Media Q's and A's

• Which branches of engineering are relevent to Occupational Health and Safety (OHS)? How?

Owing to their specialized training, engineers play a crucial role in the design and development of new products or infrastructure as well as the creation of wealth. Consequently, engineers recognize that in the performance of these functions they have a specific responsibility to take such measures as are appropriate to safeguard the health, safety and well-being of the public. The Canadian Engineering Accreditation Board (CEAB) requires engineers in all disciplines to acquire knowledge of occupational health and safety in accordance with section 2.2.7: Each program must ensure that students are made aware of the role and responsibilities of the professional engineer in society. Appropriate exposure to ethics, equity, public and worker safety and health considerations and concepts of sustainable development and environmental stewardship must be an integral component of the engineering curriculum". The College of Engineering of Quebec (Ordre des ingénieurs du Québec) offers training in management of risks for Quebec engineers. This initiative flows directly from the code of ethics stipulating that "In all aspects of his work, the engineer must respect his obligations towards man and take into account the consequences of the performance of his work on the environment and on the life, health and property of every person". In October, 2003, the Organization for Economic Co-operation and Development (OECD, 2004) held a workshop on this topic. International in scope, this workshop concluded that engineers:

1) Have a professional responsibility to take account of potential risks associated with the performance of their work with respect to human health, the environment and property of others;
2) Must communicate information on the risks to all stakeholders involved in various phases of the lifecycle of a project;
3) Have the responsibility to influence the culture of their institutions or their places of business with regard to greater awareness of safety at all levels in the decision making process;
4) Have the duty to identify safety concerns and provide leadership in the field;
5) Must integrate points of view from other disciplines with regard to decisions addressing various risks (legal, social, economic, health, environment, psychology and communications);
6) Must be conscious of the limits of their knowledge and monitor risks posed by technology.

Object of the Act respecting Occupational health and safety is “the elimination at source of dangers related to the health, safety and physical integrity of workers.” This law abides within a judicial framework that recognizes employers and employees must take charge of health and safety in the workplace. By virtue of their training, engineers are often called upon to optimize and make processes safer; they are also called upon to play a consultative and supportive role to managers of firms. Consequently, engineers, through their professional conduct, are, beyond any doubt, important agents in attaining the goals of this law.

All branches of engineering are relevant to OHS.

The engineer is a designer and a decision maker with respect to systems operating in environments where workers are protected by the Act respecting Occupational health and safety. Our code of ethics and our responsibility is to protect these workers.

- Considering the impact on society and the environment. How can engineering in OHS “make for a better world?” Why do we need engineers in OHS?

Sustainable development seeks to respond to the current needs of people worldwide without compromising the capacity of future generations. From a sustainable development perspective, the International Labour Organization (ILO) supports the right to decent work which cannot be performed without efforts to prevent occupational accidents and illnesses. The ILO estimates some 270 million occupational accidents occur and occupational illness afflicts some 160 million workers worldwide each year. That represents “4% of the world’s Gross Domestic Product (GDP), or the astronomical sum of more than $1,250 billion in 2001,” (ILO, 2005). Failures associated with occupational safety were cited in eighteen (18) deaths among workers in Quebec during 2006. Workers suffered 4,652 injuries operating all types of dangerous machinery, such as presses, guillotines, cutting machines, saws, lift trucks and tractors. The Workers Compensation Board (WCB) said workers exposed to moving parts of equipment incurred 1,134 injuries in 2007. Hazards arise in starting-up, loading and maintaining certain equipment in sectors such as metal and electrical products, transport equipment, mining, forestry, textiles, furniture, pulp and paper. Advanced technologies (expressly nanotechnologies), global markets and deregulation all have served to foster profound change in organizations: Systems of production have become more and more integrated and dynamic. The Council of Science and Technology in 2006 called for products meeting specific requirements of users, offering high value added from a technical and knowledge-based perspective that are turned out in significant quantities. The professional practice of engineering has therefore grown more complex and requires a systematic management of risks, including those associated with OHS.

Use: To foster decent and safe work for our workers consistent with production imperatives of systems we design and control.

Better world: OHS is a component of sustainable development.

Engineers are on the front line in application of the Act respecting Occupational health and safety.

• What key challenges confront engineering in OHS?

Traditionally, Quebec engineers engaged in OHS work in the following technical fields: industrial safety; applied human factors engineering; acoustics; vibration; risk management; industrial hygiene; protective equipment; fire protection; biomechanical studies and machine maintenance.

Currently, OHS engineers participate in two (2) axes of the Réseau de recherche en santé et en sécurité du travail du Québec (RRSSTQ): Those focused on occupational safety and those addressing nanotoxicology. www.rrsstq.qc.ca/fra/default.asp

The occupational safety axis of RRSSTQ spelled out clearly the challenges confronting research and development in the field from 2009 to 2013: To prevent injuries arising from the start-up, loading and maintenance of dangerous machines. In this regard, efforts are aimed at :

1) Developing new design tools integrating occupational safety;
2) Developing new protective devices based on the technologies of vision, control and command used for satellites;
3) Pursuing the technical improvement of various personal protective equipment and developing multi-criteria approaches for their evaluation and selection;
4) Developing protective approaches, procedures and planning tools for the lockout of equipment.

Engineers engaged in nanotoxicology seek to study the effects on health as well as means to control nano-aerosols and nanoparticles. Engineers conducting this work are:

1) Studying the aerodynamic behaviour of nanoparticles (NPs);
2) Studying the efficiency of cutaneous protective equipment and respirators.

Mid-term goals are aimed at:

1) Improving social conditions through response to claims made by employers and unions;
2) Changing certain public policies through possible revision of specific rules and standards;
3) Improving the quality of life of workers through a response to the goals of the ILO in reference to the right to decent work;
4) Improving productivity of firms through reduced downtime or absenteeism caused by workplace accidents or occupational illnesses.

• How do you think this discipline is going to evolve over the next few years?

Quebec universities formed a number of research groups beginning in 1980. École de technologie supérieure (ETS) established its research team in work safety and industrial risk analysis called Équipe de recherche en sécurité du travail (EREST); Université de Sherbrooke launched Gauss to study knowledge transfer and risk management; Université du Québec à Trois-Rivières (UQTR) focused on issues relating to heat stress and loading docks; Concordia University embarked on its study of vibration; Université du Québec à Rimouski (UQAR) addressed the Maritime industry; École Polytechnique took up its work on musculo-skeletal injuries and Université du Québec en Abitibi Temiskamingue (UQAT) examined the mining industry.

Engineers conducting OHS research are confronted with distances that separate them geographically, their specialization in industrial sectors that operate regionally and a shortage of human resources expert in the field. Departures owing to retirement have begun.

Following are steps taken to address this shortage:

1) We are recruiting new researcher-engineers whose initial field of interest may not have included OHS but whose expertise is nevertheless closely related to the resolution of problems dealing with occupational safety;
2) We are discussing the creation of multidisciplinary and inter-university training programs;
3) We have initiated pedagogic developments aimed at better integrating OHS in the training offered engineers. Accordingly, institutions charged with the prevention of occupational accidents and illnesses, those responsible for accreditation in engineering training, protection of the public as it relates to the practice of engineering and the teaching of engineering are giving strategic consideration to the integration of occupational health and safety skills at the undergraduate level of training in hopes of raising awareness among engineers;
4) We have created a community of practice which holds regular lunchtime meetings, a yearly scientific conference and publishes a semi-annual scientific journal : www.etsmtl.ca/zone2/recherche/labo/erest/communaute.html.

• Why is this discipline of special interest? What distinguishes it from other disciplines?

Problems to be resolved are always complex, always interdisciplinary and invariably we experience the satisfaction of knowing we have contributed directly to improving the occupational health and safety of others.

It's a perfect mix of technical challenge and social commitment.

• What are the current aims of l'Équipe de recherche en sécurité du travail (ÉREST)?

Risk management

Managing occupational health and safety risks

This goal is aimed at developing a model for the management of risks taking into account the strategic behaviours of stakeholders. Efforts consist in constructing a model for OHS risk management for self-employed and versatile work in uncertain environments. Principal applications are in the sectors of moving, erection of steel structures and upgrading of urban infrastructure. One component of risk management from nanoparticles is in development (coll. N. DeMarcellis-Warin (Poly), B. Sinclair-Desgagné (HEC), C. Viau (U of M) and M. Therrien (ÉNAP)).

Integrated risk management

This axis seeks to develop integrated risk management tools. Development work focuses on formulating models integrating OHS risks with operational risks. Applications affect :

1) integrating equipment lockouts with production imperatives (coll. J.P. Kenné);
2) evaluating the performance of suppliers in the manufacturing industry (coll. K. Zaras (UQAT));
3) integrating risks posed by lift trucks in the design of cell/flexible manufacturing;
4) integrating OHS risks with the management of industrial projects (coll. A. Gbodossou (UQAT));
5) integrating questions surrounding the rate of return from mineral extraction and syndrome risks posed by toxic organic dusts (coll. C. Côté (UQAT))

Safety design of equipment

This axis seeks to prevent injuries caused by activating, loading and maintaining dangerous machinery. To this end, efforts are focused on:

1) evaluating and improving the safety of new control systems for industrial machinery by adding material and software redundancy;
2) developing new protective approaches using control and vision technologies based on those employed in aeronautics and aerospace;
3) reducing at source noise from these machines. Three applications are targeted: folding presses (coll. L. Lamarche), felling devices in forestry (coll. L. Giraud IRSST), nailers and bostitchers (coll. H. Nélisse and F. Sgard (IRSST)).

Industrial hygiene

Biosafety of nanoparticles
This axis seeks:

1) to study dispersal of nanoparticles in the environment with a view to predicting levels of exposure and identifying control measures afforded through engineering, such as ventilation;
2) to demonstrate the pulmonary toxicity of these particles through cellular models (e.g. whole blood, basophilic strand or EpiAirway);
3) to develop a standardized model for evaluation of risks posed by these particles. Among others, applications include TiO_2 (coll. Y.Cloutier (IRSST), G. Truchon (IRSST), R. Tardif (U of M)), quantum wells (coll. C. Emond (leader of TITNT), multi-walled carbon nanotubes (TITNT) and particles generated during high speed machining (coll. V. Songméné, M. Viens, J. Masounave, Y. Cloutier (IRSST)).

Air quality
This axis focuses on the experimental and numerical study of thermo-ventilation movements within buildings aimed at improving air quality, thermal comfort, bio-safety (coll. J. Lavoie (IRSST)) and developing optimal ventilation strategies.

Preventing musculo-skeletal injuries

Herniated disc mechanism
Development work examines construction of a non-linear elastic model to better understand herniated disc mechanism in the L5/S1 region.

Transmission of vibrations to the human body
This axis looks at ways to assess fatigue in the vertebral column and sets out limits to exposure which must not be exceeded. The research work seeks to develop a numeric model for the transmission of vibrations to the spinal column (coll. S. Doré, J.P. Dron-France).

Design of protective equipment :

This axis examines ways to promote technical and user-friendly improvement (comfort and range of movement) in various types of personal protective equipment (PPE) and to develop multi-criteria approaches for their evaluation and selection. Two (2) PPE are targeted : Anti-fall systems and auditory protection (coll. H. Nélisse, F. Sgard (IRSST) and J. Voix (Sonomax)).

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