Integrating Learning Into Safety

Developing a robust lessons-learned program

By Howard J. Gordon

SHARING INFORMATION is part of the human experience and is how people learn. The need to share information can be dated back to approximately 10,000 BC to 5,000 BC, when the dominant method of documenting information took the form of prewriting symbols known as petroglyphs. Found on cave walls throughout the world, many petroglyphs represent the prehistory between the Neolithic and late Upper Paleolithic eras. Experts believe that these images had both cultural and religious importance to their creators. What that was is yet to be understood.

Over the past 20 years, few safety-related incidents have been noticed by as many people worldwide as the loss of the space shuttle *Challenger* on Jan. 28, 1986, the crash of Air France's Concorde on July 25, 2000, and the loss of the space shuttle *Columbia* on Feb. 1, 2003. The losses of these highly technical and complex vehicles were shown on television and the resulting investigations, reported in various forms of media, documented the outcome of the root-cause analyses.

Each incident was the result of what Vaughan (1996) refers to as the "normalization of deviance." Before the *Challenger* explosion, the space shuttle program saw regular erosion of the solid rocket booster's O-rings; the Concorde had as many as seven incidents of tire failure resulting in damage to the underside of its wing (Covault, 2003b); and the space shuttle program saw an estimated 1.67-lb piece of low-density foam insulation fall off the external tank during ascent and strike the leading edge of the shuttle's left wing.

In August 2003, the Columbia Accident Investigation Board (CAIB) published its report documenting the events leading up to the loss of the space shuttle *Columbia.* CAIB Chair Admiral (ret.) Harold Gehman Jr. indicated that the loss of *Columbia* on reentry could not be attributed to a random event, but rather was the predictable outcome of a multiyear saga that evolved as NASA's safety program grew ineffective and embroiled with management issues (Covault, 2003b).

When reviewing the issues related to the foam on the external tank, which is managed by the Marshall Space Flight Center, and the space shuttle, which is managed by the Johnson Space Center, an editorial in *Aviation Week and Space Technology* (2003) stated in reference to these two organizations, "Each lives in a technical culture with vastly different aspirations, rules and prejudices, and often is at odds with the others, who sometimes can seem more like opponents than colleagues."

After the *Columbia* incident, NASA and the U.S. Navy (2003) conducted a benchmarking effort to review what safety systems the Navy had regarding its complex technology/high-risk nuclear propulsion program, NR, which provides nuclear reactors for submarines and surface warships, has safety programs and processes that are more rigorous than NASA's (Morring, 2003).

The level of focus on safety processes has resulted in the NR never experiencing a reactor incident. Much of this can be attributed to the fact that the "basic tenet of the NR is to make every person acutely aware of the consequences of substandard quality and unsafe conditions" (NASA & U.S. Navy). Part of the focus on safety is to ensure adherence to written procedures with any needed deviations from nor-

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mal practices requiring "careful, thorough, formal and documented consideration" before an operational waiver can be issued.

Lessons Learned

Since publication of the CAIB report, many SH&E professionals have reexamined safety and cultural processes within their organizations from a different perspective and have begun to ask questions about the safety culture. These questions include the following:

- Do we have methods and processes in place to capture safety-related learning?
- Do we have systemic issues with communicating significant safety information throughout our organization?
- Are we using the lessons we should be learning from incident investigations inside the organization to prevent the recurrence of significant safety incidents?
- Do we have an effective lessons-learned process that can disseminate learning from abnormal events and from the integration of best practices obtained from internal and external sources?

Manuele (2004) reviewed causal factors leading up to the *Columbia* incident along with relevant excerpts from the CAIB report. The CAIB report became a touchstone for companies and organizations within the U.S. and around the world to understand issues associated with large, complex organizational cultures related to safety.

The U.S. Department of Energy (DOE) was one of the organizations that analyzed the CAIB report closely as many sites within the DOE organization involve complex technologies and high-risk activities (DOE, 2005). DOE has a complex-wide lessons-learned program that provides learning from off-normal events as well as from the implementation of best practices.

A lesson learned can be defined as information that has a real or assumed impact on operations; valid in that it is factually correct; and applicable in that it identifies a process or decision that reduces or eliminates the potential for the recurrence of an incident or reinforces a positive result. Another way of defining a lesson learned is as 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.

The concept of integrating safety-related learning into an organization's operations has become a component of many world-class safety programs. Companies such as International Paper, Shell Oil, Merrick & Co., MACTEC Inc., Kodak, British Nuclear Fuels plc, ConAgra Foods, Energy Solutions and Bechtel have methods to formally capture and share learning within their organizations.

An analogy between lessons learned and a bank helps one visualize the integration process. Knowledge in the form of learning is withdrawn from the bank before performing work. Once the work is complete, new knowledge learned while performing the work safely is deposited into the bank to be used by the next project that will perform a similar task (Collison & Parcell, 2001).

Learning from incident investigations that focus on determining root causes can develop into effective safety-related best practices. The process of learning should be a principal component of an organizational safety culture committed to continuous improvement. Although OSHA's Voluntary Protection Programs (VPP) do not specifically call for participants to have such a program, the implementation of one clearly addresses the need to "provide recommendations to prevent recurrence" of incidents and to provide the results of incident investigations to employees (OSHA, 2003).

Best practices can become a cornerstone of a company's efforts to ensure continuous improvement of the SH&E management system—a comprehensive collection of policies, programs and procedures that provides the methods and processes to ensure the safe operation of work and to meet both regulatory and industry standards.

An effective lessons-learned

Abstract: *Incident investigation is a critical component of most safety management programs. Sharing applicable facts and corrective actions defined by the incident investigation process ensures that continuous learning can be integrated into existing operations. When properly integrated, this learning can improve an organization's overall safety performance. Best practices also provide opportunities for organizational learning and improvement. This article examines how a lessons-learned program can help improve an organization's safety performance.*

Figure 1

How Incident-Derived Learning Is Integrated Into Organizational Safety Program

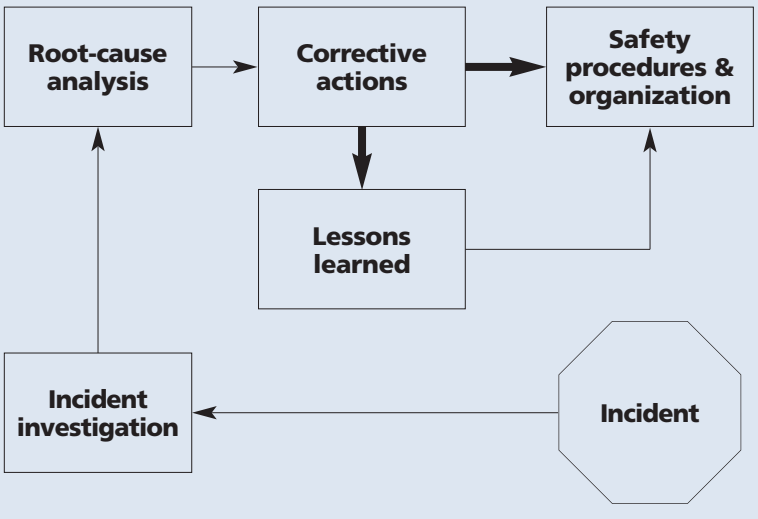
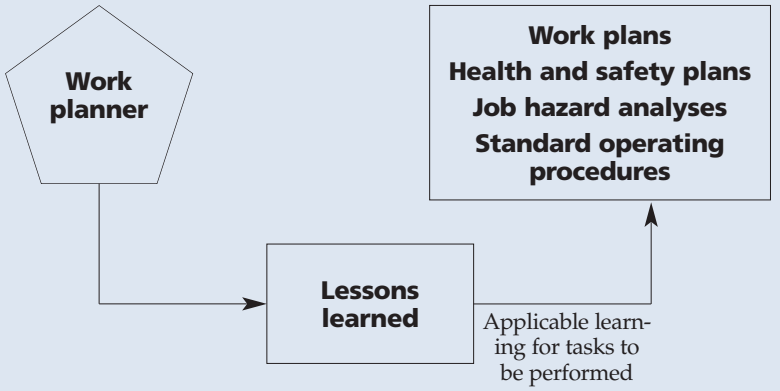


Figure 2

How Learning Is Integrated Into Work Plans



program has two major components: 1) capturing lessons and 2) sharing lessons within the organization so that the right people receive and incorporate applicable learning into their operations and activities. Figures 1 (p. 31) and 2 illustrate these two processes. Both components require established lines of communication for learning from internal and external sources, as well as allowing the flow of learning (so-called learning nuggets) to those individuals who can best use and implement it.

For a lesson to be of value, learning must come from the root-cause analysis of the event and reflect how corrective actions will be implemented to prevent recurrence. These facts facilitate learning by documenting what happened and describing how the root causes were addressed. This learning can then be integrated not only by operations that are directly similar but also by operational activities with the potential for similar events.

Capturing Lessons

Content for generating lessons learned related to specific aspects of a company's activities as well as general learning should come from internal and external sources such as:

- personal experiences;
- field activities;
- incident reports and investigations;
- self-assessments, audits and appraisals;
- safety meetings;
- evaluation of training practices;
- training evaluations;
- OSHA safety-related information;
- postjob debriefs;
- project planning and evaluation results;
- safety performance metrics and trending results;
- performance improvement initiatives;
- work planning;
- critiques, analyses and investigations;
- process improvement initiatives;
- safety-related journal and newspaper articles;
- external meetings.

The sources for learning are extensive and must be applicable and relevant to a given organization and its activities. Once the learning nuggets have been defined, they can be developed into a format that is easily prepared with the appropriate level of detail to capture the learning. DOE uses a time-tested format that provides the most amount of information with the least amount of effort for the author while offering users knowledge needed to 1) determine its applicability to their activities; 2) understand the origin of the learning; 3) establish how the learning can be used; and 4) categorize the significance of the learning to the safe conduct of work or the implementation of a best practice.

Writing a Lesson Learned

Preparing a lesson that will be read and integrated into operations requires that the reader quickly and easily find what s/he is looking for. Before beginning to craft the lesson learned, the author should consider the following:

- Who is the audience?
- Is this important?
- How will the information be used?
- Is the information preliminary or conclusive?
- Can the information be validated for factual accuracy?
- Do I want the reader to take any specific actions?
- Can the lesson be used immediately and does it have long-term use as a historical document?

Whether using the format discussed in the next section or one developed for site-specific circumstances, it is important to avoid information overload. The lesson should represent a synthesis of facts generated by an incident investigation or newly defined best practice. General factors to consider include the following:

- Use the reader's language and avoid technical language. Do not assume that the reader knows the terminology and acronyms.
- Do not use inappropriate slang.
- Write in conversational language using active verbs.
- Avoid long or cumbersome sentences.
- Ensure that objects and pronouns are clear.

Crafting the Lesson

Based on the DOE's lessons-learned program—which encompasses more than 1,700 published safety-focused lessons and feedback from many users—an abridged version of a lessons-learned format follows. This model calls for the following elements:

- **title** of the lesson;
- **date** the lesson was issued;
- **identifier** that is unique to provide reference back to the lesson;
- **learning statement** that provides an executive summary of the learning gained;
- **analysis** that documents findings of the incident review;
- **recommended action(s)** implemented to prevent recurrence;
- **significance descriptor** to identify a level of significance of the learning;
- **work function(s)** where the learning can be applied;
- **hazard(s)** defined and discussed in the lesson;
- **contact information** so the reader can, if needed, learn details that were not published with the lesson.

Sharing Learning

The capturing phase of an effective lessons-learned program allows an organization to document best practices, root causes and implemented corrective actions that result from internal and external incident investigations. These learning nuggets can then be used by work planners to help develop health and safety plans, job hazard or safety analyses, and standard operating procedures. Putting this learning into a format that can easily be digested and used represents the second phase—sharing. DOE uses the format described earlier across its operations. While no single practice fits every organization, the DOE format represents a best practice.

In 2002, the General Accounting Office evaluated how NASA shared learning within its organization. The directive to examine this process was issued by the House Subcommittee on Space and Aeronautics after two failed satellite missions to Mars—the Mars Polar Lander and the Climate Orbiter.

One factor that negatively impacted NASA's ability to share learning was that "it is difficult to weed through all the irrelevant lessons to get to the few 'jewels' that you need to find" (GAO, 2002). It was also determined that the agency's lessons-learned program was difficult to search because of the inconsistent quality of information contained in the database, including a general lack of best practices.

Various methods can be used to facilitate the distribution of lessons learned within an organization. Sharing lessons learned with the right person helps to ensure that they will be used. Lessons-learned systems that use e-mail distribution allow users to subscribe to specific or general areas of learning based on their job duties and responsibilities. Safety professionals, plant managers, project managers and other functions can receive organizational learning via e-mail on subjects specific to their needs based on the type of hazards, operational activities or other category of information.

To ensure that lessons are beneficial, well written and applicable to the organization's needs, many systems have gatekeepers, one or more people who review the content of each generated lesson before it is distributed. If a lesson does not meet the organization's standards, it is 1) revised, 2) returned to the original author to be rewritten or 3) rejected.

Currently, DOE provides limited access to its online lessons-learned database. To apply for access, visit www.hss.energy.gov/CSA/Analysis/DOEll/reqProfile1.asp. Access to some of NASA's lessons learned is available at http://ildp.nasa.gov/offices/oce/llis/home.

Conclusion

Any SH&E process must be supported by an organization's leadership, formal documentation must be developed and implemented in the form of policies, programs and/or procedures to ensure the process is used, and performance metrics must be developed and shared to monitor the implementation, use and effectiveness of the process. Safety-related lessons learned can lead to continuous improvements in the safety management system. A fully functioning lessons-learned program can help ensure continuous learning associated not only with safety, but also with other organizational activities. ■

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