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Lessons learned from process incident databases and the process safety incident database (PSID) approach sponsored by the Center for Chemical Process Safety

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Abstract

Learning from the experiences of others has long been recognized as a valued and relatively painless process. In the world of process safety, this learning method is an essential tool since industry has neither the time and resources nor the willingness to experience an incident before taking corrective or preventative steps.

This paper examines the need for and value of process safety incident databases that collect incidents of high learning value and structure them so that needed information can be easily and quickly extracted. It also explores how they might be used to prevent incidents by increasing awareness and by being a tool for conducting PHAs and incident investigations. The paper then discusses how the CCPS PSID meets those requirements, how PSID is structured and managed, and its attributes and features.

Keywords: CCPS PSID; Database; Incident database; Key learnings; Major incident; Precursors; Prevent incidents; Process safety incident database (PSID); PSID; Pull down menus; Query system; Reduce risk; Leading indicators; Learn from peers; Learning value; Lessons learned; Trends; Voice of experience

1. Lessons learned from process incident databases

There are two categories of unawareness or lack of knowledge. The first is knowing that you do not know; the second is not knowing that you do not know. Although both categories carry hazards, the second category is arguably worse since it eliminates the opportunity to research, identify and react appropriately. In the world of process safety incident prevention, not knowing about potential hazards can have adverse consequences. Yet, if you know that you lack specific knowledge on a particular subject, those hazards can be managed by research and diligent follow-up. However, not knowing that you do not know about potential hazards can have catastrophic consequences. Since there is no prompt to research questions in the first place, these consequences are much more likely to happen and are more difficult to manage.

Both categories of hazards can be overcome with an effective, well-designed, and user friendly incident database. For this incident database to be effective, however, it must have the proper goals, scope, and attributes. The need for goals, benefits, and attributes of an incident database that benefits both the "aware" and the "unaware" users are discussed below.

2. Basis for need

The media love to report major incidents. The headlines they generate capture our attention in print or on the television screen. We may be an interested stakeholder with a financial involvement in the company, someone who simply lives near a facility that has an incident, or just a member of the general public—regardless, we are interested. None of us are very tolerant of events we perceive might adversely affect our daily lives, health, or livelihood. We tend to have a lower opinion of a company after it experiences a major incident than before it has experienced one. The general perception is that such companies must put profit ahead of safety or a clean environment, or that they must have poor management systems or managers for this to happen to them. Stock prices can plummet based on the perceived impact of an incident on that company's profitability. A company's franchise to operate may even be adversely

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affected by a major incident if the surrounding community is involved.

More often than not, the reason for a major incident is a combination of failures instead of a single event. Failures include management system breakdowns, miscommunications, and misunderstandings—all impacting the company's framework of process safety management programs. Precursors (leading indicators) are almost always there. Rarely does a catastrophic event result the very first time a system fails. We need to learn how to recognize the precursors/leading indicators early enough to resource preventative actions.

Major incidents, in addition to bringing the horror of an industrial catastrophe into our living rooms, make us keenly aware of what can happen when safety systems break down and things go terribly wrong. Immediately following the relief that a reported particular incident did not occur at one of their own facilities, process safety professionals usually turn their thoughts to how a similar event might occur in their company, even if there are slightly different prompting conditions. The astute professional recognizes that an analysis of a loss at another company's facility may help them understand what improvements to facilities, procedures, and programs are needed in their own company to prevent a similar occurrence. Their objective is to learn from previous incidents and losses, others or their own, so that they are not repeated. They also expect to learn enough so that the possibility of new incidents and losses, in some way associated with the same, though not identical, failure mechanisms is reduced. This analysis is a key tool in finding the weak spots, the un-addressed areas, and the easily misunderstood or misapplied parts of a company's process safety management program so that those areas can be strengthened. It does not replace an effective, well-managed suite of process safety programs but supplements them.

3. Goals

An effective database must have goals and then be structured to meet those goals. Key goals of a process safety incident database might include the following:

- prevent incidents;
- reduce the risk of incidents (reduce the probability of occurrence and/or the consequence severity of incidents) by making information available on known hazards and risks;
- function as a mechanism to learn from peers;
- capture and share key learnings from past incidents and near misses;
- educate today's workforce so that yesterday's failures are not repeated;
- help meet OSHA PSM requirements to share incident information, including root causes (without revealing source);
- provide information in a fashion that it can be found and extracted easily and quickly as needed.

Each of these individual goals when working together provides the framework for an effective database.

4. Uses and benefits [1]

A well-managed incident database with a sufficient number of meaningful incidents provides a multitude of information and resources for addressing hazards, both known and unknown. It is a listing of the things that went wrong, why they went wrong, what was done to correct them, and the type of process or equipment that suffered the failure. It is a chronology, a time-line, of events that, uninterrupted, led to the failures. It is also a road map of what can be done to interrupt that sequence of events and, thereby, prevent the incident. It is a textbook, open for review, of what not to do if you have this type of process or equipment. It is a leading indicator of possible failures in your company and may be a map of hidden hazards that would prevent incident free operation. Used to its fullest, it can be the "experience" your company does not have in the form of a seasoned engineer when designing a process or doing a process hazard analysis (PHA) by providing insightful and sometimes historical data relative to the hazards of a process or particular type of equipment. It can help your company meet the OSHA PSM requirement to use lessons learned from past incidents in PHAs and to share learnings with others outside of your company. Of course, it also can be effectively utilized as another investigator on an incident investigation team by providing the experience of history as well as a listing of possible causes for failures associated with similar processes or systems. A list of common and valuable uses might include:

- *Process hazards analysis*: A search of the database before the PHA or revalidation PHA is conducted may yield hazards the team would not otherwise recognize. This may be helpful in any of the stages of the various PHAs, such as the initial design PHA, the design-finalized PHA, the pre-start-up PHA or pre-start-up safety review (PSSR), or in a management of change (MOC) related PHA. In each of these cases, the incident database functions as another member of the review team—a member who has tremendous experience and a great memory!
- *Mechanical integrity improvements*: By matching listed equipment failures with similar types of equipment in another facility, predictions and alerts can be generated based on in-service time, mean time between failures (MTBF), chemicals handled, temperature and pressure ranges, etc. Trends can also be identified associated with certain types of equipment, manufacturers of equipment, and metallurgy of key components when used in certain services and under certain conditions. These trends can be the leading indicators needed to build an effective predictive or preventative maintenance program.
- *Operator training*: Investigation findings often point to operational errors caused by failures in training systems. Real life examples of how these failures resulted in significant losses can provide senior management the justification needed to allocate resources to improve training systems. Front line operators more readily believe that training has a basis and will be helpful to them when they are faced with an example of how a training failure resulted in an incident and injury to someone in a similar position as theirs.