



Key lessons from incidents related to audits

Introduction

Process safety management auditing is a process of systematic examination to assess the extent of conformance with defined standards and recognised good practice and thereby identify opportunities for improvement. It is important that organisations seek assurance of the processes and operations, rather than reassurance that everything is ok. This issue addresses how audit findings failed or audits failed to address certain aspects in operation and/or were not followed up, which eventually contributed to the incident.

Case 1 – Oil refinery

On March 23, 2005, a series of explosions occurred at an oil refinery during the restarting of a hydrocarbon isomerisation unit. During the start-up, operations personnel pumped flammable liquid hydrocarbons into the raffinate splitter tower for over three hours without any liquid being removed (as opposed to what was in the written procedures). Critical alarms and control instrumentation provided false indications that failed to alert the operators of the high liquid level in the tower. Consequently, unknown to the operations crew, the tower was overfilled and liquid overflowed into the overhead pipe at the top of the tower. As a result, the blowdown drum and stack was overfilled with flammable liquid, which led to a geyser-like release out of the stack. The released liquid evaporated as it fell to the ground and formed a flammable vapour cloud that found an ignition source and exploded. Fifteen people were killed and 180 others were injured with major damage caused to the unit and the adjacent plant and equipment.

Key findings – audits revealed urging issues

Years prior to the tragic explosion there were many occasions where internal studies revealed serious concerns about the potential for a major incident due to the large number of hydrocarbon releases; over 80 in the 2000-2001 period and the findings were communicated to the company management. Further audits between 2002 and 2004 and studies highlighted “*inadequate level of hazard awareness and understanding of process safety and lack of early warning system for process safety exposures*”. Between 1994-2004 eight serious blowdown drum incidents occurred and these events were not effectively reported or investigated. External audits, one in 2003 and another in 2004 indicated the insufficient incident investigation system in place. In 2003, the unit HAZOP revalidation missed addressing previous incidents with catastrophic potential. Other findings from an external ISO14001 audit revealed that “*by not robustly addressing issues identified through inspections and audits, and ensuring that a preventative element is included in the corrective action, management is not taking advantage of the opportunity to prevent undesirable outcomes*”. An internal report a few months prior to the explosion pointed out that safety was not a priority and that may result in casualties in the foreseeable future, within 12-18 months’ time.

Case 2 – Chemical manufacturing plant

On November 15, 2014, approximately 11 tonnes of highly toxic methyl mercaptan was released from an insecticide production unit of a chemical manufacturing facility. The release took the lives of three operators and a shift supervisor inside the building as a result of the combination of asphyxia and acute exposure (by inhalation) to methyl mercaptan. For several days leading up to the leak, operations personnel attempted to clear blocked piping outside of the manufacturing building. Two workers went to drain liquid from piping inside the building as a routine operation believing it was an unrelated pressure problem. Instead, it was related to the clearing activities. Liquid methyl mercaptan drained from the piping and filled the manufacturing building with toxic vapour.

Key findings – audits missed urging issues

An external audit in 2007 identified the existence of the methyl mercaptan detection system but did not evaluate whether this system could effectively protect workers by warning them of potentially toxic environments. It found the detection system to be in conformance simply because it existed. During the incident, methyl mercaptan detectors were alarming; however, the system did not signify an early release of methyl mercaptan, because the alarms were set above the ceiling limit set by standard and they were not communicated to personnel. An effective audit would identify such gaps in the system but in this case, it did not pick up the problem. One third-party audit and six self-audits were completed between 2007 and the date of the incident. None of these audits identified or effectively corrected the many serious and long-standing process safety deficiencies at the site. The investigation revealed, that the Responsible Care external auditors have short amount of time to analyse significant matters, and that could potentially limit the scope and depth of any audit. At the same time, the site completed process safety management compliance audits between 2012 and 2014, which lasted five times longer than a Responsible Care one. However, not even these audits were sufficient to identify and resolve process safety management deficiencies that contributed to the incident.



The ISC believes that leadership across six key functional elements is vital to achieve good process safety outcomes. These elements are:

- systems & procedures
- engineering & design
- assurance
- knowledge & competence
- human factors
- culture

In the *What can I do* section below you can see how each of these elements plays a part.

Figure 1: The ISC Framework

What can I do?	
Management	
● ●	<ul style="list-style-type: none"> Establish a robust audit program and develop process safety metrics, both lagging and leading to check the health of the audit system.
●	<ul style="list-style-type: none"> Understanding the health of an organisation's process safety management system, requires a comprehensive assessment of the content and implementation of its programs.
●	<ul style="list-style-type: none"> It is proposed that the audit should be carried out every five years. That ensures that some of those involved in the previous audit are still around and continuity has not been lost completely.
● ●	<ul style="list-style-type: none"> Make sure that corrective actions meet the intent of the recommendations.
● ●	<ul style="list-style-type: none"> It is a good practice to respond to the auditor's report, including an action plan for addressing agreed non-conformances and other observations made by them.
● ●	<ul style="list-style-type: none"> Make sure that the audit program identifies complex issues in the facility and ensure that corrective measures are taken.
● ●	<ul style="list-style-type: none"> It is key that action items are tracked and effectively closed. Therefore, make sure to develop an effective system to verify that recommendations from audits are satisfactorily addressed.
●	<ul style="list-style-type: none"> Make sure that the safety report or safety case provides a description of auditing activities carried out on site.
●	<ul style="list-style-type: none"> Make sure that the resources and competent personnel required for each audit are planned and available.
●	<ul style="list-style-type: none"> Auditors need to possess a range of skills from auditing skills and the technical knowledge and experience of plant and process safety and specific technologies.
Process Engineer/Supervisor/Auditor	
● ●	<ul style="list-style-type: none"> Make sure that you follow the audit protocols such as the use of questionnaires, checklists, open and structured interviews or checking documents and measurements and observations.
● ●	<ul style="list-style-type: none"> During audits, make sure to focus on actual practices, such as that operators follow operating procedures and adhere to the rules.
● ●	<ul style="list-style-type: none"> It is important that findings from the audit are recorded and submitted to the management for corrective actions if any non-conformances are found.
● ●	<ul style="list-style-type: none"> Make sure to write down all negative and positive feedback from the audit as these can be used as metrics to assess the health of the process safety management system in the company.
● ●	<ul style="list-style-type: none"> If you use checklist, each checklist calls for a list of action items. Such a list is only of service if the required action is taken or good reasons for cancelling it are documented. There needs to be a follow up procedure to ensure that this happens.
● ●	<ul style="list-style-type: none"> Make sure to be familiar with results of previous site audit findings.
● ●	<ul style="list-style-type: none"> During the audit, emphasise openness of the process and discuss concerns as they are identified.
●	<ul style="list-style-type: none"> Look for patterns or trends which indicate chronic problems affecting multiple areas and identify common themes.
Operator	
● ●	<ul style="list-style-type: none"> When being audited, make sure you provide the auditors with all information about your work and any issues or difficulties that you may face. An audit is about the process, not you as an individual.
● ●	<ul style="list-style-type: none"> Make sure to follow operating procedures and if you discover any inconsistency in the procedures, be open about it to the auditor.
●	<ul style="list-style-type: none"> Make sure to report any major concerns to your supervisor immediately, in order to make sure that these issues are addressed.