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Report No 32

Process Safety Auditing

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Objectives of the European Process Safety Centre

1. Information

To provide advice on how to access safety information and whom to consult, what process safety databases exist and what information on current acceptable practices is available.

2. Research and Development

To collect European research and development needs and activities in the safety and loss prevention field, to inform members accordingly, to act as a catalyst in stimulating the required R&D and to provide independent advice to funding agencies priorities. “R&D” here includes experimental research and the development and review of models, techniques and software.

3. Legislation and Regulations

To provide technical and scientific background information in connection with European safety legislation and regulations, eg to legislative bodies and competent authorities.

4. Know How Exchange

To provide a platform for development of process safety knowledge for its members and to act as a focal point for dissemination of that knowledge to the European process safety community. Involvement in the Centre's groups gives organisations and individuals the opportunity to meet safety professionals from other companies to discuss areas of common interest and to share knowledge and experience, thus enabling informed comparisons of safety management systems and practice.

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Introduction

This report revises and updates the previous EPSC report on SHE Auditing Practice in the process industries published in 2001.

Many of the principles described in the 2001 report are still valid so the reader may be tempted to ponder on the reason for a follow up. Whilst it is true that the fundamentals remain unchanged the auditing environment has certainly altered in the intervening years. We have seen the collapse of Enron which has highlighted the hazards of compromising auditor independence for the auditing profession in general. The reader will no doubt also note the recommendations of the so called Baker Panel report in the aftermath of the Texas City accident which made explicit reference to process safety auditing.

Baker described the need for trained and technically knowledgeable auditors who had amongst other expertise substantial experience of the various elements of process safety management.

Returning to the current report one of the main differences between this and the earlier publication is that the auditing of process safety specifically figures to a larger extent. We also have recourse to auditing experiences of EPSC members which we have included both as a narrative in a new chapter, and the results of a member survey of auditing practice contained in the appendices. The report also details in the appendices the elements of a typical PSM system and a glossary of auditing terms which in many ways reflect how also the language of auditing has changed since the earlier report.

Chapter 1: 'The need for auditing'

1.1 Why audit?

We know from experience that a systematic approach to auditing is required to ensure the adequate safety, health and environmental protection of operations in the process industries. We have also learned from experience that a management system, as any control system, will tend to deteriorate with time or become obsolete as a result of changing standards, practices, or organisation structure. Hence, to avoid degradation, a system must be monitored and verified on a systematic basis. A robust management system should therefore contain those checking functions as vital specific elements see for example the typical management system structure illustrated in figure 1.1.

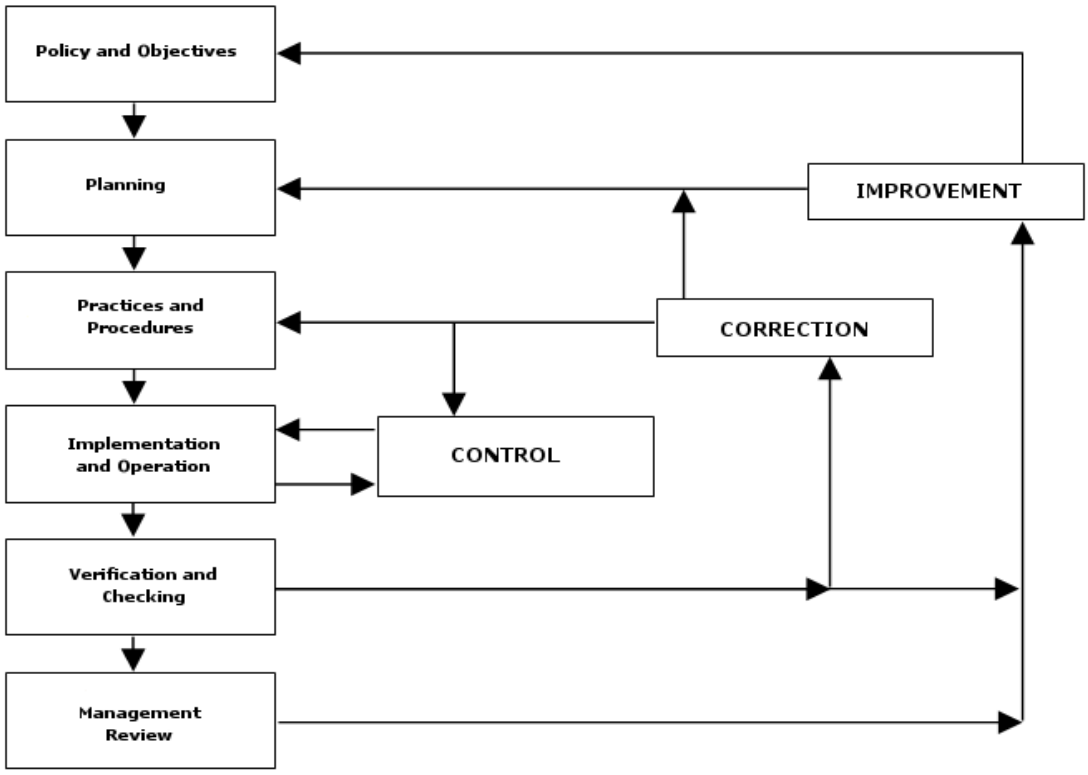


Figure 1-1: Typical management system structure

Auditing is a major part of the monitoring and verification process, which has the overall objectives of:

- Correction - providing adequate assurance that all aspects of safety, health and environment (SHE or HSE or ESH) protection are being managed in accordance with the appropriate requirements

- Improvement - stimulating and driving improvement in performance

These are distinct but related activities that may play different roles as an organisation's safety culture matures. In an early stage of developing the process safety management system, correction will form the most important function of an audit, identifying and prioritising the elements which must be in place in order to advance. In an organisation with a more developed management structure and safety culture, the audit process transitions to providing a troubleshooting role. In this stage, while still having a corrective role, continuous improvement becomes the main outcome of the audit process.

Most audits will be regular, scheduled, and with a general improvement goal. It is also possible for audits to be a one-time action, limited in scope to a specific issue, organised in response to new information or to act on a perceived problem. While such audits are unusual and more tightly focused than scheduled audits, the aim is still to provide correction and improvement, and the methods used will not differ.

1.1.1 Baker Panel Findings

The Baker Panel Report of the investigation into the Texas City refinery explosion made several points regarding the effectiveness of audits. An ineffective audit programme is potentially worse than none at all. Resources expended on a programme are wasted unless correction or improvement results, but a greater danger is that poorly conducted audits may fail to flag serious issues, instead falsely signalling that all is well.

Reasons for audits to fail in this way can be highly varied, including anything from inadequate scope of investigation to lack of support from higher management. In the Baker Panel Report, issues of particular concern were the level of experience of auditors, the independence of the audit teams, and the procedure for treating audit findings.

Auditor skill sets are a critical determining factor of the quality and reliability of the audit. While specialist experience and familiarity with equipment or systems is valuable, these are not more important than training in the auditor role. Previous experience on an auditing team should not necessarily be assumed to be a substitute for training, although of course experience is also of great importance.

As listed in section 1.2, another critical attribute of an audit must be independence. This is not only a guard against conscious bias, but also a means of ensuring that

the audit is not of compliance against an organisation's own interpretation of standards. An external viewpoint is needed to prevent an organisation's culture becoming blind to its own habits.
Causes for audit failure are discussed in further detail in section 5.1 - Pitfalls to Avoid.

Chapter 6 - Reaping the Benefits discusses methods for ensuring that an audit report leads to meaningful improvement.

1.2 What is an audit?

A definition of "audit" is:

'A process of independent, systematic examination to assess the extent of conformance with defined standards and recognised good practice, to thereby identify opportunities for improvement'.

Important aspects are:

- '**independent'** - those carrying out the audit should be independent from those carrying out the audited activity. The degree of independence will be discussed later.

- '**conformance with defined standards**' - it has to be clear what are the standards against which an activity is being audited.

- '**assess**' - in some types of auditing the examination is clear cut and essentially requires answers to yes/no questions (e.g. as for much of financial auditing) but for much of SHE auditing the issues are not 'black and white' and audits are really 'assessments' of the extent of conformance, with gradations on a scale from zero to full.

There are sometimes differences between organisations as to what is included within their SHE management systems auditing process. Rather than try to establish a single definition of what SHE auditing covers, it is better to think about what has to be achieved by the monitoring and verification elements of the management system.

Three simple phrases can be used to describe a management system and its implementation:

- "What we should do" (i.e. the relevant standards, guidelines and other good practice)
- "What we say we do" (i.e. the procedures for operation of the unit)
- "What we actually do" (i.e. what is done on a day to day basis to operate the unit)

The ultimate objective is to seek continuous improvement in process safety performance using the Plan, Do, Check, Act (PDCA) as a model.
The management aim is to ensure, with the help of appropriate monitoring and verification, that the three phrases are, in fact 'equal' and describe the same situation (see Figure 1-2).

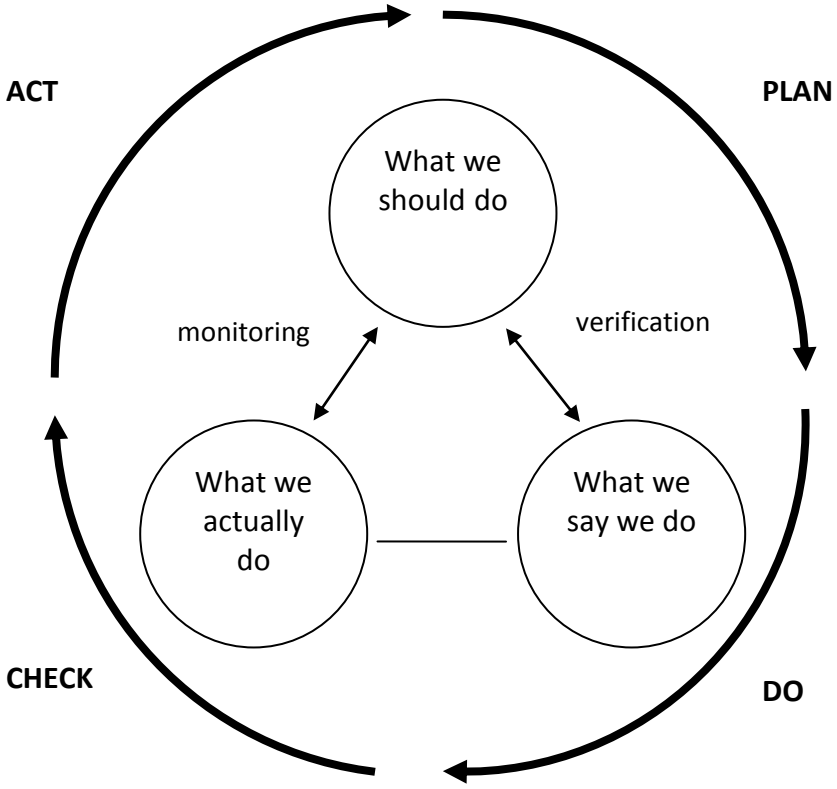


Figure 1-2 describing the implementation of a management system

Monitoring and verification, as featured in the management system structure of figure 1-1 and illustrated by the diagram in figure 1-2, can be defined broadly as follows:

Monitoring comprises all the regular checks and inspections that are made to ensure that operations are conducted in accordance with required practices and procedures. These are carried out primarily by the staff of the unit and seek to give them the answer to the question 'Do we do what we say we do?'

Verification is an examination of the required practices and procedures to test and assess them against appropriate standards, which will include Statutory Regulations, National Standards and Codes of Practice, Industry Standards and Codes, Company Standards and Codes and other appropriate recognised good practice. This examination is primarily carried out by appropriately experienced persons from

outside the unit and seeks to give local management the answer to the question 'Is what we say we do good enough?'

Although most monitoring is done by staff of a unit, some independent input is desirable. In some organisations the independent element of monitoring forms part of their SHE audit process which includes compliance audits carried out by staff independent of the unit being audited. These audits are similar to 'System Compliance Audits' in quality assurance terminology (an example is the 'Operational Audits' of the audit process outlined in Example 4-3, see also Reference 2, part 4.1).

Verification assessments, being largely independent assessments, are normally described as audits. Such audits are similar to 'System Integrity Audits' in quality assurance terminology. In some cases an organisation may decide to have its management system verified as conforming to ISO 14001, for example. In practice, SHE verification audits may sometimes include an element of compliance monitoring.

The two components Monitoring and Verification, combined with suitable corrective actions, bring Improvement – the bringing together of "what we should do" and "what we actually do". While the amount of time dedicated to each may change over time in response to the condition of the audited entity, a complete audit programme should always include both elements.

The auditing practices discussed in the following chapters of this report primarily relate to auditing for verification purposes, as defined above. There are some basic principles with regard to the way that auditing is carried out, that have a significant influence on the success of auditing. These are reviewed in the next chapter.

1.3 What is a Process Safety Audit?

Ultimately, an audit is defined by the standards that it tests against. A process safety audit is intended to check and monitor the management systems that deal with process safety risks. A complete process safety management system has many elements ranging from initial design and planning, to daily maintenance tasks, each of which can be a complex subject in its own right.

The skill set of an auditing team is of high importance when dealing with a complex system such as these. Familiarity with the tasks and methods of process safety management will allow an understanding of the purpose of the audited standards, and so allow a more effective audit.

A process safety management system exists to manage physical equipment and processes, so an audit will very often include an element of inspection. This can assist in understanding how a site works, or may provide indications of where problems exist. In either case, a familiarity with the equipment and processes being used is also a valuable skill to have on the audit team.

Chapter 2: 'Principles for effective auditing'

2.1 Getting the ethos right

It is important that audits are carried out in the right spirit and with the right attitude, both as regards those doing the auditing and those being audited.

An audit is a critical process of examination. No organisation is perfect, so it must be expected that flaws will be found. The purpose of the audit is to stimulate improvement, whether by offering suggestions or by identifying deficiencies. Where possible, this should be a positive exercise, identifying good performance and showing opportunities for further improvement. Issues can be presented with options to resolve them in an atmosphere of constructive criticism. An audit need not be an inquisition. An audit in itself will not find all the shortcomings as it is not intended to.

However, it must be understood that an audit is not simply a process of reassurance that a system as it stands is "good enough". To gain real benefit from the process, the audited entity should be willing to see flaws revealed. In an environment of good safety culture, this will not present any difficulty to the auditor, and the audit should be welcomed as a useful check on the system. Other organisations may have the expectation that an audit will do nothing except tell them what they already know, or worse, may view it as outside interference. In such cases, clarity of communication is important.

Helpful steps to take to avoid friction between auditor and auditee include discussing the scheduling of the audit with the site management to allow planning for post-audit workload, and making clear in advance the purpose of the audits and the standards it will be evaluating. As mentioned in the survey responses appendix, a pre-audit questionnaire can be used to set expectations, giving site management an overview of what scope to expect from the audit.

The auditor's role should not be adversarial, but neither should an audit be something that can be ignored.

Some organisations have a culture that places importance on appearance and so an auditor should dress appropriately, making an attempt to match local concepts of formal business wear.

2.2 Getting the right style

From experience, companies have learned that there are a number of desirable features for an effective audit process. Particularly important are the following points:

- A systematic approach is required whereby audits are conducted at regular defined intervals to a plan with units targeted for attention on the basis of their SHE risks

- Audits should be carried out in a structured way to ensure that issues are addressed in a thorough and consistent manner

- Auditors must be competent with appropriate training and experience to ensure their credibility in the eyes of those being audited

- Added value is gained from auditing if it is an interactive process in which auditors and auditees both learn from each other

- Auditors need to have sufficient independence from the management of the unit being audited. In most cases this can be achieved by using auditors from a different part of the same company/organisation. Sometimes it will be appropriate to involve one or more auditors from outside of the company when a more independent assessment is judged to be necessary

- Issues raised in audits should be considered objectively and handled both by auditors and the management of the audited unit in a transparent manner

- Audit findings should be related to management system references with which the person audited can perform the correct and consistent follow up

- Audits need to be searching and probing (though not inquisitorial, see section 2.1) to ensure that the true situation is revealed. Such an approach can be promoted by appropriate aids e.g. pre-prepared question sets for auditors to use

- A key output from the audit should be suggestions for improving on any area where performance has been judged deficient. Reporting a problem without also including a potential change to solve it is unhelpful. If audit scores are being used (see discussion of scoring in chapter 3), any score less than 100% should be paired with recommendations for methods to bring performance up to 100%

To summarise the principles, the aim should be to implement an audit process which can be described as follows (to quote one company):

"Audit: a positive and helpful force for improvement, owned and welcomed by management and conducted on a planned and regular basis."

Chapter 3: 'Implementing an audit process'

3.1 Managing the audit process

3.1.1 Procedural aspects

Auditing has to be an integral part of a SHE management system and so, just as for any other key element, such as 'management of change', there should be a management procedure defining the requirements for implementing the audit process. Typically the procedure should specify

- the units to be audited
- the types of audits to be done
- the audit frequency
- auditor training and experience requirements
- audit team composition
- level of auditor independence
- required outcomes e.g. assessment of performance, action plans for improvement, a timeline for implementation of changes
- formal documentation requirements
- responsibilities for implementation of the procedure

The audit procedure, together with any more detailed supporting documentation, should itself be auditable, i.e. it should give a clear statement of who should do what and when.

An appropriate manager should be appointed to 'manage' the implementation of the process, typically that might be the SHE Manager for the company or business. A programme of audits needs to be drawn up, resources identified and allocated, training needs identified and satisfied. The audit manager should generally oversee and co-ordinate the audit activity to ensure that it progresses according to the programme.

3.1.2 Training and selection of audit team

Although a verification audit can be carried out by a single, appropriately experienced auditor, it is more common for a team of several auditors to be used for this type of audit. It can be advantageous for auditors to operate in groups so that, for instance, one can lead an interview whilst another takes notes. For a large unit several auditors may be necessary in order to complete the audit within a reasonable time.

It has already been stressed that auditors need to have good credibility to those being audited. For that credibility, auditors mostly need to have:

1. Several years of relevant management experience

2. Good familiarity with SHE management systems
3. Auditing skills (including communication, reporting, etc.)
4. Language and intercultural skills (depending on location)

Conditions 1 and 2 are generally met by selecting appropriately experienced line and/or SHE managers as auditors. Condition 3 usually requires some specific training. The training will need to cover the audit methodology to be used and all aspects of conducting an audit, including the inter-person skills of good interviewing. Many companies organise internal seminars for auditor training, others use seminars offered by specialist companies who offer auditing and inspection services. Such companies will often 'tailor' seminars to meet specific customer requirements. It is usual to supplement formal 'classroom' training with 'on the job' training in which trainee auditors work alongside experienced auditors. In some cases, a period of 'on the job' training may be sufficient.

For any particular audit, there must also be available within an audit team any specialist expertise required for the audit. That could be, for instance, expertise in a specific process safety aspect, awareness of local legislation or fluency in the local language. Where auditors themselves do not have the particular expertise, an appropriate specialist may need to be co-opted onto the team.

The chart below shows a typical definition of minimum auditor training and experience requirements. Included in the appendices is an outline of a typical programme for a comprehensive in-house auditor training seminar. The actual content and duration of such training programmes will, of course, reflect the previous experience of the trainees.

Typical definition of minimum auditor training and experience requirements

	Lead auditor	Auditor(s)	Specialist(s) (as required)
Full audit skills training	√	(√)	
Basic audit skills training and/or 'on the job' training		√	
Previous audit experience	√	√	(√)
Specific expert knowledge (local legislation, language etc)	(See notes)	(See notes)	√

Notes: √ indicates an obligatory requirement.
(√) indicates a desirable requirement.

Clearly, if lead and/or support auditor have the necessary expertise an additional specialist may not be required.
Trainee auditors may often be included in an audit team.

3.1.3 Management review of the audit process

As the audit programme progresses to completion, the audit manager should ensure that there is a review of all the audits. An objective of the review would be to identify any SHE issues or concerns which are common to several of the audited units and may require joint attention.

Another objective would be to identify any possible improvements to the audit process (see also Chapter 5).

3.1.4 Verification of the audit process

A company needs to be satisfied that its audit process is effective. This may require the audit process itself to be subject to some degree of independent assurance, in the same way as for all the other elements of the management system. Sometimes there may be external pressure for such assurance, e.g. from regulators or the public (see next Section).

Useful assurance can be gained by 'peer review' of the audit process by experienced auditors or audit managers from another company. Within a large company, with semi-independent component parts, it is common practice to use internal peer review to test and improve the audit processes implemented in the separate parts of the company. However, internal peer review might not be feasible, or may not be sufficient to satisfy the assurance requirement, and external peer review may be necessary, involving appropriate people from another company or organisation. The external viewpoint will allow a company to guard against flaws in the overall company culture, which an internal review may overlook or even praise.

As part of its assurance process, a company may decide to have its management system certified against an appropriate national or international standard.

3.1.5 External influences

The SHE audit processes must take account of any regulatory requirements. For instance, those companies with operations subject to the EU 'Seveso' directive are required by law to audit their safety management systems (see Reference 4).

Also, Regulatory authorities themselves have requirements to audit a company's activities, for instance again under the EU Seveso Directive, the designated 'Competent Authority' must carry out a periodic 'inspection' (i.e. a type of audit) of operations subject to the directive. It can be beneficial for companies to consider to what extent they can liaise with regulatory authorities over the latter's audit requirements.

For example, if a company can demonstrate to the authority that it has a rigorous, independent audit process in place, then the authority may take that into account when determining what audits it should carry out itself. Authorities will tend to

concentrate on poorer performers and will generally carry out fewer inspections for companies that are doing well.

Also it is sensible for a company to co-operate with authority to ensure that the authority inspections and audits 'add value'. For example, the authority overview audits/inspections should build on the detailed 'in-house' audits by sampling and verifying that company audits are correctly carried out.

There may be scope for mutually useful co-operation to reduce audit demands by minimising overlap and duplication. For example:

- a regulatory authority auditor might be invited to participate in a company internal audit

- where a company is informed that a regulatory audit is scheduled for a unit for which an internal audit is programmed, the company might decide to postpone the internal audit in order to reduce the audit load on the unit

But this does require there to be trust between industry and authorities.

Sometimes public pressures for assurance on the adequacy of SHE protection measures may arise, perhaps as a result of an incident or a planned development. A company is better placed to respond to such pressures if it can display to the public that it has a rigorous audit process in place. It might be judged appropriate to invite interested members of the public to observe the conduct of an audit. Public interest is likely to focus on the extent of independence of audits and, in some cases, a company may find it appropriate to arrange for a fully independent third-party audit to allay public concerns.

Another external influence is the certification considerations already mentioned in the previous section.

3.2 Conducting an audit

3.2.1 Structure and timetable

A typical audit will consist of three phases: Audit Preparation, which takes place well in advance of the audit; the Audit Visit itself, lasting anything from days to weeks, with one working week being common; and Audit Follow-Up, in which the findings are agreed, and compiled into the final report.

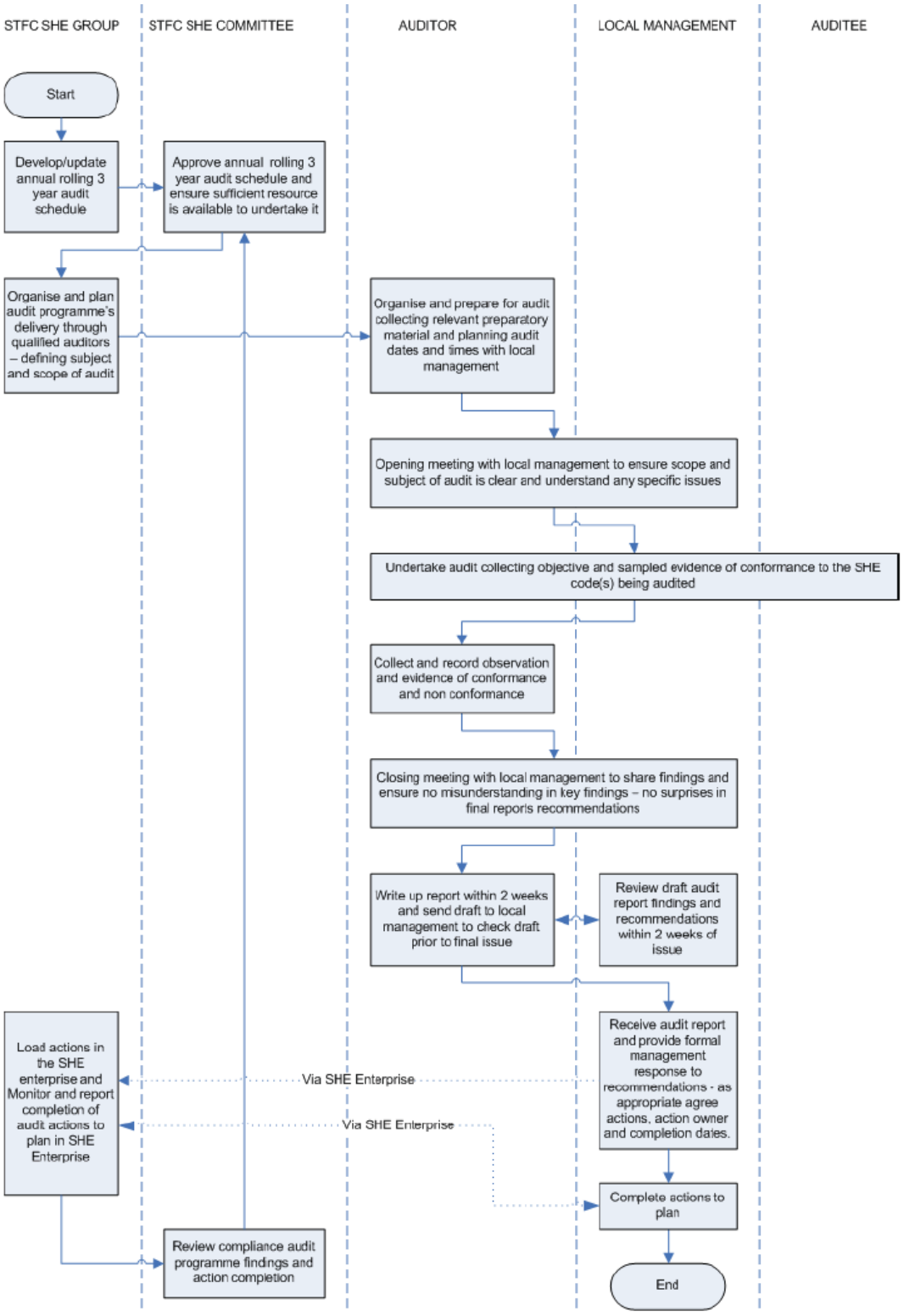


Figure 3.1 the position of auditing within pre-audit and post-audit activities

3.2.2 Preparation for an audit

The preparation phase may take place weeks or months prior to the site visit, and will commonly start with a review of past audit reports or other relevant records.

Preferably under the lead of the senior auditor in the team, the preparation phase will see the auditors and site management communicating requirements to allow a smoothly run site visit. The scope and objectives of the audit should be specified and agreed with company management and the management of the unit to be audited. Also to be specified and agreed is the information that the unit is required to provide for the auditors. Typically this information will include:

- background information on the unit activities and management structure
- previous audit reports
- performance reports
- improvement programmes
- outline of the management system
- self-assessment results where applicable (see section 3.3.1)
- completed pre-audit questionnaires where applicable (see section 3.3.2)

There should be a formal protocol* which sets down the audit scope, objectives and pre-audit information required.

The auditors use the information provided to familiarise themselves the unit to be audited. It may also enable them to identify issues that should receive particular scrutiny.

As previously noted, the information provided by the site will demonstrate the scope and focus of the audit to site management, and so may help to avoid misunderstandings.

** Note that the term 'protocol' is also sometimes used for the auditing questionnaires and scoring guidelines described in sections 3.3.2 and 3.3.3*.

3.2.3 Starting the Site Visit

Two important methods for starting the main audit process are the audit opening meeting, and the initial tour.

The opening meeting provides an opportunity for the auditors to introduce themselves to the unit management and staff. Also an important part of the opening meeting is an introduction to the site or facility and the safety aspects related to the auditors visiting. In addition to the senior management team, it is helpful if a cross section of staff is present so that all levels are represented. It is also an opportunity for the auditors to learn of any particular local issues that might impinge on the audit or which the auditors could usefully give particular attention to during the audit.

The agenda for an opening meeting typically includes:

- confirmation of the scope and objectives of the audit
- outline of the audit structure and method
- the processes of the facility and the related hazards
- summary of any relevant local issues
- local contacts/facilitators to work with the auditors to ensure smooth progress

Typically following this, the audit team will take an initial tour around the site. The purpose of this tour is to give a very brief inspection of the site as a whole, noting areas that might need more detailed attention later and getting a feel for how the real business compares to the paperwork.

3.2.4 Collecting information

For each aspect of the unit to be audited, the auditors need to gain an understanding of the requirements of the management system and then through interviews with staff, how they are implemented through local procedures.

They then need to test and verify, through further interviews and inspections of plant and documentation, whether the requirements of the system are properly implemented and conform to the relevant standards and good practice.

It will often be impractical for the auditors to interview all staff. A sample usually needs to be selected which takes a 'vertical slice' and/or a 'horizontal slice' through the organisation to ensure that a true picture is revealed and evidence of performance is corroborated. A vertical slice is the examination of management of a single issue from top to bottom, and a horizontal slice is the examination of one aspect or level of management as it is applied throughout all managed safety processes.

Usually auditors will use a pre-prepared question set or checklist to structure the verification process (see Section 3.3.2) but they will also examine and observe situations on the basis of their specialist knowledge and experience. This experience-led examination is a significant enhancement to the procedure-led portions of the audit, and will reveal a more accurate picture of the true situation.

As already emphasised in Section 2.2, interviews should be conducted on a non-inquisitorial and non-adversarial manner. There should be two-way communication to maximise shared learning.

During the audit, the auditors should, together, review progress on a daily basis, say at the beginning and end of each day. This provides an opportunity to focus on any significant issues arising, to identify any particular needs for corroboration of important findings and for correction of misunderstandings.

If any concerns are identified during the audit, which are sufficiently serious to require immediate attention, they should be reported to the appropriate unit management straightaway.

3.2.5 Closing meetings

It is important that there is some immediate feedback from the auditors to the management of the unit audited. This can be achieved through meetings with the site management. These can be organised as a single closing meeting, which typically would be attended by those who attended to opening meeting, or they can be short daily meetings at the end of each day of work. The auditors give a summary of their findings, both positive and negative, and invite open discussion for clarification where necessary. The auditors should also give a preliminary indication of the recommendations being made. Regular meetings throughout the course of the audit help to prevent unpleasant surprises for both auditors and auditees, and may reveal areas needing re-examination following feedback.

Where a draft report has already been prepared, it would be left with management for factual checking and a timetable for comments and completion of the report agreed.

3.2.6 Formal reporting of findings

It is normal practice for the outcome of an audit to be the subject of a formal report. To demonstrate commitment to SHE improvement, this report should be completed and submitted as soon as possible after the audit. The report should be factually correct and it is normal practice for the management of the audited unit to have the opportunity to see a draft of the report for them to comment on **facts only**. The facts should have clear references with which a good follow up programme can be developed.

In the report, the auditors should commend good features and performance that they observed as well as giving a clear presentation of any concerns and deficiencies they identified. Generally an overall assessment of performance is given but there are differing practices with regard to how performance is measured (see section 3.3.3 and the examples in Chapter 4).

Concerns requiring action for improvement should be prioritised. Generally auditors are required also to give specific suggestions for improvement action. Some companies limit the audit report to a display of findings with improvement actions identified subsequently by the unit management (see section 3.2.7

Often, an organisation will have a standard format for a report which includes a priority system. Examples might be a five point scale consisting of ratings: excellent, good, satisfactory, poor, and critical. Regardless of what is used, the report should make a clear distinction between high priority findings, such as serious safety risks or

regulatory noncompliance, and less urgent findings, such as breaches of any internal company standards that have limited relevance to safety.

Section 3.3.3 discusses the benefits and problems of audit scoring methods in more detail.

The circulation of the report should be agreed with the management of the audited unit. The circulation will have to meet any requirements laid down in the local audit procedure, however in general it is better for the audit report to be as widely circulated within company management as is reasonable. Normally, in addition to the management directly responsible for the unit, the senior executive management with overall responsibility should receive the report, or at least an executive summary that clearly presents the key findings and recommendations.

3.2.7 Follow-up

It is the responsibility of the management of the audited unit to generate a detailed action plan to address the audit recommendations. The auditors should have the opportunity to comment on the plans and endorse that they satisfactorily deal with the recommendations. The plans should detail actions and give target dates for implementation. Agreement on the plans should be achieved quickly after the audit (typically within a few months). Interaction between the auditors and unit management can contribute to achieving the optimum response to the recommendations.

Within a set time, the action plan should be presented by the unit management to their executive management for approval. Thereafter the unit management drive the implementation of the plan to achieve the targets set and should issue regular status reports until all actions have been completed.

Chapter 6 discusses the action plan and post audit activities in more detail.

3.3 Audit methodology

3.3.1 Self assessments

Increasingly, a management self-assessment approach is being used as a useful complement to independent audits. The self-assessments are normally completed by key line managers of a unit. Typically they take the form of a set of questions structured around the management system. Completion of the self-assessment by a manager gives an indication of the status of the implementation of the system on that manager's part of the unit. Examples 4.2 and 4.3 each have a self-assessment element integrated into the audit process.

Typically the self-assessments are done on a yearly or half-yearly basis. They are seen as a good way of increasing local manager involvement in the working of the system. They make a useful input to an audit and help focus the audit on areas

requiring closest scrutiny. The audit needs to check the responses to a sample of the questions in a self-assessment in order to verify its accuracy.

A self-assessment system provides a good means of promoting and monitoring improvement. The implementation of the system is typically monitored by the SHE Manager for the unit.

3.3.2 Audit questionnaires

Although some experienced auditors may be able to audit satisfactorily without aids, for most audits the auditors will have a pre-prepared question set and/or checklist to aid the collecting of information during the audit. These take a variety of forms (*note that in some companies the term 'protocol' is used for this type of question set*). At one extreme, the question set might be a minimal set of general 'open' questions (see Example 3.6 for instance). The auditors use their experience to apply such questions to virtually any aspect of the management system being examined. The audit questions should be clearly related to the management system. References to the specifics may need to be incorporated in the audit questionnaire.

Example 3-6:

Typical generic question set for examining the implementation of SHE requirements.

The following questions are asked with regard to each specific requirement:

1. Has all legislation, standards and good practice experience relevant to the requirement been identified and understood?
   eg Statutory Regulations, National Standards and Codes of Practice, Industry Standards and Codes, Company Standards and Codes and other appropriate recognised good practice. *(Check by noting the availability of relevant information, awareness of and familiarity with it.)*

2. Are management systems in place to ensure continuing conformance with the requirement in all parts of the unit?

2.1 Are there written procedures? *(Confirm by inspection.)*

2.2 Is there a system for review and update of procedures *(When was the last review, who did it?)*

2.3 Are responsibilities for carrying out procedures assigned? *(Check nominated persons are in date).*

2.4 Have training needs in relation to the requirement been identified and satisfied? *(Check by examination of sample of training programmes and records.)*

3. Are systems in place to verify conformance with the requirement?

3.1 What compliance monitoring and auditing is carried out and by whom? *(Confirm by inspection of monitoring and audit plan and records.)*

3.2 What is management's own assessment of the degree of conformance with the requirement? *(Check how assessed, inspect sample of results.)*

3.3 Are local improvement plans in place, how are they progressed and what is senior management involvement? *(Confirm by inspection of documentation.)*

At the other extreme, the question set might consist of a large number of very specific questions requiring only a 'yes' or 'no' answer (i.e. 'closed' questions). In practice, there may often be a combination of open and closed questions.

A fixed set of closed questions can remove ambiguity, promote objectivity, reduce reliance on auditor experience and facilitate consistency of assessment between audits (both the sequential audits of a particular unit and similar audits of different units). However, because they are very specific, almost inevitably there tends to be several questions to cover, for example, each matter within a management system. Consequently many hundreds of questions may be necessary to cover a whole management system. There is then the possibility that the audit may degenerate into a rather mechanical process; a 'tick in the box' mentality could develop and constructive interaction between auditors and auditees might be lost.

Open questions are generally more favoured for their flexibility and because they encourage interactive discussion. However, they do place more emphasis on the auditors' knowledge and experience if consistent assessments are to be achieved.

Whatever the type of question set utilised, it is useful to allow the auditors discretion to adapt or extend the questions should the needs of a particular situation so require.

In addition to questionnaires or checklists used during the audit, pre-audit questionnaires are frequently used to obtain information prior to an audit. In the survey given in Example 5.2, 7 out of the 11 companies sent out questionnaires to be completed by the management of a unit and returned to the auditors in a specified time before the audit.

Example 4.7 includes examples of both pre-audit and in-audit questionnaires.

3.3.3 Performance rating and scoring systems

An output from an audit is an indication of the performance of the audited unit in meeting the SHE requirements covered by the audit. However, there are mixed opinions how best the level of performance should be indicated.

A measure of performance is implicit in the nature and number of recommendations made by the auditors and in some companies no other performance measure is given in an audit report. More commonly a more explicit indication is given, most typically a qualitative rating on a 3, 4 or 5 point scale (a typical scale is given in Example 3.7).

Example 3-7

0) No action planned at this time or no action yet
1) Facility evaluating the requirement for action in programme
2) Developing action Plan
3) System exists, is up to date, and has been reviewed internally
4) System exists, and has been assessed by self assessment process
5) System exists, and has been audited by staff external to the facility

Quantitative scoring schemes are sometimes used. Usually the individual items considered in the audit are scored and the item scores summed to give an overall score. Guidelines are usually prepared to assist the scoring. The guideline may simply be a general set of definitions which the auditors apply, using their judgement, to the various aspects of SHE assessed in the audit -Example 3.8 shows a typical simple scoring guideline. Alternatively the guideline (sometimes called a protocol) may be more detailed with specific scoring criteria defined for each individual aspect of SHE to be assessed – example 3.9 gives a small part of such a protocol (see also Example 4.1).

In other schemes, points are allocated to each question of an audit question set. Sometimes weightings are applied with a greater number of points allocated to the more significant items. There are mixed opinions about the desirability of such detail which some feel can be misleading.

While individual findings need to be rated to reflect their relative importance, it is not necessarily useful to combine this into an overall score.

The question of how audits reports should be scored overall, or even whether they should be, is a recurring one. It is not uncommon for a company to adjust its procedure in this regard as circumstances change, fitting the audit programme to match what the organisation needs.

The great benefit of a single numerical score for a report is enabling comparison of performance over time and between sites. A documented scoring method used by appropriately trained auditors will give a consistent standard for audit performance. From this, a high level view over a large organisation can be taken, identifying sites that are struggling with compliance and safety performance with a simple comparison of numbers.

There are two potential disadvantages of numerical scoring. The first is that auditing becomes seen as a performance indicator, rather than a driver of improvement.

The second problem is that effort may be diverted into changing what is measured, not what needs to be changed. A poorly applied scoring system may not accurately reflect the relative importance of what it measures, for example, critical safety activities on hazardous materials being given an equal weight in the score as recordkeeping for relatively harmless substances.

It is not important that a scoring system accurately reflect risk if it is used only as a rough indicator of progress and for approximate comparisons between sites, but if audit scores are linked in any way to the perceived success of the audited site this can give rise to a temptation to game the system.

Scoring an audit may create a negative effect on the openness of the auditors and with the efficiency of the improvement part of the audit.

Chapter 4: Experiences of Auditing

Through the contact working group meetings on process safety auditing organised by EPSC, many have shared their experiences. Together these represent the full life cycle of an auditing programme, from its creation, going through normal operations, to continuous improvement and the avoidance of stagnation.

4.1 Creation of an Audit Programme at Dow

Prior to 1990 Dow Europe was in its infancy as far as HSE auditing, a patch work of different systems and standards and little organisation of the auditing process. In 1990 a consolidated audit programme was established for sites in Europe, operating on a three year cycle and using internal staff as auditors, exchanged between sites.

With audits on a consistent schedule and given organisation-wide attention and comparison, problems became apparent. The single audit system was an improvement, but in its early stages it lacked defined standards, auditors did not have specific auditing training leading to varying ideas about the role of an auditor, and in some cases sites would even refuse to accept an audit.

It was known for auditors to pursue their own agenda and make demands of the site that were greater than necessary or desirable. The issue of differing standards and requirements in Dow was addressed by the formation of global requirements throughout the company and establishment of an operating discipline for all manufacturing functions including safety. The globalisation of standards also led to the creation of an audit expertise centre and global standards for the integrated audit process including protocol, documentation and reporting. In parallel with this development was the introduction of certificated training for auditors and audit leaders. Another change introduced was the use of self assessments for sites, a critical examination of sites performed by their own staff prior to audits, which can be validated by a separate body to give focus to the audit itself.

The lessons learned during this period of change were: the importance of distinguishing between mandatory standards and desirable standards to avoid inconsistency and unnecessary workload placed on sites; a timetable that will not allow audits to be forgotten or ignored; and the distinction between expertise in the audited subject and expertise in the auditing process.

4.2 Growth of the Tata Process Safety Auditing System

In 2007, Tata Steel had recognised that although its management of personal safety was strong and with good results, process safety management was lagging behind at the level of compliance only.

A set of process safety audits had been conducted over the previous year on the highest hazard sites, top tier Seveso sites only. It was later realised that these audits

had suffered from many problems that greatly limited their effectiveness and value. A lack of protocol and lack of auditor training were serious flaws, but a greater flaw was the limited visibility of the audit programme and absence of follow up procedure. This reduced the level of the audit findings to something akin to informal recommendations.

A plan was set in motion to develop a more effective audit programme. The plan called for three types of audit operating within Tata Steel Europe. The first audit is a Management Audit performed by independent auditors which identifies whether the SMS is effective. The question asked is: "where are our systems deficient?" The second is a Specialist Audit performed by relevant experts, normally independent auditors. This is an Integrity Audit which answers the question: "is what we are doing good enough?" The third and final type of audit is a Compliance Audit performed by local Tata Steel auditors and answers the question: "do we do what we say we do?" Over the course of 2008 a central auditing team was set up to organise, oversee and perform these three audit types as an integrated programme.

In addition to these three audit types, a rigorous programme of self assessments were also started, this practice having been seen to be very effective in the nuclear industry if treated with due seriousness.

Over the following years, the team have taken on the task of developing and maintaining a competent resource to carry out an audit programme, arranging training to bring non-auditing safety professionals up to the required level of competence in auditing skills.

4.3 Lessons from an Established Audit System at Dow

As described in section 4.1, the auditing programme at Dow in Europe has been operating for many years now and in that time has gone through refinements and improvements in several areas.

The programme has a well defined structure that is geared towards assisting in continuous improvement of process safety. Audits are linked to a body named the Process Safety Technology group, which receives information on each facility regarding non conformance findings and the associated advice for achieving best practice. The lead auditor also takes an active role in audit follow-up activities, working with the audited unit in approving an action plan for corrective actions. Each year the expertise centres within Dow are asked to evaluate audit findings and determine whether there are actions necessary to address universal issues.

Through many years of operating this audit programme, experience has been built up of pitfalls to avoid. Listed below are examples of these potential problems that can lessen the effectiveness of an audit programme, whether in the long or the short term.

a. A lack of co-ordination of audits or audit like events which results in strain placed on the audited entity – too much time and effort being spent on audit activities within the audited site.

b. The tendency to over-audit especially to confirm improvement which places a strain on auditing resources – too much time and effort being used on measuring what has already been measured.

c. Underestimating the risk of some activities, for example - routine laboratory work for which additional lab safety training would be required for auditors

d. An undue focus on scores without understanding the sense behind them – audit scores should not be used in a punitive way or used for reward

e. Reliance on an interpreter from the audited unit which can result in a loss of independence. More time needs to be allowed in the schedule for the audit team to translate local regulations

f. Lack of independence or competence of the auditor

g. Only modest level of information from audits being fed into international or regional networks of companies – lessons learned are only being learned locally resulting in duplicated effort or missed opportunities

h. Ignoring the opportunities to calibrate and reset own EHS auditing practice by peer review and benchmarking with both internal and external audit functions

i. Overlooking opportunities to apply findings from root cause analysis company wide

j. Imbalance between resource and auditing team load - a failure to find a proper match between number of auditors and time spent against the complexity of the audited unit

k. Unrealistic time scheduled for auditor to carry out tasks properly and confusion in organisation

l. Unclear priorities during the audit visit itself – lack of preparation leading to wasted time at the site

m. A tendency to report actions when it would be quicker to correct a fault directly with the audited party

n. Striking the wrong balance between comprehensiveness of audit and the paperwork necessary to achieve this

o. A tendency for auditors to focus on paperwork or spend too much time in the office away from operations

p. Overstating the importance of the audit process over and above the knowledge and experience of the individual auditor - no matter how well the audit itself is structured there appears no substitute for the competence of the individual auditor, and how conversant each is in the area under audit

q. Lack of formal training for new auditors or recognition that more experienced auditors may require only modest refresher training

r. An audit team tasking an audited facility with unrealistic actions (not actionable)

s. Assumptions that auditors are welcomed by the audited facility (they are not)

4.4 An Example of a Typical Process Safety Audit Programme at Exxon

To give a clear distinction with financial audits Exxon do not use the term audit for safety and instead use the term "assessment". The safety assessments focus on the evaluation of management systems. Assessments are conducted by multidisciplinary teams and include staff exchanged from other sites.

External assessments are organised at corporate level and are conducted every three to five years, with the frequency within that range determined by the Operations Integrity performance of the assessable unit and the level of risk in the unit's operation. They have a typical lead time of 1-2 years. The team comprises 8-15 people and takes between 5-10 days. It is led by the Plant Manager and supported by a professional facilitator and core assessors (3-4 people). Also members of the team are specialists (such as process safety) and those who bring skills such as experience in the field of operation and particular language proficiency. Ordinary audit team members receive 2 days training. A typical audit can conduct 20 interviews per day. The benefit to team members is that they learn from each other and learn also to be self critical.

Internal assessments are conducted annually in the intervening year.

Currently there is increased discussion on using a risk-based approach to auditing, including use of risk criteria to identify audit targets (both facilities and systems within facilities) and frequencies. Similarly, a risk-based approach is used for prioritising corrective actions and improvements based on audit findings.

A feature of the audit programme is an emphasis on process safety improvement plans being the responsibility of, and owned by, the facility operator rather than the auditor. The auditor verifies that the operator management knows what needs to be done, how well it is being done, and what improvements should be made next. The

operator managers are not relying on the auditor to tell them what to do, but rather to confirm that what they are doing is ok. The ideal is that an audit validates and supports the plant's existing systems and current improvement plan.

4.5 Challenging the Status Quo – Taking Audit Results Seriously at Clariant

Risk Communication is a significant component of safety management at Clariant, and is important in auditing. Presenting audit results, whether in a report or otherwise, is a critical skill for an auditor. Once the auditor has spent time understanding a system and discovering areas to be improved, communicating those discoveries to others is vital. One part of this is in clarity of writing, providing a report in understandable language, in a concise standard format, and with no information that is irrelevant to process safety. Audit reports are adapted to the needs of the reader, with the full detailed report in technical language given to the management of the audited site, and shorter summarised versions given to higher management as an overview.

The report must be seen at multiple levels of management, with copies given to those who enact and oversee changes, and by those who support the regional management. Reliability of distribution of the information is also important, with a formal document and archive system guarding against poor communication.

Alongside clarity of communication, auditors must be persuasive. They must convince decision makers that the results of auditing need to be seriously considered. It is a necessary part of an auditors make up to challenge the status quo, otherwise without these skills auditing becomes an academic exercise.

The purpose of auditing at Clariant is to drive continual improvement as well as to guard against non-compliances, and as such the auditor will be speaking in favour of an investment in positive change.

4.6 Interventions – The Right to Halt Operations

One company has publically reported a historical incident involving an audit visit coming to a premature end due to the severity of the findings. Safety issues present at the site were sufficiently serious that they could not be resolved informally, and potentially dangerous in such an immediate way that finishing the audit and preparing a report would not suffice. The auditor in this case ordered operations at the site to be shut down until improvements could be made. Prior to this intervention, the management at the site had greatly underestimated the risk of their operations.

The authority to perform this sort of immediate action is not often formally granted to auditors, however there is a clear duty to do whatever is necessary to avoid harm if the risk is too great.

4.7 Review and Avoiding Complacency - BP

Among the recommendations of the Baker panel report were several relating to the independence and effectiveness of audits. BP has enacted these recommendations by creating a new Safety and Operations group within the company structure, which takes responsibility for performing audits and reporting their outcome to management.

The updated audit programme is capable of supplying time and resources sufficient to go into great detail within each audit. Over 50 full time auditing staff are available in total, with external auditors assisting on each visit. A full audit may consist of up to 30 staff visiting a site over a three week period, allowing investigations to be both in depth and broad.

Audits performed by the Safety and Operations group have more weight of authority supporting them compared to previous audits. Auditors on the team do have the authority to override decisions of local site management on safety issues if there is a need to do so, potentially including ordering a halt to operations.

Similarly, oversight of post-audit activities has been strengthened, with greater involvement by the audit team in the approval of a corrective action plan, and more rigorous checks performed on the completion of actions in the plan.

4.8 Review and Avoiding Complacency - AkzoNobel

At AkzoNobel, the established audit programme conducted management audits on sites at a frequency of 1 to 5 years depending on hazard rating and performance. These audits focused on compliance with legislation and corporate standards with auditors drawn from a company pool of HSE professionals.

Following Texas City, the Baker Panel report and an internal complaint, AkzoNobel felt compelled to ask whether they exhibited the same symptoms as those that existed at Texas City. To address this, a series of reviews of HSE performance and policy were brought into being under the name “process safety assurance visits.”

The process safety assurance visits aimed to swiftly uncover faults in the process safety management system and then collect the necessary evidence to support the initial observations, partially based on informed guesswork and instinct. Each visit lasted two days and involved independent HSE specialists supported by consultants using the Baker Panel report as a reference. The format was firstly a plant tour, followed by natural conversation interview with key actors and then collecting evidence from the management system and field observations.

These visits acted in part similarly to an audit, and to an extent shared the same function, but the process safety assurance visits acted at a higher level and it would be more true to say that they were a complete reactive review of the management

system including review of the effectiveness of audits, and of safety culture in general.

One development of this period was the option of specialist process safety audits which could be called at the request of a business unit if a general HSE audit cast doubts on performance in this area.

Two main findings of the reviews were related problems. The first was that of support and funding for sites not being sufficient to enact all required changes called for by audits of the safety management system. This led to the second problem, a tendency for sites to do what they could with what they had to improve compliance scores, thus putting the focus of effort on the numbers instead of the safety outcome. To address these issues, a more risk based approach was taken to the allocation of budget. The same awareness of risk level was also applied in management of organisational change, with priority going towards safety relevant matters. The goal became to focus effort on management of hazards where a potential hazard was real and significant, rather than judging chiefly by compliance scores.

Chapter 5: 'Continuous improvement of the audit process'

The management objective of continual improvement applies to the audit process, and the management of it, just as for any other aspect of a management system

5.1 Pitfalls to avoid

To optimise the management of their audit process, audit managers need to be aware of a number of pitfalls to avoid. These include:

- **Audit overload**:- There are many aspects of SHE management to be audited and so audit programmes need to be arranged to avoid subjecting a unit to several different audits within too short a period of time, otherwise the unit staff will likely suffer audit fatigue and the effectiveness of the audits will be jeopardised. As far as is possible, audit demands from regulatory authorities or other external bodies should also be taken into account when arranging programmes (see Section 3.1.5).

- **Under-estimating risk of some activities**:- Areas of highest hazard clearly need to receive priority attention but low hazard, peripheral activities must not be ignored. Routine laboratory and office based activities can sometimes pose higher risks than is properly appreciated and may require occasional audit.

- **Over complex protocols/questionnaires**:- Where SHE requirements are defined in substantial detail in standards and guidelines, there can be a tendency for the number of questions in a formal audit protocol/questionnaire to grow to a very large number. This can lead to audit interviews becoming de-motivating for both auditors and auditees, with loss of constructive interactive discussion.

- **Undue focus on scores**:- Whilst a quantitative measure of performance from an audit is often welcomed by management, scoring systems need to be used with care. Managers need to be aware that scoring systems can rarely take all factors into account and improvement plans may need to consider more than simply improving the audit score.

- **Language:**- In international companies, it often arises that auditors carry out audits on units where they have little knowledge of the local language. Clarity of understanding is vital for effective auditing. Ideally, audit teams should include an auditor fluent in the local language and auditor training should take account of that need. Extra time may be needed on an audit visit if there is a language barrier. It is advisable not to use managers or supervises from the audited unit as interpreters when staff and/or activities for which they are directly responsible are being audited.

- **Culture**:- Similarly, in global operations, audit processes need to be reviewed by someone from each of the countries in which audits will take place in order to identify and allow for any cultural factors that might impinge on the conduct of an audit.

- **"Blinkered" thinking**:- For example, in situations where there is generally very good or excellent implementation of a management system, auditors need to be on their guard and not allow the good performance for the majority of aspects to deflect their attention from other aspects where there might just be some weaknesses.

5.2 Improvement possibilities

Management review of the implementation of an audit programme should be carried out periodically (typically annually) to identify opportunities for improvement. There may, for instance, be areas where the good principles and practice discussed in the previous chapters of this report are not followed in the audit process as well as they might. Other improvement possibilities include:

- **The integration of common audit requirements:-** S, H, E and Q have elements in common which in some instances can efficiently be audited together thereby reducing the number of audits necessary. A balance needs to be struck however, between the need to optimise the amount of auditing and the need to give all aspects the detailed attention that they need. Regulatory authorities have requirements to audit a company's activities and it is sensible for a company to liaise with the authority to explore possibilities for co-operation in satisfying overlapping audit requirements (see section 3.1.5).

- **Dynamic methodology:-** A flexible approach to audit methodology should be adopted so that it can be changed to reflect changing circumstances. Protocols and questionnaires should be allowed to develop to meet what may be differing needs as performance improves. For instance, as a management system becomes fully established and mature, the focus of audits could move from assessing the 'quality' of the system more towards assessing its implementation. All the audit processes described in the examples in Chapter 4 have evolved as a result of continual improvement, in particular, Example 4.8 outlines the progressive development of an audit process.

- **Interaction between audits and other activities:-** There may be scope to utilise auditing activity to satisfy parts of other requirements. For instance, audits can be useful training for managers and staff. It is also good to involve as many staff as possible in the audit activity, both as auditors and auditees, to encourage their active participation in SHE improvement.

5.3 Peer review and benchmarking

An effective way to identify improvement opportunities is to organise a 'peer review' of the audit process by experienced audit managers or auditors from another company. Another useful approach is to share experience and learning with one or more other companies through a benchmarking exercise which compares the audit processes of the participating companies. Usually differences will be revealed which may stimulate ideas for improvement.

Chapter 6: 'Reaping the benefits'

As was said in the opening chapter the overall objective of audit is to help maintain a good level of SHE management performance and to identify and stimulate actions for further improvement. Audit can be a key part of a structured change mechanism to move SHE performance toward defined targets. Review of audit findings defines a present situation in order that the 'gaps' between the present and the desired situation are revealed for action.

Audit findings can be used to benchmark SHE management performance. This can be done both internally to compare differing methods on units within a company and externally to compare the methods of different companies. Either way, it will usually stimulate some ideas for improvement.

Finally, although it has been stressed that audit is a vital part of a management system, it should be remembered that:

Audit is not a goal in itself, it is an aid. The real goal is assured and continually improving SHE performance.

6.1 The Role of Auditors

It is the duty of the audited organisation to act on the results of an audit, but the auditor can make this task easier in many ways, not least of which is a well prepared report.

Many organisations will have a standard form into which the results and findings can be categorised. Use of standards such as these allow for specific sections to be easily found within the report. Whether or not a standard report format is used, findings should be listed in distinct sections, with each section showing a summary, details of one finding, and the related recommended action. The aim is to provide information in a form that is easy and quick to refer to.

Written sections of the report should be in clear language. Long sentence structure should be avoided where reasonable.

The report should not assume knowledge on the part of the reader - it is not a personal message to the management of the audited unit. If part of a finding or corrective action has been discussed during the audit visit itself, this must still be included in the report text. Similarly, any description of a finding should not be so brief that site-specific knowledge is required to understand it.

Above all, the report must be both factually correct and delivered within a reasonable time.

In cases where official distribution systems for the report are limited or informal, it may be helpful to encourage distribution of copies of the report over multiple levels of management, although the organisation may consider this to be the responsibility of leadership or site management. The Baker Panel report notes that formal consideration of the report at multiple levels of management is essential for the effectiveness of the audit process.

6.2 The Role of the Audited Entity

A negative finding should always lead to a plan for a corrective action. In exceptional circumstances, an action plan may need to be partially or entirely altered to fit new circumstances. However, where there is an identified flaw, a plan for necessary improvement should always be implemented. Any specific plan suggested in the audit report should be reviewed and strongly considered as an option for making the necessary improvements. Management at the level of the audited entity has the responsibility for making these things happen.

As corrective actions happen, they must be seen to be happening. The process of change should be recorded and made visible to those outside the site.

6.3 The Role of Organisation Leadership

An audit programme is an effective way for highest level management to display their commitment to SHE topics. An audit is a very noticeable sign of interest in safety from outside of a business unit, but this can be undermined if there is no matching sign of support when audit reports call for action.

Guaranteeing the ability of site managers to make improvements is the most visible responsibility of leadership level management, but the main role is to oversee the health of the audit programme.

Seek to avoid audit fatigue - too frequent audits may lead to resentment of the process and ignoring of findings. An audit should not be a disruptive process, but it does take time and effort, and will generate more work to be done in implementing changes. Trying to force too many audits onto a site may become the equivalent of trying to force too high a rate of change.

Benchmarking audit methods against peer organisations is helpful for checking the health of the framework. Review of audit outcomes will tell whether the framework is leading to the desired results (see section 5.3).

Above all, oversight of the audit process should ensure that the audits are providing some benefit to the organisation. If no recommendations for change result from an audit, this may mean that the audited entity has achieved excellent performance in all areas, but it may also be a sign that problems are not being noticed, even in review. Be suspicious of audit reports that contain only positive findings.

It is also the responsibility of high management to ensure that audit results are not ignored or forgotten. Audited sites should report progress on action plans following an audit, and improvements made should be noted. If an audit report makes significant recommendations and no action follows, this should be noticed by high management and investigated. Possible responses include a repeat visit by the audit team in a more specialised investigation.

6.4 Additional benefits

The audit process will generally provide insight into process safety performance that can be used for other purposes. While improvement must always be the core function of audits, there is no harm in taking advantage of other benefits.

Including cross-trained safety experts from other sites within audit teams allows for information exchange between sites – an additional route for knowledge and skill transfer within the organisation. Having auditors with appropriate skills relevant to the business is a gain for those being audited, but it is also possible for the auditor to learn during the same process.

As stated in the first chapter, an audit can be a method for seeking out examples of good safety practice and performance. When these good examples are shared within a company, it is an opportunity for an audited site to be proud and to get positive exposure. By enabling further recognition of good safety behaviour, audits can become a part of an effective and improving safety culture (see section on audit scoring).

APPENDIX 1 – GLOSSARY OF AUDITING TERMS

ISO 19011 defines the following terms:

audit - systematic, independent and documented process for obtaining **audit evidence** and evaluating it objectively to determine the extent to which the **audit criteria** are fulfilled

NOTE 1 Internal audits, sometimes called first party audits, are conducted by, or on behalf of, the organization itself for management review and other internal purposes (eg to confirm the intended operation of the management system or to obtain information for improvement of the management system), and may form the basis for an organization's self-declaration of conformity. In many cases, particularly in smaller organizations, independence can be demonstrated by the freedom from responsibility for the activity being audited or freedom from bias and conflict of interest.

NOTE 2 External audits include second and third party audits. Second party audits are conducted by parties having an interest in the organisation, such as customers, or by other persons on their behalf. Third party audits are conducted by independent auditing organisations, such as regulators or those providing registration or certification.

NOTE 3 When two or more management systems of different disciplines (eg quality, environmental, occupational health and safety) are audited together, this is termed a combined audit.

NOTE 4 When two or more auditing organisations cooperate to audit a single **auditee**, this is termed a joint audit.

audit criteria - set of policies, procedures or requirements

NOTE 1 Audit criteria are used as a reference against which **audit evidence** is compared.

NOTE 2 If the audit criteria are selected from legal or other requirements, the audit finding is termed compliance or non compliance.

NOTE 3 If the audit criteria are selected from standards (internal or external), the audit finding is termed a **conformity** or **nonconformity**

audit evidence - records, statements of fact or other information, which are relevant to the **audit criteria** and verifiable

NOTE Audit evidence may be qualitative or quantitative.

audit findings - results of the evaluation of the collected **audit evidence** against a**udit criteria**

NOTE Audit findings may indicate **conformity**, **nonconformity**, and opportunities for improvement or good practices

audit conclusion - outcome of an **audit**, after consideration of the audit objectives and all **audit findings**

audit client - organization or person requesting an **audit**

NOTE The audit client may be the **auditee** or any other organisation which has the regulatory or contractual right to request an audit

auditee - organization being audited

auditor - person who conducts an **audit**

audit team - one or more **auditors** conducting an **audit**, supported if needed by **technical experts**

NOTE 1 One auditor of the audit team is appointed as the audit team leader.

NOTE 2 The audit team may include auditors-in-training.

audit programme - arrangements for a set of one or more **audits** planned for a specific time frame and directed towards a specific purpose

audit plan - description of the activities and arrangements for an **audit**
risk - effect of uncertainty on objectives

audit scope - extent and boundaries of an **audit**

NOTE The audit scope generally includes a description of the physical locations, organizational units, activities and processes, as well as the time period covered

competence - ability to apply knowledge and skills to achieve intended results

NOTE ability implies the appropriate application of personal behaviour during the audit process

technical expert - person who provides specific knowledge or expertise to the **audit team**

NOTE 1 Specific knowledge or expertise is that which relates to the organization, the process or activity to be audited, local legislation, or language or culture.

NOTE 2 A technical expert does not act as an **auditor** in the audit team

conformity - fulfilment of a requirement

nonconformity - non-fulfilment of a requirement

guide - person appointed by the auditee to assist the audit team

In addition to these terms, this report uses the following, not defined in the ISO standard:

audit report – The document which presents the audit findings and audit conclusion in a single official format.

audit score – A numerical value derived by a defined system from audit findings, representing the level of compliance of the audited entity as a whole.

audit preparation – The process of assembling and preparing the audit team prior to the audit.

site visit – The part of the audit that takes place on the auditee's premises, allowing physical inspection and in person interviews.

APPENDIX 2 – EXAMPLE OF A SITE VISIT

Day 1

Session	Desired outcomes
Welcome and introductions: Trainers Trainees Programme	Establish a relaxed situation conducive to good learning
SHE Management System summary	Confirm understanding of the system requirements and operation
SHE Audit Process: Auditing concept and scope Philosophy and culture Style and structure Mandate, roles, and responsibilities	Establish understanding of the audit process and the role of auditors
Trainees' learning goals	Trainees to identify what they need to know and learn and where they might expect difficulties
Case Study introduction: outline of study and audit objectives site information formation of groups for practical work	Understand the scope of the case study audit and the goals to be achieved
Planning and preparation for SHE audits: interactive development of purpose, goals, audit plan audit activities and tools	Ability to prepare for an audit, recognise the value of pre-audit questionnaires and checklists, know the activities, methodology and tools for effective auditing
Group work 1: Development of pre-audit and in-audit questionnaire	Groups develop and present their questionnaires for the case study
Group work 2: Development of audit plan	Groups develop and present their audit plan
Evening task: Pre-reading on principles of audit interviews	Preliminary appreciation of the critical factors for interactive communication.

Day 2

Session	Desired outcomes
Review of day 1	Clarify learning from day 1.
Simulation exercises 1: Introductory meeting with site management presentation about site by site manager introduction to audit by team leader	Recognise the key factors for creating a positive climate at start of audit
Simulation exercises 2: Interviewing skills short interviews with a 'normal', 'over-busy', 'over-committed' site manager using the prepared questionnaires	Experience the critical factors in interviewing including 'putting at ease' and handling difficult interviewees.

focus more on interaction than 'technical' issues.	
Plenary review of learning from exercises	Learn from the strengths and mistakes of others, collect general recommendations for good interviewing, identify points for individual improvement.
Preparation for site tour: site information setting priorities, objectives, procedure	Groups agree approach and what to look for.
Social evening	Relaxation!

Day 3

Session	Desired outcomes
Review of day 2	Clarify learning from day 1
Site tour of nearby facility: practical inspection of a section of plant accompanied by an experienced auditor acting as plant/area manager	Experience how to collect evidence of performance
Plenary discussion of learning from site tour: do's and don'ts for collecting evidence assessment of observations making recommendations	Understand the critical factors for the collection of evidence and assessing the significance of observations.
Report writing requirements: target audience structure, contents, style legal implications, advice	Understand the importance of the formal record of audit and the key points of report preparation
Group work 3: Report writing	Groups prepare summary report of main findings with assessment of significance.
Preparation for audit closing meeting: feedback on group's summary reports discussion of observations to agree recommendations making the case for improvements	Understand the need for factual accuracy and sensible judgements with respect to 'added value' recommendations

Day 4

Session	Desired outcomes
Review of day 3	Clarify the learning from day 3
Simulation exercises 3: Closing meeting with site management: discussion of summary report review of recommendations	Understand the objectives of and importance of the closing meeting; recognise successful approaches for communication of perceived problems.
Plenary review of learning from exercises	Learn from the strengths and mistakes of others, collect general recommendations for good closing meetings, identify points for individual improvement
Feedback on reports prepared by groups	Receive comments on style and content, obtain recommendations for improvement
Follow-up: report distribution and response action plans and implementation monitoring	Understand required process for review of reports, responsibilities for acting on audit recommendations
Legal aspects role and responsibilities duty of care legal implications of audit findings	Understand legalities of an auditor's position
Recap and personal development plans summary of learning points what next?	Trainees develop own personal plan for further development; identify mentors to provide trainees with advice and coaching during their first audits.

APPENDIX 3 – ELEMENTS OF A TYPICAL PSM SYSTEM

As shown at the start of chapter 1, all management systems have levels of control that are applied on different timescales and at different tiers of the organisation. Process Safety Management systems are no different.

Figure 1 from Chapter 1 shows the elements of a general management system. These are:

- Policy and Objectives
- Planning
- Practices and Procedures
- Implementation and Operation
- Verification
- Management Review

In the case of process safety management, the specific tasks associated with these general elements are as follows:

Policy and Objectives – This element in the case of process safety is simply the statement that harm should be minimised. Safety is the overall goal. Legal compliance may also be a relevant objective if regulation requires action in addition to those elements already planned for effective safety management.

Minimise Harm
Legal Compliance

Planning

The two major activities in this element are Management of Change (MOC) and initial design planning, both of which require some form of hazard assessment. This includes the setup and changes to the organisation. The hazard assessment procedure chosen should be appropriate to the task, and therefore can vary in form, but in all cases the assessment should be a formal documented procedure that can be referred to in later work. Any hazards identified at this stage will be the major focus of safety management in other elements, unless the hazards can be mitigated or entirely removed before implementation during this planning phase. A hazard analysis should be followed by a risk analysis of each hazard, determining probability or expected frequency of failure under various operating conditions, and the consequences of a failure. Land use planning should be a critical component of risk analysis, to judge and avoid offsite consequences of a hazardous event.

Evaluate hazards in initial design
Evaluate hazards during changes to design
Evaluate risks associated with all hazards
Land Use Planning

Practices and Procedures

From the outcome of planning, procedures for safe completion of all expected tasks should be derived. Detailed operating procedures that take into account any hazards identified during design and review should exist for, at minimum, the following tasks:

- continuous operation
- start up and shut down of operation
- emergency shutdown of operation
- inspection
- maintenance and cleaning

Knowledge relevant to these tasks should be kept, such as material hazard information, the current state of the facility and equipment, the past state of equipment and records of modifications made, and records of any incidents.

Create documented procedures for tasks for safe operation
Procedures for putting equipment in a safe state for maintenance
Procedures for safe inspection and maintenance
Maintain a knowledge database
Develop plans for emergency situations

Implementation and Operation

There should be a well defined system of responsibilities and authorities that will clearly indicate which role corresponds to which person. By means of setting down the pathways used to initiate action, this system should ensure that staff are able to implement practices and procedures.

The system should in particular have the following attributes:

- Both authority and responsibility start at the top, such that the most senior person in the organisation is accountable for the operation of the safety management system

- Authorisation for actions should be documented to record the following of procedure, with permits to work not issued without a suitable procedure

- Sufficient numbers of employees should be available to cover all necessary roles, and employees should be competent to perform those roles

- Channels of communication and documentation should exist to ensure all individuals are able to understand the responsibilities and authority of their role, with reference to the safety relevance of the role and any associated hazards

- Provision should be made for any material resources required for a role, with budget and allocation of equipment controlled at an appropriate level

- Channels of communication should exist for contractors as well as full employees, to ensure that workers from outside the organisation can understand their role and the associated procedures.

Clearly defined roles
An awareness of human risk factors
Sufficient staff
Staff competent to perform their roles
A permit to work system

Verification

Deviations from the intended procedures of operation should be investigated, and attempts should be made to either correct gaps in procedure or to prevent similar future deviations. The process used for this will depend upon what type of activity is being examined, and at what level. Serious or potentially serious individual incidents require handling as a special case, with accident investigation methods made to match the incident. For cases of regular actions that have a directly and quickly measurable success or failure outcome, performance indicators will be of most use in identifying problems. Audits will be of greatest value in identifying procedural problems in applying SMS elements.

Accident investigation
Leading and Lagging indicators of process safety performance
Audits

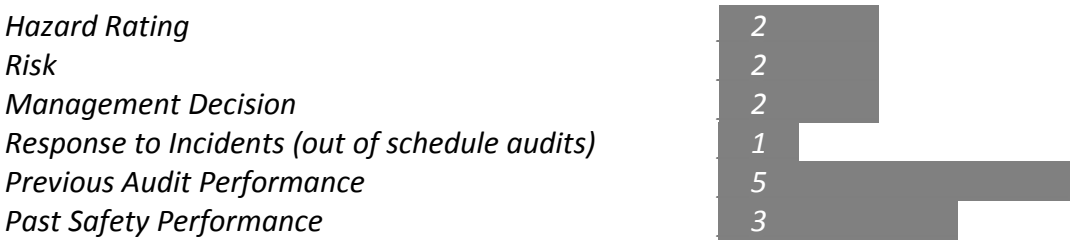
Management Review

Unforeseen problems are always possible, and a system may need to be adapted to deal with such problems. From the outcomes of verification elements, organisation leadership will need to determine whether the safety management system is functioning to achieve policy and objectives. If policy and objectives are not met by the system, change should be initiated. This might be in the form of a revised system, for example an adjustment of budget allocation, or it might be in the form of a greater commitment to achieving objectives, for example a drive to develop stronger safety culture.

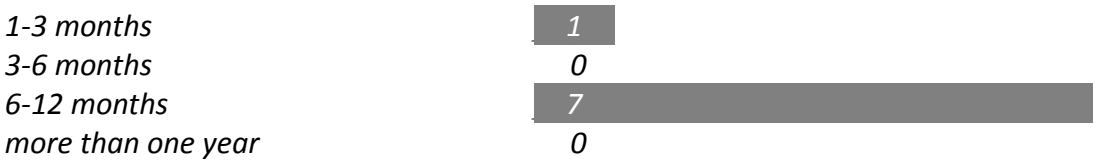
APPENDIX 4 – SURVEY OF MEMBER AUDITING PRACTICE

Audit Organisation and Pre-Audit Activities

Q1) Most responding companies audit sites on one, three or five year cycles as standard, although all will adjust the schedule to account for circumstance. Only a single company permits audits to be more infrequent than once per five year cycle. Factors used to determine the frequency of audits are:



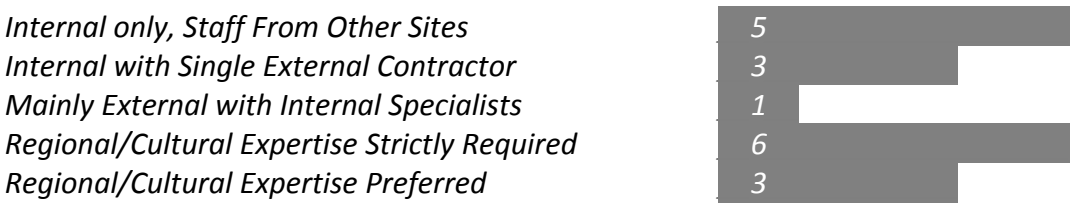
Q2) Methods for advance planning and preparation of audits vary considerably, however every response shows audits scheduled well in advance under normal circumstance, with all but one giving a minimum of 6 months planning. Normal pre-audit lead times are:



Q3) Pre-audit activities are used by all responding companies to prepare the auditors in advance. Companies that ask the audited unit to perform a self assessment indicate that it is a useful tool for setting correct expectations of the audit. Prior activities to support of the audit process include:

Audit Team, Site Visits and Sources of Evidence

Q4) All but one responding company use internal staff with relevant experience, further trained to audit. Three companies require the participation of an external contractor on standard audits.



Q4b) There is significant variation among responding companies on the amount of labour needed for an audit visit. 7 companies use small teams in brief visits, giving between 5 and 20 auditor-days of labour to each visit. 2 companies use far larger teams of up to 10 or 15 auditors with the visit covering more than a week, greater than 70 auditor-days per visit.

Q7 &
Q9) Organisational basis of process safety audits:

Q10) Answers show an even split between a highly structured audit process involving documented guidance, and a more freeform process with guide list of topics only. Responding companies use the following methods to guide the audit team during the visit:

Q11) Methods used for selecting samples of inspected equipment, inspected documents and interviewed staff show a similar even split. Approximately half of companies do not specify selection methods and rely on auditor judgement.

Q12) Unsurprisingly, all companies consider plant observation and documentation review to be vital core elements of the audit process. Only one company does not consider interviews to be part of the evidence gathering process to back audit findings.

A majority of companies begin the audit process with a site tour on the first day.

Audit Management and Validation

Q13b) Most companies ensure the effectiveness of their audit programme by normal management oversight of audit outcomes.
Of the survey answers, the most rigorous system for audit programme improvement used a combination of methods: auditor refresher training, regular review of audit guidance documents to match the audited standards, third party audit of the audit programme including participation in site visits, and strict rules for the independence of auditors.
Standard assessment of each audit by both audit team and audited site was used by another company to ensure continued effectiveness, alongside Internal audit of the audit programme and third party oversight.
Long term tracking of audit scores and analysis of audit findings by higher levels of organisation are also used.

Q14) There is not an overwhelming majority of companies that benchmark their auditing programme with peer companies:

Q15) No companies answered to say they had experienced audit failure. One response questioned whether it was possible for audits to fail, given their goal of improvement at a high level, as opposed to exposing specific flaws.

Q16) All responses show a collaborative process of report approval between auditors and the audited entity. Three companies involve higher levels of safety management in the approval process before issuing the report to the audited site.

Q17) All responses place the responsibility for implementing required changes with site/unit management. 7 responses detail a procedure of higher level management oversight of the progress of the audit follow up actions.

Q18) All responses indicate that audits are an important part of safety management structure. All companies with enough data to support the statement say that auditing is an effective method for improvement and identification of gaps.

Questions of Interest – A Closer Look

Q3 - "What methods are used prior to the audit to support the audit process?"

It is no surprise to see that a documentation review is a very common pre audit activity - preparing the auditors by giving them some familiarity with the site to be examined and some understanding of how it is managed. It is the other activities that reveal the purpose and attitudes behind the audit system.
Two companies started the audit preparation with the question "what are we protecting against" in the form of a major hazard assessment. This is an excellent way to focus attention on the process safety aspects of a safety audit, allowing auditor time to be effectively prioritised on the day, if needed.
The role of pre-audit self assessments was also raised - as a useful tool for setting expectations. An audit can work best as a cooperative process of improvement if all parties involved understand how it will work. A standard self assessment plays a part in this, showing the standards that are under examination and the level of detail that will be considered.

Q4 - "What is the typical composition of the team?"

Most companies use internal staff, either dedicated auditors or safety professionals trained for part-time auditing, to form the backbone of the audit team. However, some companies strictly require that an external contractor be present in the audit team, while others use contract specialists only to cover gaps in available skill-sets.

This question reveals a divided opinion on one issue, an issue that shows attitudes towards the expectations of the audit. Is an external viewpoint needed to have a truly searching audit?

Q4 - "What is the usual scheduled duration of the audit process?"

It should be expected that organisations need varying amount of effort to audit, and that differences in scope would lead to a greater amount of work needed for some audits. The difference in scale is still surprising to see. Some companies answered that their standard audits consist of a two person team over a handful of days, others report using teams of up to 15 visiting for two weeks.

Q10 - "In your organisation, what kinds of tools do you use to guide an audit?"

Among responses there was an even split between regimented systems which guided audits through documented procedure, and those which listed only topics to be investigated, leaving the auditors to plan their own use of time.

Q15 - "Do you have example of where individual audit programmes have been seen to be ineffective or failed?"

While no company gave an example of failure, one response raised the question: is it possible for an audit to fail?

Taken as being a high level process of validation and investigation, it is unreasonable to expect an audit to find everything. An audit cannot be said to have failed if later a significant but low level flaw is discovered. The audit will give an overview of safety performance, not guarantee safe operation.
However, an audit programme could be seen to fail if systematic problems are present over multiple audits, remaining uncorrected. A less significant form of failure could be the lack of improvement that would follow from a stagnant audit programme acting in a poor safety culture.