ELSEVIER

Journal of Hazardous Materials 142 (2007) 574–581

Journal of Hazardous Materials

www.elsevier.com/locate/jhazmat

Keys to effective third-party process safety audits

John C. Birkmire [a,*], James R. Lay [b,1], Mona C. McMahon [c,2]

[a] *Tourgee and Associates Inc., 11459 Cronhill Drive, Suite A, Owings Mills, MD 21117, USA*
[b] *5644 High Tor Hill, Columbia, MD 21045, USA*
[c] *General Physics Corporation, 6095 Marshalee Drive, Suite 300, Elkridge, MD 21075, USA*

Available online 27 June 2006

Abstract

The Occupational Safety and Health Administration's (OSHA's) Process Safety Management (PSM) regulation was promulgated in 1992. The U.S. Environmental Protection Agency's (EPA's) corresponding Risk Management Program (RMP) rule followed in 1996. Both programs include requirements for triennial compliance audits. Effective compliance audits are critical in identifying program weaknesses and ensuring the safety of facility personnel and the surrounding public.

Large companies with corporate and facility health, safety, and environmental groups typically have the resources and experience to conduct audits internally, either through a corporate audit team or the sharing of personnel between multiple facilities. Small to medium sized businesses frequently do not have the expertise or the resources to perform compliance audits, and rely on third-party consultants to provide these services.

This paper will discuss the observations of the authors in performing audits and working with PSM/RMP programs across a number of market sectors (e.g. chemical, petrochemical, pharmaceutical, food and beverage, water treatment), including effective practices, hurdles to successful implementation and execution of programs, and typical program shortcomings. The paper will also discuss steps to improve the audit process and increase effectiveness whether performed by a third party or internally.

Keywords: Third-party; Audit; PSM; Safety; Compliance

1. Introduction

The management of safety and risk represents a tremendous and ever changing challenge for industry. In recent years, a number of catastrophic accidents in industry have drawn attention to the safety of processes involving certain regulated substances.

The Occupational Safety and Health Administration's (OSHA's) Process Safety Management (PSM) regulation was promulgated in 1992 to address process safety concerns. The U.S. Environmental Protection Agency's (EPA's) corresponding Risk Management Program (RMP) rule followed in 1996. Several states have also enacted similar programs. These process safety regulations include requirements for triennial compliance audits.

The process safety regulations are performance based, and quite non-prescriptive. The compliance audit requirement in OSHA 29CFR1910.119(o), Process Safety Management of Highly Hazardous Chemicals [1], is presented in Fig. 1. Requirements under the RMP rule and state programs are similar.

Effective compliance audits are critical in identifying program weaknesses and ensuring the safety of facility personnel and the surrounding public. Properly conducted compliance audits can also reduce the risks of serious compliance problems during OSHA or EPA inspections.

Large companies with both corporate and facility environmental, health, and safety (EH&S) groups typically have the resources and experience to conduct audits internally, either through a corporate audit team or the sharing of personnel between multiple facilities. Small to medium sized companies frequently do not have the expertise or the resources to perform compliance audits, and rely on third-party consultants to provide these services.

Since compliance audits are required, the question is not "Is this necessary?" but "How can this process be utilized to maximize the return on investment?" for safety and financial considerations.

* Corresponding author. Tel.: +1 410 356 3108x239; fax: +1 410 356 3109.
E-mail addresses: jbirkmire@taiengineering.com (J.C. Birkmire), jim.lay21045@gmail.com (J.R. Lay), mmcmahon@gpworldwide.com (M.C. McMahon).
[1] Tel.: +1 443 472 6768.
[2] Tel.: +1 410 379 3673.

0304-3894/$ – see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.jhazmat.2006.06.065

29CFR1910.119(o) Compliance audits
(1) Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed
(2) The compliance audit shall be conducted by at least one person knowledgeable in the process
(3) A report of the findings of the audit shall be developed
(4) The employer shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected
(5) Employers shall retain the two (2) most recent compliance audit reports

Fig. 1. OSHA's PSM compliance audit requirements.

Effective audits will seek not only to ensure compliance with the regulations but to identify areas for improvement. Audits can identify ineffective or wasteful policies and practices. This is especially important in today's operating environment of "better results with fewer resources".

The audit process involves three main steps:

- planning;
- performance;
- follow-up.

2. Audit planning

The first phase in the audit cycle is planning. Failure to adequately plan an audit reduces the efficiency of the audit and will necessitate either a longer audit period or a less comprehensive review. Good organization and preparation are critical in performing a successful audit.

Planning discussions should be initiated approximately 2 months prior to the audit. The audit should be scheduled far enough in advance to ensure that key facility personnel can be made available to the audit team.

Coordination between the third party auditor and the facility is essential in the planning phase. Audit planning responsibilities include the following:

- Facility
  - designating a facility point of contact;
  - providing pre-read materials;
  - establishing the audit schedule (shared).
- Auditor
  - organizing the audit team;
  - providing the audit protocol;
  - establishing the audit schedule (shared).

2.1. Facility point of contact

The point of contact (POC) is responsible for coordination of the audit schedule, daily communication with the auditors, and logistical concerns such as auditor workspace. Audits performed without a POC or with multiple POCs will invariably be beset by communication issues and schedule breakdowns, sharply reducing the audit's effectiveness.

The POC does not need to be well-versed in all elements of the process safety program but should have a general understanding of the facility, processes, and program elements. More importantly, the POC should be able to direct the auditors to the proper personnel to discuss items in detail. The POC is responsible for ensuring that personnel are available as needed during the process.

2.2. Pre-read materials

The facility should provide pre-read materials to the audit team ahead of the scheduled audit. This material should include:

- process safety program policies and procedures;
- covered process system descriptions/process flow diagrams (PFDs);
- sample operating procedure;
- sample process hazard analysis (PHA);
- previous compliance audit.

This information can generally be e-mailed or copied to electronic media for transmittal, as the quantity of material can be considerable, even for small facilities. Sample materials are best selected by the auditors from a complete list of available procedures/PHAs. These should be chosen randomly to obtain a representative sample.

A review of these pre-read materials will provide the audit team with a basic background on the facility operations and process safety program. Reviewing this information ahead of time facilitates a more focused audit and allows the auditors to ask directed questions. The auditors will also be able to use this information to confirm that actual practice conforms to the documented procedures.

2.3. Organizing the audit team

The number of audit team members is dependent on the size and complexity of the facility. A two person team is usually sufficient for most small to medium sized facilities. For small facilities with a basic covered process, a one person team may be adequate. However, the audit process will generally benefit from multiple perspectives of at least two team members.

The audit team should assign a lead auditor. This person will have experience, knowledge, and training in the performance of audits and the process safety standards. The lead auditor will coordinate responsibilities with the other team members and coordinate schedule and other details with the facility POC. At least one member of the team must be knowledgeable in the process (this may be a facility resource). The team may also include an auditor-in-training.

2.4. Audit protocol

Many larger companies have established audit protocols and guidelines. The same is true for process safety consultants providing these services. The EPA has compiled a guidance document "Guidance for Auditing Risk Management Plans/Programs under Clean Air Act Section 112(r)" [2]. Similarly, OSHA has issued the directive "CPL 02-02-045-CPL 2-2.45A CH-1-Process Safety Management of Highly Hazardous Chemicals—Compliance Guidelines and Enforcement Procedures" [3]. The checklists provided in these documents can serve as the basis for the audit or used as supplemental aids.

Audit checklists are excellent tools for ensuring that all required components of the process safety program are covered. They are not a panacea, however, and the value of the audit is still largely determined by the skill and experience of the auditors. The audit team should be able to call on their background knowledge and training to identify exemplary areas that do not require further attention and potentially weak areas that should be examined in more detail.

As an example of proper use of the checklist, consider the Mechanical Integrity requirement that inspections and tests on process equipment follow recognized and generally accepted good engineering practice for inspection and testing procedures. As part of this checklist item, the auditor should consider the inspection code(s) followed, type of inspection method(s) used, number and locations of measurements collected, qualifications of the inspector, and other related items.

The completed checklists serve as documentation of the audit process, an important consideration should the validity of the audit be questioned. The facility will be able to demonstrate that all required program elements were examined through a systematic approach.

2.5. Audit schedule

An audit schedule should be prepared ahead of time and distributed to facility personnel, preferably at least 2 weeks before the audit. The schedule should not be inflexible, but used as a guide. Flexibility on the parts of the facility and the audit team is required for an effective audit. Facility personnel should be made available to the auditors but unforeseen circumstances will invariably arise that will require a reshuffling of the schedule. Additionally, some program elements may be satisfactory, while other may require a more in-depth look (and more time).

A list of positions or functional areas to be interviewed should be prepared by the audit team and presented to the facility. With small to mid-sized facilities, some of these positions will be handled by the same person.

The primary process safety program coordinator and anyone with responsibility for a particular program element should be interviewed. Additionally, the following roles should be included, at a minimum:

- engineering manager;
- process engineer;
- operations manager;
- maintenance manager;
- health safety and environmental manager(s);
- training manager;
- storeroom clerk;
- operator (2);
- maintenance trades (2);
- contractors (2).

The latter three should not be scheduled but selected at random during the audit to ensure a representative sample is achieved.

The duration of the audit is dependent on several factors, including the following:

- size of the facility;
- number of covered processes;
- size of the audit team;
- current status of the process safety program.

For example, small municipal water treatment plants or food and beverage sites covered due to ammonia refrigeration systems can be thoroughly audited by a two person team in two on-site days. Small to mid-sized chemical plants can generally be audited by a two person team in 3–4 days.

3. Audit performance

Proper preparation is important in successful audits, but even good planning cannot overcome poor performance of the audit team. Poor performance can include failure to:

- address all required elements;
- understand the facility operating environment;
- include all personnel with key responsibilities, including hourly employees;
- perform adequate spot checks.

It is important to remember that an audit is just that. The goal is not to review every detail of a program, but to evaluate representative samples of the program's implementation to establish the effectiveness in complying with the regulations. Areas found to be potentially deficient can be followed up on to more clearly resolve the extent and source of compliance problems.

The following steps are part of a successful audit:

- kick-off meeting;
- salaried employee interviews;
- hourly employee and contractor interviews;
- documentation spot check;
- field spot check;
- close-out meeting.

3.1. Kick-off meeting

On the morning of the first day of the audit, a kick-off meeting should be held with key stakeholders. The purpose of this meeting is to discuss audit goals, schedule, and resources. The

meeting should include the facility manager, POC, department heads, and the audit team.

The kick-off meeting should be followed by a facility tour to orient the audit team to the facility and processes.

3.2. Salaried employee interviews

Interviews should be conducted with salaried employees with direct responsibility for one or more of the process safety program elements. Additional interviews should be conducted with personnel key in executing program requirements (e.g. process engineer). Interviews should be scheduled ahead of time to ensure interviewee availability. The interview length will vary depending on the element(s) covered. Basic elements such as Hot Work can be covered in one half-hour or less. One hour is generally sufficient to cover most elements. Elements such as Mechanical Integrity may take longer than 1 h, or require multiple interviews.

3.3. Hourly employee and contractor interviews

Operators and maintenance personnel are valuable sources of information during audits and should not be overlooked. They are intimately involved in the day-to-day operations and their understanding and execution of process safety requirements are crucial in the success of any program.

These interviews should not be scheduled ahead of time and interviewees should be selected at random to provide a realistic perspective. At least two operators should be interviewed, preferably one with extensive experience and one relatively new to the position. It is also advisable to select operators on different shifts. This may not always be possible, but the diversity in operator perspectives is desirable.

Similarly, at least two maintenance tradespersons involved in work on covered processes should be interviewed. The same logic applies to selecting these interviews (e.g. a pipefitter and an instrument technician).

The employee may be nervous about the prospect of talking with the auditor and may be hesitant to provide negative feedback if they sense that it will be traced back to them and there might be punitive consequences. The auditor should first discuss the purpose with their supervisor and explain the importance of honest feedback. These interviews should be conducted in private without the presence of facility management.

The auditor should hold an open discussion to allow the employee to talk freely and then ease into specific questions. Conversations should be limited in duration, especially if the employee is being made available during their break. Fifteen to 20 min is generally sufficient time to conduct the interview.

Contractors should not be overlooked in the audit process. Process safety incidents frequently occur during shutdowns and turnarounds where contractors are heavily utilized. The same procedure for hourly employees applies to contractors. At least one contractor that frequently performs work for the facility and one contractor that occasionally provides services should be interviewed.

Contractors may not be on-site during the audit. If this occurs, arrangements should be made with the POC to conduct phone interviews.

3.4. Documentation spot check

The amount of documentation required for process safety programs can be quite substantial. It is impossible (and unnecessary) to review all documentation in detail. If issues are raised during a spot check that indicate a potential systemic issue, these should be followed up on as time allows or reported as an area for follow-up by the facility. Good judgment is essential in determining how much time to invest in follow-up during the audit.

Documentation may be maintained in one central location or may be located in multiple areas around the facility. Regardless of their location, the documents requested should be quickly and directly retrieved by facility personnel—regulatory personnel will expect this and failure to quickly locate requested documents is a "red flag" for the audit team. Some of the required documentation should be reviewed ahead of time as part of the pre-read material. Additional documents to spot check include:

- hazard assessments;
- process safety information;
- PHAs;
- equipment files;
- inspection and test results;
- hot work permits;
- training records;
- operating procedures;
- management of change records;
- incident investigations;
- emergency response plan.

3.5. Field spot check

Piping and instrumentation diagrams (P&IDs) and equipment files should be spot checked in the field to verify their accuracy. Two to three randomly selected moderately detailed P&IDs of covered processes are generally sufficient for a spot check. Minor discrepancies between P&IDs and the field should be expected. However, major errors may indicate larger systemic issues related to document control and management of change.

When performing the field walkthrough, the auditors should also observe the "state of the facility". This includes general housekeeping, evidence of non-destructive examination such as inspection ports, equipment numbering, flexible hose storage and maintenance, and similar items.

While observations in the field may not necessarily reflect noncompliance with regulatory requirements, the observations are good indicators of the general facility commitment to operational excellence and safety, and can identify areas for follow-up. For instance, unlabeled tanks increase the learning curve and the likelihood of errors for operations and maintenance. This should be discussed as part of the training element. Field checks also provide an excellent opportunity for identifying siting issues that can be referenced when checking PHAs.

The POC should be alerted to any unsatisfactory conditions identified in the field that require immediate attention.

3.6. Close-out meeting

On the afternoon of the last day of the audit, a close-out meeting should be held with key stakeholders. The purpose of this meeting is to discuss the performance of the audit and preliminary findings. The meeting should include the facility manager, POC, department heads, and the audit team. It should be noted that the findings are preliminary. Findings should be communicated throughout the audit process so that there are no surprises at the close-out.

The auditors must remain impartial during the process. Results should be expressed objectively. Auditors should be flexible in considering additional information that they did not uncover during initial interviews but should not bow to pressure to alter findings if not warranted.

4. Audit follow-up

Preparing for and conducting audits requires a significant amount of effort on the parts of both facility personnel and the audit team. Failure of the audit team and the facility to adequately close out the audit will negate much of the value of the audit and limit its effectiveness. Follow-up includes the following:

- fact checking;
- report finalization;
- resolution of findings.

4.1. Fact checking

Questions posed by the audit team should be answered by the facility to the extent possible during the audit itself. There may be some items that require follow-up after the audit, especially if key facility individuals were unavailable due to unforeseen circumstances. The facility should respond promptly to the audit team requests.

There may also be some issues that require clarification by the audit team to finalize the audit findings. Follow-up may require researching OSHA and EPA interpretations and clarifications and other sources of best practices if there is uncertainty or dispute on a particular finding. These items should also be addressed promptly following the audit. If this proves to be impossible, the issue should be included in the audit report for facility or corporate follow up. The audit team should not remove findings from the final report based on actions taken by the facility since the completion of the audit.

4.2. Report finalization

Preliminary findings are prepared for presentation in the close-out meeting and these findings are confirmed or modified as necessary in the fact checking phase. The findings, including areas of compliance and non-compliance as well as possible recommendations to improve program effectiveness, should be compiled into a formal document to present to facility management for review and approval.

Findings and recommendations should be stated objectively and their basis should be provided. Recommendations not required for regulatory compliance should be differentiated. The report should also document the audit team's qualifications and the audit methodology used. Certification of the audit, including signature and date, must be made by a responsible person, generally the lead auditor.

4.3. Resolution of findings

Resolution of the audit findings is the facility's responsibility. Findings must be addressed "promptly". This topic is discussed further below. A priority scheme for addressing findings is critical in ensuring that those with highest priority are considered first. The priority scheme should establish deadlines for addressing items, and the deadlines should be enforced. If a deadline cannot be met, the reason for the extension and the new deadline should be documented and signed off on by facility management. If previous audits have had poor follow-up, the importance of timely resolution of audit findings should be stressed in writing the final report.

A number of other program elements generate action items, and the same tracking system used for these action items may be used to track audit findings to conclusion. Facilities may disagree with audit findings and choose not to implement recommendations. Regardless of the decisions made, resolution of findings and timely implementation of corrective actions is extremely important. Findings often reappear on subsequent audits with no evidence of any consideration or progress. Proper tracking and documentation can avoid these "repeat offenses".

5. Typical process safety program pitfalls

Each facility's process safety program will be different. Even facilities in the same company and division operate in unique environments. However, all programs must meet the minimum requirements for regulatory compliance.

Each audit will also be unique, although the basic framework and steps should be the same. However, despite the differences in approaches to process safety found across facilities and industries, the same program shortcomings are often found.

Ten of these common shortcomings are listed in Fig. 2 and discussed below (in no particular order). Note that some of the discussion below addresses areas not necessarily required by the regulations but that may improve the effectiveness of process safety programs.

5.1. Undocumented program scope

A fence-to-fence approach for compliance with the process safety regulations is not practical for all but the smallest facilities, and has generally been abandoned in favor of a more effective process-based approach. Programs can include PSM/RMP covered processes, as well as other processes representing significant safety hazards. Facilities often reserve the right not

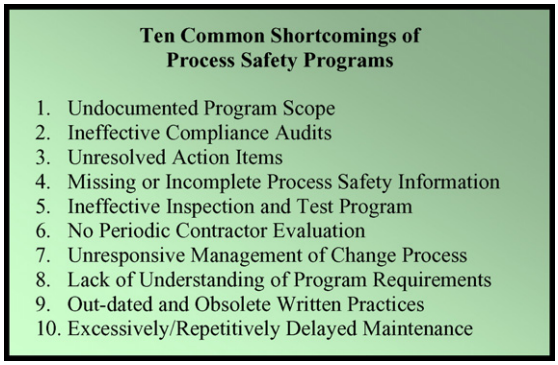

Fig. 2. Typical PSM/RMP program shortcomings.

to apply the same level of scrutiny to non-PSM/RMP covered systems. Program scope is a critical element in process safety program implementation, but is frequently undefined or poorly documented.

A clearly defined program scope is strongly recommended as an aid to OSHA and EPA inspectors, as well as to facility employees, in understanding the limits of coverage under PSM and RMP. This will greatly reduce confusion. The scope can be discussed in an overall program "governing document" and covered processes may also be shown visually on a plot plan. The rationale for selecting covered processes should be documented, including the use of any allowed exemptions.

While not specifically required within the regulations, it is much harder to defend a program that has no written basis. This is especially important in processes where there is no clear break between covered and non-covered sections. It is important that the transitions to non-covered processes are appropriate and well documented. The justification for determination of covered processes should be solid (e.g. could a process upset result in a hazardous condition downstream of the covered process boundary?). The "break" points with systems such as non-company owned pipelines should be clearly defined.

5.2. Ineffective compliance audits

As discussed above, triennial compliance audits are required as part of the regulations. Audits can be time and resource consuming, especially for smaller facilities where personnel fulfill multiple roles in the process safety program framework, and audits can be disruptive of ongoing operations. While this resource and time requirement may be burdensome, audits can provide critical feedback on the strengths and weaknesses of a program. Some keys to a successful audit are discussed above.

Unfortunately, audit reports are often filed and forgotten. A cycle of program enhancement initiatives followed by a 3-year slide into inefficiency and ineffectiveness can result. It is management's responsibility to ensure effective follow-up on audit findings and to prevent program slippage between audits.

5.3. Unresolved action items

Failure to adequately address action items in a timely manner is generally the biggest weakness in process safety programs. A number of the initial and on-going requirements of the regulations generate action items, including:

- process hazard analyses;
- pre-startup safety reviews;
- compliance audits;
- inspections and tests;
- incident investigations.

It is critical to have an effective system and a champion in place to manage these action items to resolution. There are numerous examples of successful paper-based and electronic tracking systems that can be used; whatever the system, all action items need to be dispositioned. Quite often, action items that arise are determined to be impractical, irrelevant, or otherwise not worth pursuing. However, other action items addressing critical deficiencies are sometimes indefinitely deferred due to resource constraints; this inaction can have serious consequences.

The actions to be taken on audit findings should be documented and those selected for implementation acted on in a timely manner. The authors have seen numerous examples of action items reappearing in audit after audit with no apparent (i.e. documented) follow-up or resolution.

Action items accepted for implementation need to be addressed "promptly". This term can be highly subjective. It is recommended as a rule of thumb that all action items be addressed within 6 months. As discussed above, a priority scheme for addressing action items is critical in ensuring that those with highest priority are considered first.

An effective action item management system will also include periodic high level management review. Without this support, the task of dispositioning action items will typically not be given the priority needed and implementation of action items may lag.

5.4. Missing or incomplete process safety information

The amount of process safety information (PSI) required under the PSM/RMP regulations is substantial. Small facilities may have this information available in a central location but it is typically located in various areas around a facility. Enforced document control procedures are vital in ensuring that required information does not become lost or misplaced, and is easily retrievable when needed (e.g. for maintenance or an OSHA inspection). Facilities should consider consolidating equipment files, inspection reports, etc. into one common file for ease of process safety information retrieval. If one central location is not practical, the central process safety location should reference the location of all required program files.

In addition to misplaced information, several elements of the PSI requirement are frequently overlooked. These include:

- ventilation system design basis—for older existing buildings, the design basis often has to be recreated.
- relief system design basis—relief valve specification sheets are often available but do not include the back-up calculations and assumptions used to determine required relieving

rates. Relief valve inlet and outlet hydraulics are also often undocumented.
- hazardous effects of inadvertent mixing—many facilities rely on Material Safety Data Sheets (MSDSs) to provide chemical information. However, MSDSs do not usually provide all of the information required for this element.

Ironically, recent capital projects often have significantly incomplete equipment files. Project close-out can be haphazard as attention is shifted to other priorities, and required equipment documents can end up buried in the project files. To avoid this, guidelines for project file content and turnover should be established and enforced. Again, documentation control is critical so that the required information remains available when needed.

5.5. Ineffective inspection and test program

The process safety regulations require that equipment be inspected and maintained in accordance with recognized and generally accepted good engineering practice (RAGAGEP). Small facilities often do not have the same access to in-house Mechanical Integrity experts as do large refineries and chemical plants, and may be unaware of or unfamiliar with the industry inspection codes and standards and best practices.

Equipment integrity is also not the primary focus of inspections in some industries. For example, it has been the experience of the authors that pharmaceutical plants are concerned first with product integrity issues. A properly designed inspection and test program will address both product integrity and equipment integrity, but this is not always the case.

It is important to ensure that both the frequency and type of inspections and tests are appropriate. Frequent inspections are inefficient if the results continue to indicate that no degradation is occurring. Conversely, infrequent inspections can fail to detect significant integrity issues that could lead to an incident.

In following a risk based inspection approach, it is especially important to document the basis for inspections. Inspection and test programs are "evergreen", and processes should be in place to re-evaluate inspection type and frequency based on actual findings.

Inspections and tests must also be conducted by personnel with the appropriate training and qualifications. As an example, pressure vessel inspectors may be qualified through the American Petroleum Institute's API-510 Inspector Certification Program or through their employer's SNT-TC-1A based qualification program [4].

Inspection procedures and inspector certifications should be documented. If contract inspectors are used, the contractor inspector certifications and inspection, qualification/certification, and quality assurance procedures should be obtained and kept on file.

5.6. No periodic contractor evaluation

Contractors are an important consideration in the success of any process safety program. A significant percentage of incidents occur during shutdowns and turnarounds, when usage of contractors is prevalent. Procedures for initial contractor selection are typically well-documented and initial contractor selection is generally well considered.

However, the regulations also require that contractors be periodically evaluated. There is often no formal procedure for doing this, or the procedure is not followed, especially for contractors with a long-standing relationship with the facility. Collecting annual contractor illness and injury logs is important but not sufficient. Audits of contractor safety programs, training, and documentation should be performed in accordance with the regulations. On-site performance should also be reviewed. This is often done through field spot checks.

5.7. Unresponsive management of change process

The management of change (MOC) process is crucial in ensuring that engineering, maintenance, operations, and other changes affecting covered processes are properly considered. MOC processes should be structured to provide a level of review consistent with the complexity of the change being considered. Careful attention should be paid to the logistics of the MOC process to ensure appropriate and timely evaluation of planned changes. Failure to do so can result in an unresponsive process that will likely be avoided or "worked around" by facility personnel.

Unresponsive MOC processes that bog down facility functions will lead to frustration and inefficiency. A clear indication of an unresponsive program is when steps are taken to avoid initiating the MOC process when it is clearly required.

As an example, the operations department of a plant created "work instructions" to supplement the official SOP procedures. These work instructions were considered by operations to be exempt from MOC review for changes, but clearly allowed significant changes to be made to SOPs without adequate review. This dual system was created because operating changes required to keep the process running often took many days to be approved using the facility MOC program.

MOC processes should be customized to the facility's unique operating environment; the key is to ensure that changes are considered appropriately and in a responsive manner.

5.8. Lack of understanding of program requirements

Facility employees (including both salaried and hourly) frequently do not have a good understanding of process safety program requirements and why these perceived "barriers" to productivity are in place. This can lead to failure to apply or inappropriate application of program requirements. The root cause of the lack of understanding should be addressed. Are the employees given information on a "need to know" basis? Is refresher training adequate? Is there a lack of consistency between written and actual practice?

The best program on paper won't be successful if it is not understood by those charged with carrying out the daily requirements. This understanding can be deduced from interviews during the audit process. A primary purpose of the regulations is

to ensure the safety of employees, and it is important that this underlying goal is understood.

Actively engaging employees in PHAs, incident investigations, and safety review meetings and providing ready access to safety information will facilitate understanding and emphasize the importance of the program requirements from both regulatory and safety perspectives.

5.9. Out-dated and obsolete written practices

Process safety programs are continually evolving, hopefully towards greater efficiency and effectiveness. The written practices documenting the program frequently lag behind actual practice. It is important that written practices match execution.

As an example, a facility may switch from inspecting pressure vessels on a set basis to a risk-based approach. Written practices must be updated to reflect this. Auditors and regulators will compare documented practices to actual practices and question why the documented requirements are not followed, regardless of which is more appropriate.

Written practices should be reviewed on a regular basis (annually is recommended) to ensure accuracy. Documents that have not been reviewed between audits are likely either out-of-date or not followed. Either situation should be corrected. This fulfills two objectives: ensuring that personnel know what the practices are and ensuring that the practices are appropriate.

5.10. Excessively/repetitively delayed maintenance tasks

Inspections and tests of covered process equipment are required under the Mechanical Integrity element. These tasks may be scheduled through the facility's preventive maintenance system or through a separate inspection and test (I&T) plan, and may require equipment to periodically be taken out of service.

During the execution of an I&T plan, the schedule may need to be adjusted due to production requirements. It is important to evaluate if the inspection can reasonably be delayed and to document the justification for doing so. Care must be taken to avoid continually postponing inspections for production reasons. Excessive postponements have led to process safety incidents. Escalating management approval requirements for continued deferments combined with careful coordination with operations can help to control, if not eliminate, this problem.

Tasks should be scheduled to best utilize the available resources. Tasks should be performed first on equipment that pose the highest risk, delaying tasks for those components for which there is a higher degree of confidence in the mechanical integrity of the equipment.

If inspection and test schedules are routinely not followed, the root cause should be evaluated and corrected (e.g. are the frequencies too low or are there insufficient resources).

6. Conclusion

Triennial compliance audits are required under the PSM and RMP regulations, as well as some state regulations. These audits can be time and resource consuming, and are often performed by third parties. Well considered audits can identify regulatory non-compliance and provide recommendations on improving program efficiency and effectiveness.

Effective audits will seek not only to ensure compliance with the regulations but to identify areas for improvement. Audits can identify ineffective or wasteful policies and practices. This is especially important in today's operating environment of "better results with fewer resources".

Despite the differences in approaches to process safety found across facilities and industries, the same types of program shortcomings are often found. Through proper planning, performance, and follow-up, compliance audits can address these troublesome areas and help ensure the continued success of process safety programs.

References

[1] U.S. Department of Labor Occupational Safety and Health Administration, Process Safety Management Guidelines for Compliance, vol. 3133, OSHA, 1994.

[2] United States Environmental Protection Agency, Guidance for Auditing Risk Management Plans/Programs under Clean Air Act Section 112(r), EPA 550-B99-008, August 1999.

[3] Occupational Safety and Health Administration, CPL 02-02-045-CPL 2-2.45A CH-1-Process Safety Management of Highly Hazardous Chemicals—Compliance Guidelines and Enforcement Procedures, September, 1994.

[4] American Society for Non-destructive Testing, Recommended Practice No. SNT-TC-1A—Non-Destructive Testing, 2001.