NorthWest Occupational Health & Safety

The OH&S Establishment And The Challenge Of Highly Consequential, Rare Events

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Parts of this document were excerpted from *Managing Hazardous Energy: Deactivation, De-Energization, Isolation, Lockout*; *Safety and Health in Confined Spaces;* and *The WHMIS Training Program* The ideas presented here represent opinions of the author and are intended solely to promote discussion.

Introduction

Organized attempts to bring safer conditions to the workplace have existed now for over 100 years, thanks to the formation and activities of the American Society of Safety Engineers (ASSE). ASSE has served as the model for other associations of volunteers who share this goal.

The efforts promoted by these groups have led to the dramatic decrease in the number and severity of accidents that occur across the broad spectrum of industry. Recently, visionaries have realized that on-going efforts have produced no improvement in safe working conditions and that a change in approach is needed.

While routine accident and injury prevention appear to be responsive to current strategies and efforts, what is emerging is the occurrence of highly unusual situations that involve catastrophic loss of life and traumatic injury, damage and destruction of facilities, and serious psychological injury and loss of employment to survivors. The specifics of these situations in a particular facility are difficult to predict and very expensive to prevent. To complicate things further, some of these situations are occurring in organizations that otherwise have low rates of accidents and injuries.

The US Chemical Safety and Hazard Investigation Board have investigated an increasing number of these situations. What is emerging is the inability of the safety system that exists in organizations to address these situations *a priori*; that is, prior to their occurrence. This inability to prevent the occurrence of these events argues for an examination of the current *status quo* with a view of determining whether and how improvement can occur.

An Example

A catastrophic accident that occurred recently highlights the complexity of this problem and the difficulty in approaching and solving it.

A sawmill in northern British Columbia exploded and burned during cold winter conditions. Two workers died. Many others experienced severe burns. The sawmill was totally destroyed. The sawmill was a very large structure, around the area of two football fields, surrounded by walls and enclosed under a roof. Witnesses indicated that the roof lifted and collapsed downward, and that the walls blew outward during the event.

Explosions are not part of normal discussion about the hazards of sawmilling, despite the presence of large quantities of sawdust. Sawmills normally handle wood that is wetted externally by rain, snow or ice and internally by sap. The dust is coarse and poses a fire hazard when dry.

As reported by witnesses, the sawmill was processing trees killed by the mountain pine beetle. The wood was dry compared to wood normally processed in sawmills. The design of the mill would reflect hazardous conditions associated with cutting and processing wet wood. Dry wood poses different issues and could lie outside the envelope of parameters considered in the design for controlling hazardous conditions in sawmills.

Witnesses reported that the interior of the mill contained considerable dust both on surfaces and in the air prior to the event. The mill used misters to suppress dust formation. Use of these devices would be very difficult at winter temperatures of -20° C and lower.

Some of the witnesses were unaware of the explosive capability of wood dust. To create the conditions for an explosion, dust from wood and other combustible materials requires containment, particles of appropriately small size, low humidity, a mechanism to produce an airborne cloud containing the appropriate concentration for explosibility, a source of oxygen (usually the air) and an energetic source of ignition.

A welder commented that he had experienced a dust explosion in the mill the day of the tragedy or close in proximity to it
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The workers were also using tiger torches (propane-fuelled torches at the end of a long handle).

The operators closed the windows due to the cold winter temperatures (-20° C). At -20° C, electrostatic charge accumulation on particulates becomes a serious concern because the arc produced during electrostatic discharge is an ignition source. Water droplets in air can become electrostatically charged.

I received a request from the CBC, the Canadian public broadcaster, to participate in an interview on this matter. The reporter asked many questions over the span of an hour. Following is the link to the article and the screen for viewing the interview. Please also scroll to the bottom of the web page to read comments sent in by viewers. They are very interesting and very insightful.

http://www.cbc.ca/news/canada/british-columbia/story/2012/01/25/bc-burns-lake-mill-dust-levels.html

One viewer indicated that the temperature in the area of the mill had only recently warmed from -35° C to -20° C. At these temperatures, the air inside the building and wood dust containing any moisture would become extremely dry. Static electricity (electrostatic charge accumulation and discharge) is a serious problem in winter at these temperatures when humidity is low. Particulates readily become electrostatically charged. Electrostatic discharge is a source of ignition of airborne mixtures of vapours and gases, and at high level, particulates of combustible dust

A viewer who had visited the mill two months previously commented about large quantities of dust on surfaces.

Another viewer commented that a research report commissioned regarding potential for forest fires involving trees infested by the mountain pine beetle indicated that the trees produce additional resin as a presumed defensive mechanism. This resin and substances that off-gas from it render the wood aggressively combustible.

Several viewers reported that dust explosions involving wood dust have occurred recently in Canada in sawmills and wood processing and handling facilities.

A number of viewers expressed the view that wood dust is not explosible, while other viewers discussed about dust explosions involving grain dust and wood dust. The critical issue is particle size and possibly the type of wood. Much of this discussion focused on cedar and not pine. The behavior of these woods is potentially different under conditions of extreme dryness.

There isn't much in a sawmill, other than wood dust, to fuel an explosion with the power to destroy an entire very large building by lifting the roof and blowing out the walls. As above, and using the powers of elimination provided to us by Sir Arthur Conan Doyle through Sherlock Holmes, once you eliminate all of the other possibilities, the one that remains, however improbable, must be the answer.

The workforce were unionized. There was a health and safety committee. WorkSafeBC is an aggressive regulator. The pieces of the prevention puzzle should have been in place.

The Bigger Picture

At time of writing, the official attributed cause and its contributory factors remain to be assigned. Ultimately, this is not important to this discussion. What is important to discern from the available information is that this tragedy involved complex factors that strain the knowledge and experience of technically trained individuals.

Starting with the premise that accidents of this type and magnitude are both predictable and preventable enables a progression of thought. Allow me begin with the observation that events and activities that occur at work are either managed (meaning actively controlled) or they are allowed to happen. If this observation is correct, this provides an additional basis for discussion.

What seems to be a major contributory factor in the example was the lack of knowledge that an explosion involving wood dust was a possible occurrence. People interviewed on site indicated no knowledge about the ability of wood dust to explode. Furthermore, they knew nothing about the power and destructiveness of dust explosions in general and dust explosions involving wood dust in particular.

So, how could this deficiency of knowledge have occurred, given the information that is available to us, and now readily so through a simple search on the internet? There have been a number of major explosions recently, mainly in the US, involving combustible dust. OSHA (Occupational Safety and Health Administration), NIOSH (National Institute for Occupational Safety and Health and the CSB (US Chemical Safety and Hazard Investigation Board) have focused on explosions involving combustible dust during recent years. The US Bureau of Mines investigated the explosive properties of combustible dust in the 1950s and wrote reports providing technical data. So, what has happened or not happened to enable these tragedies to occur?

Currently, we are hearing about other accidents that caused catastrophic consequences to individuals and employers. These accidents are highly unusual in their occurrence, highly destructive in their impact on facilities and the future well-being of the people employed in them, costly in injuries and lives lost, and very frustrating to high-level thinkers at regulators and other agencies involved in accident prevention.

The event discussed in the preceding example happened because the preventive measures to the level needed to prevent the event did not occur. Had the appropriate preventive measures occurred to the level needed to prevent the event, then it would not have happened and would not have become available as a focal point for discussion. That is, the events that are prevented, therefore, are not recognized, and are not available for discussion.

Prevention is a difficult undertaking because the reward, meaning absence of consequence, is difficult to obtain and to recognize. Absence of consequence is not recognizable as a reward for expending effort and considerable money. The absent consequence is indistinguishable from normal routine. This is especially true where the consequence is a rare event. Hence, expending effort to prevent rare events is difficult to justify economically when no result is demonstrable. That is, the specifics of a rare event as they apply to a particular facility are very difficult to predict and very expensive to prevent and very destructive and costly when they do occur.

In some situations, follow-up investigation indicated that the knowledge needed to address the hazardous conditions that contributed to the tragedy was not resident in the individuals engaged by the employers as OH&S (Occupational Health and Safety) practitioners. Given the premise that these accidents are predictable and preventable begs the question about whether the health and safety system, as presently constituted in North America, is capable of addressing these challenges or requires upgrading.

The OH&S Establishment

Regulators hold employers responsible for ensuring safe conditions of work. They exercise this requirement through the creation and enforcement of specific and general regulations.

The current model employed in many multi-site and larger employers downloads responsibility for OH&S to local management. Historically, OH&S reported directly to the Chief Executive or Senior Vice President. Everyone in the organization recognized the importance, and ultimately power, accorded to the function by the individuals ultimately accountable and responsible for the safe and economic operation of the enterprise.

OH&S practitioners often reside in head offices and not in operating facilities. OH&S practitioners in many organizations don't ‘do’ OH&S. They go to meetings and read reports created by consultants whom they employ and create paperwork. Some OH&S practitioners perform audits of paperwork called 'programs'. In what way does the audit or the paperwork prevent an accident, especially a rare event involving major consequences? All the audit does is satisfies the auditor that the paperwork exists in a form that meets their perception of regulatory requirements. Effectively, OH&S at this level is an administrative function and not a functional service.

Management often now delegates OH&S to operate and report through Human Resources. OH&S is a sideline to the main function of Human Resources (as implicit in the term). OH&S is a complex technical endeavor. People in Human Resources and local management likely know only the superficial details about the interplay between hazardous conditions and decisions taken during design, production, and maintenance, and expectations contained in regulatory requirements. Regulatory requirements often express requirements necessitating major effort and expenditure through short phrases or even single words.

The latter situation can easily leave the OH&S practitioner in the unenviable position of trying to explain the magnitude and extent and the associated expense of a requirement encoded in a single word or a short phrase to and through individuals who have no way of evaluating the wisdom of the explanation and recommendations for the organization that result from it.

The consequence arising from this reporting relationship is that OH&S practitioners who are assigned to report through the HR Department easily become isolated. As well, the manager of the HR Department must evaluate the performance of an individual whose actions and efforts are comprehensible only at the level of person-to-person interaction. This situation leaves the OH&S practitioner vulnerable to politics within the HR Department and the organization.

External consultants perform much of the work of OH&S in organizations. External consultants frequently send junior people to worksites to perform the work. These individuals likely know little about the operation beyond the focus of the sample collection or task to be performed. Local management not knowledgeable about the complexities of OH&S seek out the cheapest price from the consultants who will perform the work for them. They are uninterested in the statistical uncertainties of sample collection and interpretation. Hence, the internal people have no intimate contact with the workplace and no in-depth knowledge about it.

Another contributing factor in these situations is the labour-management hierarchy. Some of this results from the system of internal promotion from worker to supervisor and eventually to manager. This often means in organizations that the only difference between workers, supervisors and managers is the colour of their hardhats. They are the same people. They possess similar levels of education and knowledge about hazardous conditions, but different levels of accountability, responsibility and power. For this reason, they approach problem-recognition and problem-solving in essentially the same way.

A complicating factor in the labour-management hierarchy is the loss of knowledgeable (senior) people through downsizing, rightsizing and other euphemisms for reduction in size of the workforce. A complimentary factor is the impending loss of the knowledge base through retirement of the 'boomer' generation. These individuals include remaining survivors from previous reductions in size of the workforce.

A result of these constraints and realities is that many organizations no longer employ individuals who have high-level, in-depth, technical knowledge and experience about the operation, and potentially the ability to champion OH&S issues through the reporting and management structure. This situation leaves open the operation to the occurrence of rare events for which high-level knowledge and expertise and detailed familiarity with conditions in operating facilities are required. Accident prevention in organizations occurs on the shop floor, and not in administrative offices.

Another corollary from these observations is that the focus in OH&S has shifted from looking forward to looking backward. Looking backward considers events that have already occurred in a facility and performance relative to some metric. The emphasis is compliance with regulatory requirements (a natural consequence of their existence) and preparing statistics related to occurrence of accidents.

Looking forward considers events that could happen. In its hundredth year, ASSE has republished the thoughts of previous leaders. These individuals were pioneers. They knew what was required and acted on it, namely actively go looking for problems in the workplaces of their day and fix them. Don't wait for fixable situations to become problems through the occurrence of a major traumatic accident.

Occurrence of a major accident resulting from a rare event is the safety practitioner's worst nightmare. The spotlights turn on and outsiders focus their macro lenses on minutiae looking for details and historic events that preceded the catastrophic event. Lack of knowledge and lack of preparation and lack of follow-up on the warnings provided in previous events become readily apparent to experienced and knowledgeable investigators.

Moving Forward

The accidents discussed previously indicate that unrecognized hazardous conditions generally affect facilities during on-going operation, rather than during construction and commissioning during start-up. In addition, causes and contributing factors in many of these accidents, while potentially related directly to day-to-day operation, could include some deviation from the *status quo*. This deviation and its significance to the safety of the operation is not recognized and addressed by the *status quo*.

How can this reality be addressed in a practical way at reasonable cost in order to restore control and to prevent the occurrence of highly consequential, rare events in industrial facilities? Given the realities considered in previous discussion, it would seem that the best approach is to ensure the continuous, on-going presence of individuals possessing a high level of technical knowledge about hazardous conditions that can occur on a site, their potential impacts on the specific type of industry and how to eliminate or at least to control them. They must apply the knowledge to the specifics of the work location; convey the knowledge to decisonmakers in an effective manner; make the knowledge available to others who are potentially affected by consequences arising from it; and be prepared to act assertively under the requirements of a code of ethics. All of these are required at the same time in the same person in order to be most effective.

These individuals can provide input into all aspects of the operation, starting with design, and progressing to on-going activities and maintenance, and finally to management of change. These individuals perform this function as a career and not as an initial stepping stone to an administrative position from which the knowledge is lost because it is no longer available

The key points here are the demonstrated acquisition of the right kind of knowledge to a sufficient level, the ability to apply it in the appropriate manner and adherence to a code of ethics. Adherence to a code of ethics is an essential requirement for ethical practice of OH&S within the political reality of an entity where loyalty can become negotiable as a means to ensure survival.

As discussed previously, the model involving the presence on-site of highly knowledgeable practitioners has become increasingly rare in North America. Practitioners who remain at the technical level deserve recognition and remuneration for pursuing a technical career, rather than a business-oriented one involving progression up a ladder of administrative activity..

Corollary questions include, what knowledge is required; how much is needed; who decides about the type and level of knowledge; and what mechanism ensures that practitioners achieve and maintain the appropriate level.

The operational model used for investigation and problem-solving in industrial hygiene provides the starting point for answering these questions in a disciplined way. The model contains the following elements: anticipate what could be present; recognize it when it is present; evaluate its severity; and eliminate or at least control hazardous conditions.

OH&S practitioners currently enter the field from several directions. Some are self-taught by way of workplace experience and attendance at short courses. These individuals determine what they need to learn by virtue of perception about what is needed. This approach tends to isolate the individual from the global scope of knowledge available for investigation, evaluation and resolution of specific problems. These individuals need mentors to assist them in determining directions follow to learn about additional disciplines. Notice that this situation puts the onus onto the OH&S practitioner and the mentor (often a volunteer or a supervisor) to respond to the need for greater learning in the appropriate manner.

Other practitioners acquire formal knowledge through multi-year educational programs at the bachelors and masters levels in post-secondary educational institutions. The educational institution and formal program accrediting agencies determine the curriculum. This approach has the potential to introduce students to the broad spectrum of knowledge that is needed for successful mastery of the discipline and the focus needed to address the unusual situations involved in rare, highly consequential accidents.

This approach requires regular review of the curriculum to ensure that it reflects the need for information essential for addressing the problem posed by rare, highly consequential accidents. Notice that this situation puts the onus onto educational institutions to ensure that the curriculum responds in a substantive way to the changing needs of industry.

OH&S practitioners in active practice beyond the educational system must actively pursue knowledge on their own initiative. OH&S practitioners must be able to converse with technical specialists about technical aspects of complex challenges. Notice that this situation puts the onus onto the OH&S practitioner to respond to the need for greater learning in the appropriate manner.

Experience has shown that acquiring knowledge in these subjects is a difficult undertaking. The OH&S practitioner must pursue considerable investigation into specific areas of activity to determine suitable venues for acquiring the knowledge. These areas include electrical equipment, hydraulic and pneumatic equipment, flowable bulk solids, fluid systems, and moveable and stationary equipment and machinery.

Training in these areas, while available, is sometimes difficult to find at the level of detail needed by OH&S practitioners. OH&S practitioners have a need to learn at a level deeper than the superficial but less deeply than that needed by technical specialists. Currently this information is not readily available through OH&S organizations and third party education providers.

OH&S practitioners must be able to speak the language and understand the issues of the technical specialist without necessarily being able to solve them. What is important to realize is that the OH&S practitioner bridges all of these areas whereas technical specialists remain within their area of expertise and do not communicate beyond the boundaries of the discipline.

Currently, in North America there is no emphasis on the on-going acquisition of technical knowledge as part of a strategy to attain and maintain completeness of the knowledge base of OH&S practitioners beyond basic levels. There currently is no defined body of knowledge which practitioners are expected to acquire and in which to be able to demonstrate competence rather than to answer a few questions in a multiple choice examination.

The closest that is available is the curriculum taught in educational institutions and the rubrics specified by certifying organizations offering professional designations. This is especially the case for subjects beyond the core competency needed to be able to answer questions on certification exams. Notice that this situation puts the onus onto credentialing organizations to ensure that the rubrics and the question bank used to evaluate applicants respond in a substantive way to the changing pattern of occurrence of hazardous conditions in industry.

Professional certifications in OH&S do not demand the high level of knowledge that is needed for addressing the rare events discussed previously, but do impose strict codes of ethics regarding conduct.

The limitation of this approach is that one presumably can act ethically within the realm of insufficiency of knowledge. However, one must constantly search to learn what knowledge is required to satisfy the requirements for the ‘anticipation’ and ‘recognition’ steps of the IH model for investigation and problem-solving. This requirement negates the argument for acting ethically within the realm of insufficiency of knowledge.

Once exposed to the insufficiency of knowledge reflected by what one does know versus what one must know to be prepared to address these issues, one must then act assertively to acquire the additional knowledge in order to close the gap. Once again, this situation puts the onus onto the individual practitioner to respond to the need for greater learning in the appropriate way.

The regulatory approach in North America obliges employers to determine the occurrence of hazardous conditions mentioned specifically or generally in regulations and to eliminate or at least control them. Review of regulations indicates requirements for about 43 types of hazardous conditions.

Generally, there is no specific requirement regarding the credentials and qualifications of the individuals who will perform these tasks. Regulators download the onus to determine value of credentials and qualifications onto employers through use of terms, such as ‘competent’ or ‘qualified’.

Rarely does a regulator specify earned credentials. Experience in situations where specification has occurred has led to surprises for regulators. Some individuals holding the designated credentials demonstrated lack of competence in performing the requirements of the regulation to the level required by the regulator. Many individuals employed by regulators have obtained the same credentials and therefore are capable of judging the sufficiency of the outcome.

This situation highlights the situation in which credentialing organizations have found themselves, especially those whose credentials are widely touted as setting benchmarks for attainment by practitioners. Notice that this situation again puts the onus onto credentialing organizations to ensure that the rubrics and the question bank used to evaluate applicants respond in a substantive way to the changing pattern of occurrence of hazardous conditions in industry.

The government of Brazil took another approach to this challenge. Brazil requires companies to perform a risk assessment of their operations. When the risk, in combination with the number of employees, exceeds certain thresholds, the company must employ various participants in the health and safety system. These include safety technicians, safety engineers, nurses and occupational physicians. Not all situations require participation by all of the preceding practitioners. Progressive companies can exceed the requirements contained in legislation.

A Safety Engineer in Brazil is a graduated engineer who has five years of experience and registration by the state board, who then takes a specialization in health and safety. Obtaining this specialization requires 660 hours of classroom training according to a predetermined curriculum. Notice that this situation puts the onus onto the authors of the curriculum to ensure that it responds in an appropriate manner to the challenges posed by conditions associated with extremely consequential rare events. A condition for licensing as an engineer in Brazil is agreement to adhere to a code of ethics. The specialization is not a Master's degree.

In North America, the term, safety professional or safety engineer, has no meaning in terms of achievement or capability. People use the term to create a false sense of accomplishment and status. The requirements in Brasil for qualification of Safety Engineers exceed those in the US and Canada for safety practitioners.

The logic behind the concept of the Safety Engineer is to represent or champion the interests of health and safety among peers. The Safety Engineer must speak the language of the peers and not allow overshadowing of those interests by bully tactics. Because they are on-site, they can see day-to-day what is occurring. There is no excuse for not being highly knowledgeable about the conditions of work.

Restricting entry through this door only to engineers creates a system that recognizes only one type of education as being worthwhile and fails to credit the abilities and accomplishments of other individuals who bring specialized knowledge to a discussion. Certainly, undergraduate training in engineering has no more relationship to the knowledge required to satisfy the requirements for successful practice of OH&S than undergraduate training in chemistry. As well, there is no ability exclusive to engineers to be able to learn the content included in the curriculum for the specialization.

Regardless of who is allowed to pass through the entry point, everyone must achieve the high-level knowledge and capability defined by the benchmark. Adherence to code of ethics plus the on-going assertive acquisition of knowledge are the essential requirements for ethical practice of a discipline within the political reality of an operating entity where loyalty is sometimes negotiable.

One way to express the meaning of qualified is that no one will suffer accident, injury or death as a result of deficiency of judgement brought about by deficiency of knowledge. If this is a reasonable statement of qualified, then this suggests that there is room under this umbrella for individuals with diverse backgrounds who attain the level of knowledge required through sufficient study. The key to ensuring that all individuals claiming to be qualified actually are qualified is to define the requisite type and level of knowledge.

References

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