best in the world from this author's vantage point.

We must ensure our engineering students are given every advantage in being able to design and manage safety and risk as they protect the public interest, ensure safe conditions for all workers, and set the benchmark for all engineering schools globally. Σ



## AN OVERVIEW OF MINERVA'S ENGINEERING MODULES TO DATE:

YEAR	CORE	POTENTIAL ELECTIVE MODULES
1 (10 hours)	<p>Personal safety and responsibility:</p> <ul style="list-style-type: none"> <li>• WHMIS (already a requirement of all universities)</li> <li>• Worksmart Campus (passport to safety, rights and responsibilities, safety management), covers the <i>OSH Act</i></li> <li>• principles of hazard identification (through the context of electrical safety)</li> <li>• introduction to professional accountability</li> <li>• guest speakers</li> </ul>	<ul style="list-style-type: none"> <li>• chemical safety</li> <li>• fire hazards</li> <li>• employee well-being and workplace mental health</li> <li>• electrical safety and hazardous energy</li> <li>• dangerous goods</li> </ul>
2 (20 hours)	<p>Hazard and risk management basics:</p> <ul style="list-style-type: none"> <li>• accidents/near misses investigation and reporting</li> <li>• codes, standards and regulations (general)</li> <li>• hazard and risk identification and risk assessment models</li> <li>• safety design, including design for safe maintenance</li> <li>• basics of auditing</li> </ul>	<ul style="list-style-type: none"> <li>• machine guarding</li> <li>• ergonomics and hygiene</li> <li>• radiation safety</li> <li>• process safety 1</li> <li>• codes and standards (specific)</li> <li>• toxicology, toxic reduction and emissions</li> <li>• confined space</li> </ul>
3 (20 hours)	<p>Management systems and leadership:</p> <ul style="list-style-type: none"> <li>• risk management and safe operating practices</li> <li>• accident prevention</li> <li>• managing health and safety (including some process safety) and management systems</li> <li>• due diligence</li> <li>• safety leadership, safety culture and change management</li> <li>• the business case for safety</li> </ul>	<ul style="list-style-type: none"> <li>• nanotechnology</li> <li>• process safety 2</li> <li>• robotics safety</li> <li>• ergonomics and work environment assessment</li> <li>• human factors design</li> <li>• environmental impact assessment tools</li> <li>• field considerations</li> </ul>
4 (10 hours)	<p>Ethics, the public and the environment:</p> <ul style="list-style-type: none"> <li>• safety programs, behaviour-based safety and responsible care</li> <li>• emergency preparedness</li> <li>• professional responsibility, accountability and liability</li> <li>• public and environmental responsibilities</li> <li>• capstone projects (final assessment rubric to be used as part of the capstone project requirements)</li> </ul>	<ul style="list-style-type: none"> <li>• process safety 3</li> <li>• emergency response, crisis and emergency management</li> <li>• conflict or dispute resolution</li> <li>• environmental issues and public health issues</li> </ul>

Vic Pakalnis, MEng, MBA, P.Eng., is president and CEO, MIRARCO Mining Innovation.