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Learning from incidents – A method for assessing the effectiveness of the learning cycle

Anders Jacobsson*, Åsa Ek, Roland Akselsson

Department of Design Sciences, Ergonomics and Aerosol Technology, Faculty of Engineering, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden

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ABSTRACT

This paper describes a method for assessing the effectiveness in the steps of the learning cycle: the 1st loop with reporting – analysis – decision – implementation – follow-up, and the 2nd loop on an aggregated basis. For each step, the dimensions considered the most relevant for the learning process (scope, quality, timing and information distribution) and for each dimension the most relevant aspects (e.g. completeness and detail) were defined. A method for a semi-quantitative assessment of the effectiveness of the learning cycle was developed using these dimensions and aspects and scales for rating. The method will give clear indications of areas for improvement when applied. The results of the method can also be used for correlation with other safety parameters, e.g. results from safety audits and safety climate inquiries. The method is intended to be used on a sample of the broad range of incidents normally seen in process industry companies. The method was tested on a two-year incident reporting material from six companies from various types of process industries. It was found that the method and the tools worked very well in practice. The results gave interesting insights into the effectiveness of learning from the incidents.

1. Introduction

1.1. Background

There is currently a lot of interest in using incidents for learning for safety in many businesses, such as in the aviation industry, in medical care, and in the process industry. However, the effectiveness of learning from incidents can often be questioned, and so even in learning from major accidents (Hovden, Stoerseth, & Tinmannsvik, 2011). The explanations could be found in many of the activities from reporting to implementation and follow-up. Often the analysis of causes is a weak point. Hale (2008) claims that accident investigations often stop at events close to the accident, which usually concern only the behaviour of the hardware and of the operators/workforce directly concerned with carrying out the activity.

Incidents in this paper are "deviating events which differ from normal conditions and which could have adverse effects on safety, health or environment" (OECD, 2008). With this definition most of the incidents will have only small or no consequences at all, and very few will be major accidents.

Major accidents in the high-risk process industry are normally analysed in thorough accident investigations, but major events are rare and therefore seldom to learn from. However, there are numerous events with minor consequences or no consequences at all which, if analysed, could reveal weaknesses in the organisation and the equipment and processes, the same weaknesses that under other circumstances could lead to a serious accident (Reason, 1997). These events are the ones that the process industry must use and learn from to be able to avoid both major accidents and the many smaller incidents.

The learning from an incident involves a long chain of activities and also many employees in the organisation. No step can fail without affecting the end result. First, there is the crucial step of identifying events worth reporting. Then there is a sequence of activities, which we will call the *learning cycle* (Hale, 2008; Kjellén, 2000) – reporting, analysing, decision-making, implementing, and follow-up – to convert the experience from the incident into learning in the organisation via company systems such as procedures, training, and information.

In the process industries, the handling of incidents has been a standard procedure for many decades. Numerous administrative systems for handling incidents exist, normally computer-based and many of them on a commercial basis. In the following we will use the term *incident learning (system)* to include all activities from

* Corresponding author. Tel.: +46 30369465.
E-mail address: aj.riskengineering@telia.com (A. Jacobsson).

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reporting to implementation and follow-up of actions in connection with incidents.

However, several difficulties are associated with learning from incidents and a key question is: How much learning is accomplished as a result of reporting incidents, and especially in relation to the learning that could have been achieved if the full learning potential had been utilised? The authors have written about this in another paper (Jacobsson, Ek, & Akselsson, 2011), presenting a method for assessing the learning product – the lessons learned. There is also a need for a method by which one can assess the performance – the effectiveness – of the learning process in the different steps in the learning cycle. If weaknesses can be identified, one can direct attention and resources to those areas in need of improvement.

1.2. Objectives

The objectives of the work presented in this paper were to

- develop a method with high objectivity for assessing the effectiveness in the various steps of the "learning cycle", i.e. reporting, analysis, decision, implementation, and follow-up, yielding results suitable for
  - evaluation of areas of improvement in the incident handling as such, and
  - use in work for correlation with other safety parameters (from e.g. safety audits and safety climate inquiries).
- test the method by applying it in six organisations; and
- give examples of results from the application of the method and discuss those results.

The aim was further to base the method and its tools on the information normally given in incident learning systems of process industry companies. The focus of the method was on learning at the site. The method was intended to be used on a sample of the broad range of incidents normally seen in process industry companies.

The intention is that the method should be used primarily by companies in a self-assessment to find opportunities for improvement in learning from incidents. It is also the intention that the method could be used in research work aimed at finding correlations between learning from incidents and other safety parameters.

1.3. Theoretical foundations

The theoretical foundations for the method developed and applied in this study will be briefly presented here. In an earlier paper, the authors have written about the same topic, "Learning from incidents", but with focus on the learning product, the lessons learned. Most of the theory that was presented in that paper is applicable also in this paper, so the interested reader is advised to read there (Jacobsson et al., 2011).

In this paper we are mainly interested in the learning as a process (Argyris & Schön, 1996). With an effective learning process it is anticipated that we can arrive at learning products – lessons learned – which can be stored in the *organisational memory* and utilised by the members of the organisation when relevant (Argyris & Schön, 1996). The organisational memory consists of many things, both what is held in the minds of the individual members and what is in the files of the organisation. To exemplify the content of an organisational memory, one could use the structure of Nertney (1987) for *organisational readiness*: Personnel system (e.g. training), Plant/Equipment system (e.g. engineering standards) and Procedural system (e.g. operating instructions).

For the purpose of this work, the traditional sequential *accident model* view was chosen as the most practical, considering the material from the field objects of the study. The sequential model talks about *causes* (both *direct cause(s)* and *underlying causes*), *effects (consequences)* and *barriers*. In the current study underlying causes include *latent conditions* and *situational factors*. Sometimes there are defects in the barriers and an initiating event might propagate through all the barriers and result in a major consequence – illustrated in the Swiss cheese model by Reason (1997). Also Koornneef (2000) found that the adoption of a causal model was the most feasible approach in settings similar to the one for this study.

Most companies have a formal incident learning system where the information from incidents are handled and converted into individual and organisational learning as lessons learned for everybody concerned. This normally follows the steps in the learning cycle. The incident learning system is normally a part of a bigger information system for safety (S) and health (H), often also including environment (E). Kjellén (2000) describes a SHE information system, providing four basic functions for accident prevention: (i) reporting and collecting data, (ii) storing of data, (iii) information processing, and (iv) distributing information to decision-makers inside the organisation. In order to learn from incidents the different functions must include good information both regarding quality and detail but also regarding type of aspects around the incident such as work situation, competence, support level, procedures, stress level, technical status of equipment, and knowledge of process.

Obviously, there is a need to identify the incident as something worthy of reporting before the reporting can take place. This crucial point is discussed by Phimister, Kleindorfer, and Kuhnreuther (2003). Many process industry companies have written definitions about what should be considered as a *reportable incident*, saying something like "All events leading to a personal injury or a release of dangerous substances, or events which could have led to such results should be reported". Whether an incident gets identified as a reportable incident or not is normally decided by the employee closest to the incident, with the exception of those incidents where the effects are so obvious that they become generally known in the organisation, and will be picked up by managers. Ideally, all incidents with learning potential should be reported, leading to a low *threshold for reporting*. There will always be incidents with learning potential that are not reported in an enterprise. This "hidden number" should be as low as possible. In reality, it is necessary to strike a balance, and it is probably better for the total learning to have fewer reports properly handled, than many reports poorly handled (Freitag & Hale, 2008; Rogers, Dillon, & Tinsley, 2007).

The handling of an incident, reported in the incident learning system, should end with a lesson learned. Gordon (2008) says, "a lesson learned is an effective work practice or innovative approach that is captured and shared to promote repeat application or an adverse work practice or process that is captured and shared to avoid recurrence". This definition will be used also for this study. Koornneef (2000) also writes that learning includes the effective implementation of solutions to the problem encountered. In practical terms this normally means converting the information and conclusions regarding the incident into knowledge and modifications of the artefacts of the company – e.g. operating instructions, and design of equipment – and sometimes also leads to changes in the behaviour and attitudes and values of the company. From a practical point of view lessons learned can be classified into *levels of learning* based on geographical application, degree of organisational learning, and the time aspect according to Jacobsson, Sales, and Mushtaq (2010) and Jacobsson et al. (2011).

A *learning agency* is very important in organisational learning (Argyris & Schön, 1996), i.e. "a collection of people that makes