Safety Science 48 (2010) 91–99

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

Identification, analysis and dissemination of information on near misses: A case study in the construction industry

Fabricio Borges Cambraia [a,1], Tarcisio Abreu Saurin [b,*], Carlos Torres Formoso [a,1]

[a] NORIE/UFRGS (Building Research and Innovation Unit, Federal University of Rio Grande do Sul). Av. Osvaldo Aranha, 99, 3. andar. Porto Alegre, RS, CEP 90015-190, Brazil
[b] DEPROT/UFRGS (Industrial Engineering and Transportation Department, Federal University of Rio Grande do Sul). Av. Osvaldo Aranha, 99, 5. andar. Porto Alegre, RS, CEP 90035-190, Brazil

ARTICLE INFO

Article history:
Received 26 December 2008
Received in revised form 16 June 2009
Accepted 27 June 2009

Keywords:
Near misses
Incident reporting systems
Performance measurement
Safety management

ABSTRACT

Near misses are well-known for providing a major source of useful information for safety management. They are more frequent events than accidents and their causes may potentially result in an accident under slightly different circumstances. Despite the importance of this type of feedback, there is little knowledge on the characteristics of near misses, and on the use of this information in safety management. This article proposes guidelines for identifying, analyzing and disseminating information on near misses in construction sites. In particular, it is proposed that near misses be analyzed based on four categories: (a) whether or not it was possible to track down the event; (b) the nature of each event, in terms of its physical features (e.g. falling objects); (c) whether they provided positive or negative feedback for the safety management system; and (d) risk, based on the probability and severity associated with each event. The guidelines were devised and tested while a safety management system was being developed in a healthcare building project. The monitoring of near misses was part of a safety performance measurement system. Among the main results, a dramatic increase in both the number and quality of reports stands out after the workforce was systematically encouraged to report. While in the first 4 months of the study – when the workforce was not encouraged to report – there were just 12 reports, during the subsequent 4 months – when the workforce was so encouraged – there were 110 reports, all of them being analyzed based on the four analytical categories proposed.

1. Introduction

The use of data from near misses in safety management has been identified as an important practice in the prevention of accidents, especially in the areas of civil aviation, the generation of nuclear power, the chemical industry and, more recently, in railroad transport and medicine (Van Der Schaaf and Kanse, 2004). It is likely that their use has emerged in industries with high levels of safety, in which accidents are rare events and have very serious consequences (Reason, 1997). In this context, it is necessary to gather information about events that are indicative of the likelihood of accidents, as is the case with near misses (Brazier, 1994; Van Der Schaaf, 1995).

As near misses are much more frequent events that accidents, they may indicate, in a proactive way, critical areas for improvement in safety management (Hinze, 1997; Jones et al., 1999; Reason, 1997; Van Der Schaaf, 1995). In addition, using near misses helps to strengthen the safety culture (Cooper, 2000; Glendon and Stanton, 2000; Jones et al., 1999), especially when workers are motivated to participate in the process of identification and analysis of those events (Reason, 1997; Jones et al., 1999). Indeed, studies in the construction (Hinze, 2002) and chemical industries (Jones et al., 1999) have indicated that accident rates tend to diminish in keeping with the rate at which the number of near misses identified increases.

However, identifying near misses is not an easy task (Reason, 1997). Some factors that hinder their being reported, from the perspective of workers, have been identified by Van Der Schaaf and Kanse (2004): (a) fear of disciplinary action, as a result of a culture that seeks to blame staff for the lack of safety; (b) the acceptance of risks, since such events are regarded as being part of the job and cannot be prevented, as well as there being a macho culture in some industrial environments; (c) lack of feedback on how information reported has been used; and (d) the perception that data collection is difficult and time consuming.

Some studies have investigated how data from near misses should be used in safety management. However, each study tends to emphasize one of the following steps: identifying near misses, analyzing data and defining actions resulting from the investiga-

* Corresponding author. Tel.: +55 51 3223 8009; fax: +55 51 3308 4007.
E-mail addresses: fabriciocambraia@gmail.com (F.B. Cambraia), saurin@ufrgs.br (T.A. Saurin), formoso@ufrgs.br (C.T. Formoso).
[1] Fax: +55 51 3308 4007.

0925-7535/$ - see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ssci.2009.06.006

tion of the events. For example, Brazier (1994), Reason (1997), Van Der Schaaf and Kanse (2004), Renshaw and Wiggins (2007) and Dekker (2007) focused on the stage of identifying these events. Bier and Mosleh (1990) addressed the analysis of near misses. The study by Van Der Schaaf (1995), undertaken in the context of the chemical industry, proposed a set of steps for the use of data from near misses: (a) detecting near misses, usually by means of voluntary reporting by employees; (b) selecting events useful for prevention, according to the quality and depth of information available; (c) analyzing the event selected using qualitative techniques from causal analysis; (d) classification according to the analysis of the causes; (e) statistical analysis of data from near misses in order to support management decision-making; and (f) assessing the effectiveness of actions implemented.

In the construction industry, the use of near misses in safety management appears to be a relatively recent practice. In a study on safety management best practices, Hinze (2002) identified their use in large construction companies in the United States, which had not been observed in a similar survey conducted previously by Liska et al. (1993). The study by Hinze (2002) also concluded that, on average, 22 near misses per project were documented and that 85.7% of construction sites recorded the identity of the workers who made reports. However, this study did not examine in depth how near misses were identified, analyzed and used to contribute to prevent accidents.

Studies on causal analysis of accidents are widespread in the literature, including in the construction industry (Hinze and Russell, 1995; Cameron et al., 2008). By contrast, despite the trends of causal similarity, there has been hardly any investigation of the nature of near misses, their different types and relative frequencies. This may reflect the difficulty of identifying them and the lack of legal requirements regarding their reporting and investigation. Moreover, there is no framework in the literature for identifying, analyzing and responding to these events.

Thus, this article proposes guidelines for identifying, analyzing and disseminating information on near misses, in order to support safety management in construction sites. In particular, analytical categories for such events are proposed, including whether or not it was possible to track down the events, their nature in terms of physical features, type of feedback to the safety management system and the risk associated with each event. These guidelines have arisen from a study involving the development and implementation of a safety management system in a construction project, which involved the construction of two multiple-floor healthcare buildings.

2. Concept and classifications of near misses

Near misses are usually referred to as precursors of accidents (Bier and Mosleh, 1990) or indicators of potential accidents when luck runs out (Brazier, 1994), thus suggesting that near misses should be interpreted as an imminent signal of accidents (Jones et al., 1999). However, these definitions are far from being precise, especially when one is seeking to differentiate a near miss from other situations, such as unsafe acts and unsafe conditions.

In this study, the authors have adopted the concept of near miss as an instantaneous event, which involved the sudden release of energy and had the potential to generate an accident. Its consequences do not result in personal injuries or material damage, but usually only in the loss of time. This concept also implies that a near miss has the potential to result in accidents with exclusively material damages.

This study also proposes that information on near misses be interpreted as being intermediary between information that is reactive and that which is proactive. On the one hand, although near misses have not led to injuries or material damage, which typically characterizes a piece of reactive information, there is a reactive feature in these events to the extent that a release of energy, typical of an accident, has already occurred. On the other hand, the proactive nature of a near miss is linked to the fact that the items of information generated allow actions to be performed, which will prevent injury or damage to property occurring in the future.

It is common to use the term near miss as a synonym of incident (Reason, 1997; Hinze, 1997). However, some authors consider that incidents include accidents, near misses, unsafe acts and conditions (Brazier, 1994; Jones et al., 1999, Van Der Schaaf and Kanse, 2004). In this article, 'incident' is an umbrella term adopted to refer to any situation in which there is a lack of safety.

It is also common for no distinction to be made between the terms near misses, unsafe acts and conditions. In this article, it is considered that the difference between these events is in the time of the action and in whether or not there has been a sudden release of energy. While in unsafe acts and conditions, the situation of risk arises from a continuous action or is latent in the environment (for example, an employee working high up who does not use a safety belt), in near misses there is an instantaneous action, which involves the sudden release of energy.

Jones et al. (1999) propose classifying near misses into two types, depending on the likely consequences of the event. The first, called extended near misses, are more serious and can give rise to an accident with consequences which extend in time and space, having an impact not only on individuals within the organization, but also on communities and the environment. In the European Union, chemical industries are required to report such events to governmental regulatory institutions, with to the aim of transferring the learning experience to other organizations.

In the second type, near misses are high risk situations that could result in individual accidents (Jones et al., 1999). According to Reason (1997), individual accidents are those to which an individual or a small group falls victim, thus showing that there may be serious consequences for those involved, but ones which have limited impact on the community or the environment. Reason (1997) suggests classifying near misses according to the type of feedback, whether positive or negative, to the safety management system. In the first case, preventive measures function as per what was planned or the worker manages to regain control. In the second case, the accident did not occur by chance, since the preventive measures did not work or did not exist.

3. Research methods

3.1. Sources of data

The data on monitoring near misses presented in this study were obtained as part of a broader study, which had the objective of enhancing a model for safety planning and control (SPC), previously developed by Saurin et al. (2004). This model for safety management has three hierarchical levels of decision-making (long, medium and short term), so that both hazards are identified and accident prevention methods defined in detailed over time, to the extent that uncertainty is gradually reduced. Every week, production managers, foremen, safety specialists and representatives of production teams hold meetings devoted to integrated planning between safety and production at the short and medium-term levels. Long-term planning is usually undertaken before the start of the project and updated throughout construction. As part of the SPC model, safety performance indicators are used to guide the actions of planning and control. In this context, near misses are a major source of information for monitoring safety performance.

The study was conducted in a construction project, which consisted of a 10 storey car park for a hospital and a 13 floor medical