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Towards the implementation of a safety education program in a teaching and research institution

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ABSTRACT

Education is a continuing process for improving the level of knowledge including the process of learning and acquiring information. It is widely believed that constant exposure to new ideas and skills makes people better workers, thinkers, and societal contributors. This paper presents and discusses some safety education strategies that were implemented to improve the safety level in a research and teaching institution. They were applied to our Basic Sciences School where chemical engineering is belonging. The aim was not to develop a new curricula program but to concentrate on what should be done with all the people present in research and teaching labs/buildings. Using over 10 years of experience as occupational safety and health specialists we could observe that better results are achieved when the involvement of all actors (meaning all the persons present in the labs) is effective. Encompassing everyone implies educating them beforehand. We did not develop the safety education included in the chemical engineering curricula but concentrate on the general safety education starting from the students performing their first practical labs, the hiring of new collaborators (whenever they are scientists, technicians or administrative staff) and the continuing education of all personnel.

1. Introduction

Academic labs are more dangerous than those in industry, because of their more relaxed approach towards safety (Peplow and Marris, 2006). Academic institutions have more incidents and accidents compared to industry. However they are less documented and reported mainly due to the fact that their impact and damages are generally confined within the institution. Research activities have become more complex with more interrelations and interdependencies. Moreover new technologies and developing materials introduce new risks. Furthermore, management of change (Langerman, 2008) is even more critical as research laboratories are undergoing continuous and rapid changes. This complexity, combined with increasing multifunctional use of space and increasing population densities with high turnover, creates larger risks to society. Despite the awareness about growing risks in the academic/research world, risk management in this environment is even more complex, when compared to industry and a safety culture may be hard to implement (Marendaz et al., 2013). Chemical engineering is a typical illustration of this complexity being often a mixture of basic and applied sciences evolving at different scales (from milliliters to several tenths of liters scale in universities).

Occupational safety and health (OSH) specialists analyze workplaces to ensure the safety and health of workers and the environment. They must act as a team as the hazards to be analyzed are generally multidisciplinary and need more

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than one competence or expertise. In an ideal world, one could imagine that after the OSH team has completed its work it can be stopped there as safety is now ensured and under control. Each person having spent some time in academia remembers that this continuing evolving environment will never be at this utopic level of safety.

The OSH team could not ensure safety just by itself. It needs a large support from all the actors and players present in the research and teaching institution. This population is represented by students, PhD students, post-docs, researchers, technicians, senior staff, professors and administrative staff. They need to understand their responsibilities to protect themselves, their work colleagues and the wider community. They need to be aware of the practices to work safely and also the consequences that may arise when the safety rules are not followed (Shallcross, 2013). Many institutions have implemented safety courses in their chemical engineering curricula either at the bachelor and/or at the master level. Their main idea is to instill the concept of inherently safer design (Kletz, 1988; Perrin and Laurent, 2008). Kletz supported this with three arguments:

- Safety should be treated as an integral part of the design.
- Any practicing chemical engineer will be involved in safety matters.
- Safety and loss prevention involve basic principles.

Likewise the industry, academia recognizes the importance of safety education after major accidents. The Center for Chemical Process Safety (CCPS) of the American Institute of Chemical Engineers (AIChE) began the Safety and Chemical Engineering Education (SACHE) program in 1985. The objectives of SACHE are to encourage the incorporation of safety content into the chemical engineering curriculum, to develop safety content for chemical engineering courses, and to provide opportunities for faculty members to learn about process safety from industrial experts (Louvar and Hendershot, 2003). After the dramatic accident happened in 2007 at the T2 Laboratories of the chemical manufacturing facilities in Florida, the US Chemical Safety and Hazard Investigation Board recommended that reactive chemical process awareness should be incorporated into all undergraduate chemical engineering programs in the USA (U.S. Chemical Safety and Hazard Investigation Board, 2009). The European Federation of Chemical Engineering Working Party on Education released guidelines for chemical engineering curricula within Europe including safety elements (EFCE, 2010).

The common conclusions issued by these different organizations were:

- Teach safety problem solving methods, safety concepts, and theory.
- Teach students the consequences of neglecting safety.
- Motivate students to continue their education in process safety after graduation.

More recently a panel discussion about improving safety in college and university research and teaching laboratories took place in 2011 in St. Louis, Missouri (Backus et al., 2012). They concluded that laboratory safety must be an on-going high priority and that there was strong merit in developing a banding approach for classifying the chemical hazard risk in laboratories based on the type and quantity of chemicals used. The U.S. Chemical Safety Board (CSB) should work with ACS, environmental health and safety professionals (through Campus Safety, Health, and Environmental Management Association CSHEMA), chemistry faculty representatives, college and university upper administration representatives, and other professional societies to develop chemical hazard risk assessment guidance. This should also help enhancing laboratory safety by improving management systems at all levels of academic institutions (granting and regulatory agencies).

They also agreed that safety must be of upmost importance in their teaching and research laboratories, and an integral part of chemical and laboratory-based education programs. It was expressed that if any good can come out of the tragic accidents that have occurred over the past three years in college and university laboratories across the country, it would be that higher education institutions must implement the lessons learned to prevent similar accidents from occurring in the future.

In general, it was thought that there should be “sticks and carrots” to encourage proper safety practices (Backus et al., 2012). Those safety roles and responsibilities should be clearly defined. Tools should be provided to faculty and staff on how to perform hazard risk assessments and how to implement and oversee safety programs in their laboratories. Safety should be a heavily weighted aspect of the tenure and promotion process, a grade component in undergraduate education, and an important component in approving graduate degrees and post-doctoral fellowships. One of their recommendations was to tie safety to the monetary incentives that faculty and staff receive, through granting agency requirements and/or performance (salary) merit increases.

Some other (Karapantsios et al., 2008) evaluated through a questionnaire the ability of students to correctly label a series of chemicals. They concluded that the vast majority either of students or laboratory staff members were unable to label correctly the chemicals, being essentially unaware of the chemical hazards in the laboratory. Once again, one of the possible argued explanations was linked to the education and traditional classroom teaching.

A recent study (Laberge et al., 2014) emphasized that education and awareness strategies to prevent injuries among young workers are common but they are often ineffective. These approaches emphasize teaching, rather than learning strategies, and appear to contradict recent competency-based developments in education science.

In their work, (Burke et al., 2006) observed that as training methods became more engaging (i.e. requiring trainees’ active participation), workers demonstrated greater knowledge acquisition and reductions were seen in accidents, illnesses, and injuries. Training involving behavioral modeling, a substantial amount of practice and dialogue is generally more effective than other methods of safety and health training.

The main message we could draw from all the above-mentioned examples is that there is a general consensus in stating that safety is a major concern in research and teaching institutions. How and when to perform, and to whom this teaching shall be addressed is the real challenge.

2. Discussion

2.1. *Problematic and objectives*

Occupational safety and health training can be a challenge. Workers in “high risk” industries can be particularly difficult