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Proposal of a risk-factor-based analytical approach for integrating occupational health and safety into project risk evaluation

Adel Badri[a,*], Sylvie Nadeau[a], André Gbodossou[b]

[a] Mechanical Engineering Department, University of Quebec, École de technologie supérieure, 1100 Notre Dame West, Montreal (Quebec) H3C 1K3, Canada
[b] Unit of Education and Research in Management Sciences, University of Quebec Abitibi-Témiscamingue, Rouyn-Noranda (Quebec) J9X 5E4, Canada

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ABSTRACT

Excluding occupational health and safety (OHS) from project management is no longer acceptable. Numerous industrial accidents have exposed the ineffectiveness of conventional risk evaluation methods as well as negligence of risk factors having major impact on the health and safety of workers and nearby residents. Lack of reliable and complete evaluations from the beginning of a project generates bad decisions that could end up threatening the very existence of an organization.

This article supports a systematic approach to the evaluation of OHS risks and proposes a new procedure based on the number of risk factors identified and their relative significance. A new concept called risk factor concentration along with weighting of risk factor categories as contributors to undesirable events are used in the analytical hierarchy process multi-criteria comparison model with Expert Choice© software.

A case study is used to illustrate the various steps of the risk evaluation approach and the quick and simple integration of OHS at an early stage of a project. The approach allows continual reassessment of criteria over the course of the project or when new data are acquired. It was thus possible to differentiate the OHS risks from the risk of drop in quality in the case of the factory expansion project.

1. Introduction

Industrial accidents continue to cause human suffering, capital losses, environmental destruction and social problems (Duijm et al., 2008; Kartam, 1997; Li et al., 2009; Shikdar and Sawaqed, 2003). In recent years, accidents in construction and industry have occurred in spite of rigorous management of projects and robust occupational health and safety (OHS) management systems (Makin and Winder, 2008) in all phases of project lifecycle (Li et al., 2009).

The explosion of a power plant in the start-up phase while testing a gas line in a populated region (43,000 inhabitants) of Connecticut (USA) on February 7, 2010 is reminiscent of a series of similar industrial accidents over the decades in terms of gravity and consequences. In most cases, inquiry into the causes of the accident revealed failure in the identification and evaluation of the impending risks, placing at peril the health and safety of human beings on site and in the surrounding areas. This was the case notably at Bhopal (1984) and at Chernobyl (1986).

In general, risk is evaluated in terms of its consequences with respect to project performance and rarely in terms of human suffering. Smallwood (2004) confirmed that quality, planning and costs are the parameters given the greatest consideration. This is reflected in the decision to install many high-risk production plants near or in densely populated areas (e.g. the AZF chemical plant in Toulouse, France; the now closed Sigma-Lamaque mine in Val d'Or, Quebec). In Quebec, high-risk installations still get the go-ahead in spite of the efforts by the Environmental Public Hearings Office to provide transparent information and to consult citizens.

The aim of this paper is to present a new systematic approach to the evaluation of OHS risks and proposes a new procedure based on the number of risk factors identified and their relative significance. This approach is able to overcome the difficulties of current tools in the manufacturing industry. The proposed approach is based on known techniques and tools, such as multi-criteria analysis techniques (e.g. analytic hierarchy process), expert judgment and the analysis of accidents and incidents. The analytic hierarchy process is selected to minimize the inconsistencies in expert judgments (Fera and Macchiaroli, 2009) and to support approaches that use mixed qualitative–quantitative assessment data (Chao et al., 2005).

This document is structured as follows. In Section 2, we begin by discussing the relevant tools and approaches used to manage project risk in different industrial sectors. We also give an overview of the use of qualitative and quantitative tools in various industries. Section 3 presents the methodology, including the conceptual model of the systematic approach to the evaluation of OHS risks. Given its importance in the approach proposed, the AHP method

* Corresponding author. Tel.: +1 514 3968800x7322.
E-mail addresses: adel.badri.1@ens.etsmtl.ca, badri.adel@gmail.com (A. Badri).

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