GUIDELINES FOR
MAJOR HAZARD FACILITIES



F – SAFETY
MANAGEMENT SYSTEMS

Queensland Government
Counter Disaster and Rescue Services
Department of Emergency Services

Produced by the Chemical Hazards and Emergency Management (CHEM) Unit

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(i) Sections of Act Relevant to Guideline

Dangerous Goods Safety Management Act 2001

PART 2—SAFETY OBLIGATIONS

Division 2—Obligations of occupiers and others

23 Obligations of occupiers

(1) The occupier of a major hazard facility or dangerous goods location has the following obligations—

(a) as far as practicable, to minimise the risk associated with the major hazard facility or dangerous goods location by—

(i) eliminating or minimising hazards at the facility or location; and

(ii) implementing measures to minimise the likelihood of a major accident at the facility or location; and

(iii) implementing measures to limit the consequences if a major accident happens at the facility or location;

(b) to ensure the safety of the occupier and employees while at the major hazard facility or dangerous goods location, including, for example, by providing and maintaining a safe place of work including safe storage or handling systems;

(c) and (d) are not directly relevant

(e) to develop, implement and maintain a safety management system for the facility or location.

PART 4—MAJOR HAZARD FACILITIES

Division 3—Other obligations of occupiers of major hazard facilities

45 Safety management system for major hazard facility

(1) For section 23(1)(e), the safety management system for a major hazard facility must be a documented, comprehensive integrated system for managing safety at the facility and must contain details of—

(a) the system's safety objectives; and

(b) the systems and procedures by which the objectives are to be achieved; and

(c) the performance criteria that are to be met; and

(d) the way in which adherence to the criteria is to be maintained; and

(e) other matters prescribed under a regulation.

(2) The safety management system must be developed and implemented—

(a) for a facility classified as a major hazard facility within 12 months after the commencement of this section—within 12 months after classification; or

(b) for a facility classified as a major hazard facility more than 12 months after the commencement of this section—within 3 months after classification.

(3) Without limiting subsection (1), but subject to subsection (2), the occupier of a major hazard facility must not operate the facility unless there is a safety management system for the facility.

(4) The safety management system must be reviewed and updated for the major hazard facility before any modification of the facility that significantly alters the risk associated with the facility is carried out.

(ii) Sections of Regulation Relevant to Guideline

Dangerous Goods Safety Management Regulation 2001

None specifically relevant

1 Introduction

The purpose of the Dangerous Goods Safety Management (DGSM) Act 2001 is to protect people, property and the environment from harm from hazardous materials. The Dangerous Goods Safety Management Act imposes certain safety obligations on occupiers of Major Hazard Facilities (MHFs).

For Major Hazard Facilities these obligations include conducting and documenting a Systematic Risk Assessment (SRA) of the operations, the implementation of appropriate risk reduction measures, consultation with the community and the submission of a safety report.

Included in the risk control measures are specific requirements for the establishment of emergency plans and procedures, the provision of education and training for employees and the development, implementation and maintenance of a Safety Management System (SMS).

This guideline provides information on the development of a SMS. This information is provided for guidance only on the content and structure of an occupier's SMS. It is not designed to impose a particular management model or framework; however the SMS should contain as a minimum the requirements as stated in the DGSM Act 2001. The information in a facility's safety management system should reflect the management style and culture in place.

2 Key Safety Management System Legislative Issues

2.1 Safety Obligations

The DGSM Act 2001 requires an occupier to develop, implement and maintain a SMS for the facility.

The SMS for a MHF must be a documented, comprehensive, integrated system for managing safety and must contain details of:

- the system's safety objectives;
- the systems and procedures by which the objectives are to be achieved;
- the performance criteria that are to be met; and
- the way in which adherence to the criteria is to be maintained.

2.2 Timeframe

The DGSM Act 2001 requires the timely development and implementation of SMS for MHFs.

The timing required for the development and implementation of the facility's SMS is outlined in the DGSM Act 2001 and is as follows:

- For a facility classified as a MHF before 7 May 2003, the SMS must be in place within 12 months after classification.
- For a facility classified as a MHF after 7 May 2003, the SMS must be in place within 3 months after classification.

Details of the facility's SMS should be made available to the regulatory authority upon request.

2.3 SMS Continual Review and Improvement

Within Section 45 of the Act there are specific requirements for the establishment of performance criteria and how performance should be maintained. The safety performance of the facility should be such that risk is maintained at an 'acceptable' level.

Review of performance and implementation of improvements to the SMS as a whole and to each and every SMS component, is a fundamental requirement of the Act, as it is with all modern management systems. This cycle of review and improvement is demonstrated in AS4801-2000, Occupational health and safety management systems – Specification with guidance for use. (See Guide Note 1)

Guide Note 1 – OHS Management System Model – AS4801-2000

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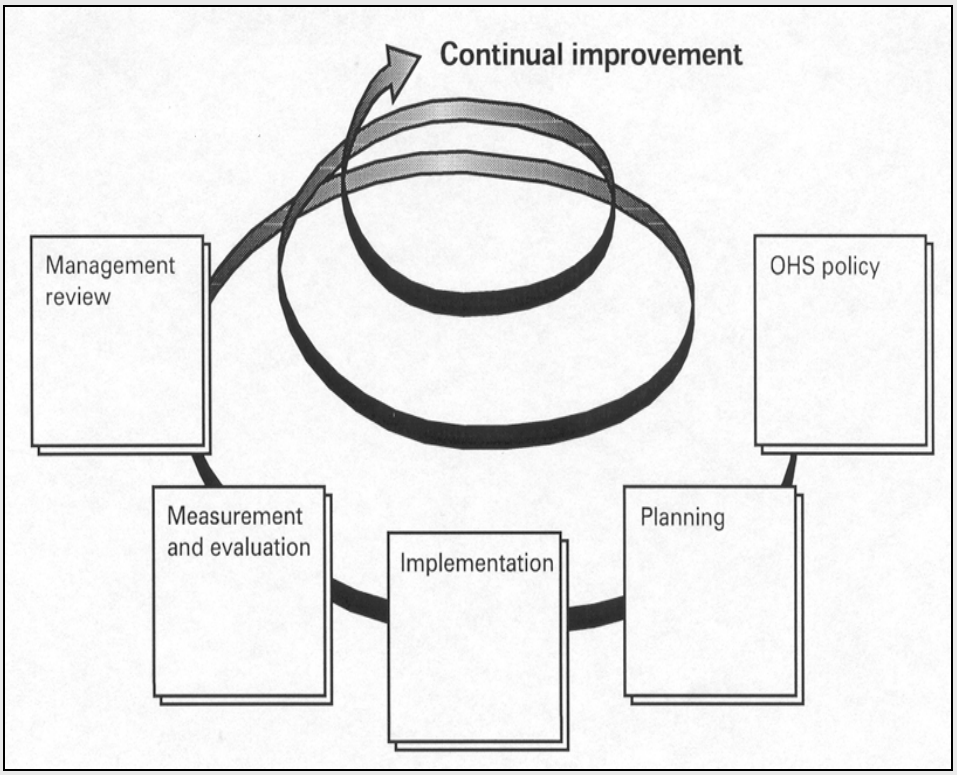


The facility's SMS should be reviewed and updated as appropriate if a modification occurs at the facility that significantly alters the risk associated with the facility. The occupier of an MHF has specific obligations under the DGSM Act with respect to modifications. Further information is available in ***Guidelines for Major Hazard Facilities, H – Modifications.***

2.4 SMS Components

Safety management systems in place within different organisations can take different forms, although they generally embody the same basic principles. The Act does not prescribe particular SMS components that should be in place, however to ensure risk is maintained at an acceptable level, particular core components should be in place. Section 3 of this document outlines typical SMS components for a MHF and most workplaces.

Other examples of safety management system core components are provided in Appendix 2 of the National Code of Practice (Control of Major Hazard Facilities) [NOHSC:2016(1996)].

3 Safety Management System - Structure

3.1 SMS Framework

The safe functioning of a facility depends on the overall management of the operation. The SMS should be the primary means of ensuring the risk arising from activities conducted at a facility is maintained at an acceptable level.

To maintain an acceptable level of risk the following basic elements are needed:

- The right plant (equipment and facilities);
- The right procedures (instructions and practices);and
- The right people (skills, culture, and behaviours).

All accidents, incidents or losses can be attributable to a breakdown of one or more of these elements. To achieve desired safety objectives it is vital that management provides appropriate support through commitment and leadership, and fosters the right safety culture.

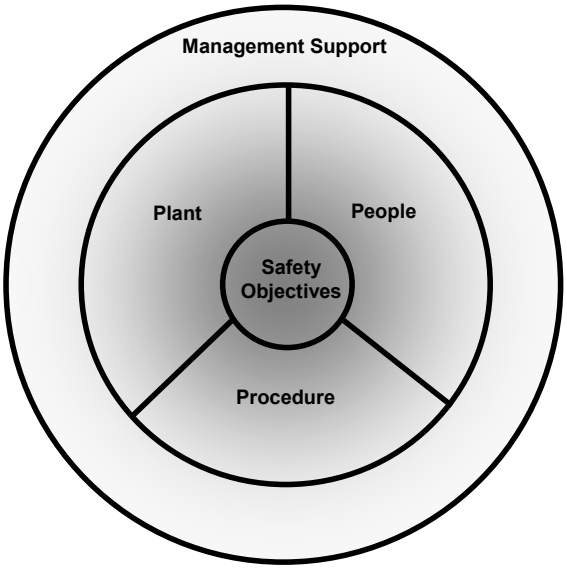


Figure 1. Elements for safe operation

The SMS provides the structured framework for the management of safety and control of risks associated with the operation at the facility. The SMS therefore needs to define the inter-relationships between these elements, e.g. to ensure continued safe operation, plant and equipment needs to be maintained by competent people following appropriate procedures and instructions - within a supportive management environment.

The framework models for a safety management system, like all effective management systems, involve the setting of objectives, the establishment of plans to meet those objectives, implementation of the plans, monitoring the outcomes of the plans and the planning and taking of corrective actions to improve performance. The safety management system should encourage continual improvement. Figure 2, below, highlights this approach, and is consistent with that of AS4801-2000 (Guide Note 1).

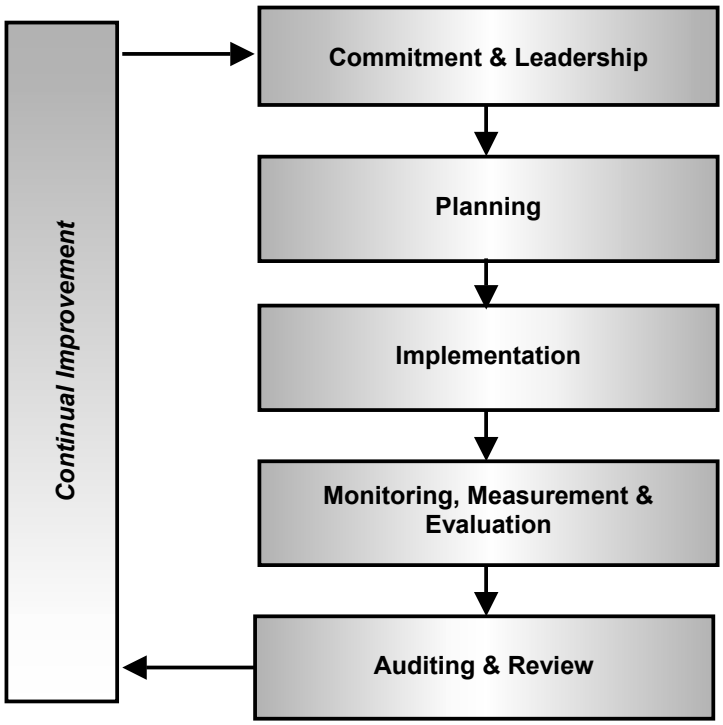


Figure 2. Safety Management System Model – Continual Improvement Cycle

Continual improvement in the functioning of the SMS, and hence the continual improvement in safety performance, requires the involvement of all employees – management and the general workforce. There should be a feeling of ownership of the system by all, through an employee understanding of why measures are in place and how they can be improved. The SMS should not just be seen simply as a series of procedures employees are forced to follow.

The SMS components should form an integrated, harmonious system with appropriate linkages and interactions, rather than just being a series of discrete activities. The SMS components should, where appropriate, cover all areas of operation.

When establishing or revising a SMS, components common to other management systems should also be considered. This may provide the opportunity to integrate the SMS with other management systems such as environmental, quality, human resources or financial. This topic is covered in AS/NZS 4581-1999 Management system integration – Guidance to business, government and community organizations.

The following subsections provide general information on each of the SMS framework elements and the typical types of components in each. The approach taken is in line with that outlined in Figure 2.

3.2 Commitment and Leadership

The responsibility for safety at a facility lies with line management who should demonstrate a high level of commitment to safety and continual improvement in safety performance.

Typical components of a SMS, which should be in place to address commitment and leadership, are as follows:

Safety Policy

There needs to be a visual demonstration of the commitment of senior management to operating in a safe manner, with the establishment of measurable objectives and targets to ensure continual improvement in safety performance.

This demonstration forms the basis of safety management and is displayed through the Safety Policy. The safety policy is a description of the company's long-term safety aspirations, setting out safety intentions and outlining how they will be accomplished. The policy should be clear and concise, relevant to the business and address key responsibilities and concerns. It should be an open document, shared inside and outside the organisation. The policy document should be issued with the personal endorsement of the most senior member of the organisation.

Specific facilities should have a safety policy relevant to the facility's local operations. This policy is generally consistent with the policy for safety in the entire organisation.

Resources

Sufficient resources, in the form of people, skills and equipment are required for the safe operation of the facility. Provision of these resources is required for the development and implementation of all aspects of the safety management system, with responsibilities and accountabilities defined.

The identification of resource requirements should be based on a continued analysis of facility needs with the following factors as the foundation:

- the ability of the facility to adequately meet business/productivity requirements; and
- in meeting these requirements, the risks to employees, surrounding communities and the environment from activities at the facility should be minimised.

There should be adequate professional safety resources available to support and assist line management in the discharge of their responsibilities.

Responsibility and Accountability

The responsibility, authority and inter-relation of personnel to ensure safety requirements are implemented, should be defined. There should be a top-down commitment to safety, with accountability for safety at all levels.

Communication

Effective participation and consultative mechanisms that support good communication and active involvement of all employees in safety management at the facility should be developed and maintained.

Employees should be aware of hazards at the facility, consulted in the assessment of risks and the implementation of control measures.

Appropriate on-site and off-site communication channels should be established for communication between management, employees, contractors and other stakeholders as appropriate.

3.3 Planning

To effectively achieve desired safety performance outcomes, time and resources should be allocated to the development of appropriate strategies and plans in a systematic manner.

Typical components of a SMS, which should be in place to address effective planning, are as follows:

Objectives and Targets

Safety objectives are specific components emanating out of the policy, which must be met. The establishment of safety objectives and targets aimed at overall SMS implementation and maintenance should be based on the management of identified risks.

Objectives should be measurable and capable of being verified. It is often useful to set medium term objectives that represent an improvement on current performance.

Safety targets are often used to assess progress towards the achievement of the objectives. For long-term objectives, it may be useful to set interim targets. In the establishment of safety objectives and targets, the following factors should be taken into consideration:

- the identified risks from the facility's hazards, e.g. those from the SRA;
- specific legislative and corporate requirements;
- the specific interests of significant stakeholders, e.g. local community; and
- availability of technology and resources.

Information Requirements

Information should be identified, compiled and maintained specific to the activities at the facility, e.g. complete and accurate information on chemicals, process technologies and process equipment should be prepared. This information has to be kept up to date for the effective safety management of the facility.

The type of specific information as a minimum should include:

- Material Safety Data Sheets (MSDS) for all hazardous materials processed, stored and handled;
- location and maximum intended quantities of materials processed and stored;

- process equipment design information, including Australian standards, legislative requirements, advisory standards, industry guide notes, codes of practice and specific company requirements;
- plant, equipment and process specifications, including safe operating limits, e.g. temperatures, pressures, flows etc.;
- process flow diagrams showing major process equipment and inter-connecting process flows;
- incident and accident records, and subsequent investigations;
- records of hazard studies and risk assessments conducted;
- critical risk reduction measures, e.g. safeguards and controls; and
- surrounding land use including sensitive receptors.

Provisions should be made for ready access to this information. This compiled information will be required in a variety of planning situations including:

- hazard identification and risk assessment processes, e.g. SRA;
- development and implementation of operating and maintenance procedures;
- development of training plans for employees and contractors;
- emergency preparedness and control of abnormal operations;
- community consultation process; and
- preparation of safety reports.

Safety Plans

Safety plans should be established to address areas of identified risk with the goal of achieving agreed safety objectives and targets.

The use of short-term milestone targets is appropriate in the development of safety plans.

All plans based on achieving targets should identify who is responsible for the actions to be taken (See Guide Note 3).

Progress against the safety plans should be continually monitored, as well as being formally reviewed at appropriate time intervals.

Guide Note 3 – S.M.A.R.T. Targets

Where possible, targets should be set as 'SMART' targets i.e.

Specific – clearly defined as to what is to be achieved
Measurable – outcome capable of being measured
Achievable – realistically attainable
Relevant – applicable to overall objective
Timed – results achievable in appropriate timeframe

3.4 Implementation

Plans only yield results when actions are taken and the plans are implemented. Continual improvement depends not only on the implementation of new actions, but also on the continual maintenance of practices that underpin the existing level of performance.

Typical components of a SMS, which should be in place to address effective implementation, are as follows:

Hazard Identification and Risk Assessment

Procedures should be established for identifying hazards and assessing the risks associated with these hazards. The hazard identification and risk assessment process is the key factor in the prevention of accidents through the identification and consideration of events that could lead to such accidents. The hazard identification and risk assessment process should also be the basis for the establishment and continued development of the facility's safety management system through the enhancement of process safety and the identification of areas for improvement.

The outcomes of the hazard identification and risk assessment and indeed involvement in the process itself, assists the occupier and the facility's employees in the development and implementation of safety improvements. These improvements can either reduce the likelihood or the consequence of unplanned releases of hazardous materials.

The hazard identification and risk assessment process for a MHF should be directed toward analysing the potential causes of explosions, fires and releases of hazardous materials and should focus on equipment, processes, materials, human actions and external factors which effect operational activities.

The methodologies available for the identification of hazards and assessment of risk are varied, and the appropriate technique(s) should be used based on factors such as complexity of operation and experience and knowledge of the team conducting the analysis. (See Guide Note 4).

Guide Note 4 – Hazard Identification Tools

- Hazard & operability studies (HAZOP);
- Checklists;
- What-if analysis;
- Fault tree analysis;
- Event tree analysis;
- Job safety analysis;
- Failure Modes & Effects Analysis (FMEA);
- Human error identification methods;
- Task-based reviews;
- Methodical leak/rupture approach;
- Past incident reports; and
- Safety reviews

Safety Assurance

The occupier should have processes in place which provide a level of assurance that the location is a 'safe place of work'. To provide this assurance, facilities, plant and equipment must be designed, constructed and maintained to an acceptable standard.

These safety assurance considerations include:

- safe access and egress from buildings and work areas, during normal and emergency conditions;
- structures and buildings designed and constructed appropriately for their purpose, expected environmental conditions etc.;
- plant and equipment is designed to appropriate standards, and is constructed and installed so that:
  - it can be started, operated and shut down safely,
  - it has a high level of containment integrity, including secondary containment, and
  - it has appropriate emergency isolation, relief and shut down arrangements;
- facilities and equipment can contain and control hazardous material emergencies;
- inspection, monitoring and auditing to ensure that level of mechanical integrity of plant and equipment is maintained;
- provision and availability of emergency response arrangements (fire extinguishers, first aid etc.); and
- review for hazards and risks to persons, property and the environment at all phases of operation (design and commissioning, operation and maintenance, decommissioning and final closure).

The selection and implementation of such safety assurance systems must have its basis in the hazards and risks identifed at the facility.

The most appropriate opportunity to eliminate or minimise these risks is during the design of the facility or design of modifications to the facility. Inherent risks in the process should be identified and minimised as far as practicable during the design phase through adherence to appropriate design rules, design reviews and use of hazard identification techniques. (See Guide Note 5).

Guide Note 5 – Hierarchy of Control

In minimising the risk from the hazards, control options should be implemented in line with the hierarchy of control.

Elimination ↓	- removal of the hazard
Substitution ↓	- replace the risk for a lesser risk such as use of a less hazardous material
Intensification ↓	- use of smaller inventories of hazardous materials in process and storage
Engineering Controls ↓	- make physical change to reduce the risk, such as use of less hazardous process conditions
Isolation ↓	- provide separation between hazards or hazards and receptors
Administrative Controls ↓	- implement systems of work to reduce risk
P.P.E.	- provide Personal Protective Equipment to employees exposed to the risk

Appropriate systems for control of the process are required to maintain operation within established safe operating parameters that collectively are the facility's operating envelope. The effective control relies on the management of a number of elements including equipment hardware, computer components and software instructions and the human interface with such systems.

The management arrangements should address areas such as the following:

- design philosophy, performance and reliability specifications for the process control systems;
- management of critical alarms and interlocks, including control of changes to alarm set points;
- monitoring the performance of critical equipment items, e.g. pressure safety valves, non-return valves, emergency isolation valves etc.; and

- assessment of human factors, such as interfacing arrangement with the process and equipment, level of operator/automatic control and human error.

Maintaining the integrity of the facility's equipment should be based on sound reliability engineering practices. Maintenance work should be centred on a risk based planning approach rather than relying on a solely re-active, 'breakdown' maintenance. (See Guide Note 6).

Arrangements should include the regular review of hazards and the routine inspection of equipment to ensure it is at all times 'fit for purpose'.

Guide Note 6 – Elements of a risk based maintenance approach

- Equipment identification and categorisation, including the identification of primary and secondary functions of the equipment.
- Identification of the root causes of equipment failure and the meantime to failure for components.
- Identification of effects and consequences in the event of failure of equipment or their components.
- Identification and implementation of preventative actions such as inspection and testing at appropriately established frequencies.
- Comparison of test results against defined acceptable criteria and the documentation of inspection and test results.

Systems of Work

Procedures should be established for the control of risks to people, property and the environment arising from activities conducted at all stages of the life of the facility. These procedures, as well as detailing the activities to be undertaken, should also specify control measures to be adopted such as Personal Protective Equipment (PPE) to be worn or specific safe practices to follow.

Systems and procedures for performing 'safe' work need to be established, maintained, monitored and reviewed to cover the following:

- **Construction and commissioning -** construction and commissioning of new facilities and modifications to existing facilities.
- **Operational phase -** start up, normal operating conditions, abnormal or deviations from normal operating conditions, emergency conditions and shut down.
- **Maintenance conditions -** pre-work safety assessment, isolation and decontamination of plant and equipment, permit to work systems (e.g. hot work, confined space entry, work at heights) non-routine work, modifications and repairs.
- **Decommissioning -** shut down and closure of facility operations or operating unit(s) at the facility.
- **Contractors -** control of work carried out at the facility by others, e.g. contractors, on behalf of the occupier.
- **Visitors -** control of all visitors to the facility.
- **Security** - provision of adequate systems for maintaining security at the facility.

Systems of work should be reviewed and updated periodically as new hazards are identified and procedures and operations change.

New procedures should not be implemented without first ensuring the risks associated with the procedure is acceptable.

Training

Safety education and training for personnel at a facility should be an integral part of operating safety, and should be considered a normal component of all operational or vocational skills training.

The training systems and procedures at a facility should include the following core components:

- development and implementation of training and education plans, to maintain the desired standards of competency;
- provision for appropriate induction of new employees;
- performance measurement to evaluate levels of competency as well as the effectiveness of training plans; and
- the provision for the ongoing management and retention of training records.

In determining what specific training is required, the minimum standards or levels of competency for all positions need to be established. The analysis of training needs required to achieve and maintain appropriate level of skills and ability to ensure operations are carried out safely should take into account the following factors:

- an assessment of the risks associated with the tasks and activities being undertaken;
- site specific factors, including basic requirements for all personnel working on the site;
- skills and knowledge required to perform specific roles safely, such as specific procedures to be followed, knowledge of processes etc.; and
- the level of supervision of the employees or contractors while performing required tasks or activities.

Provisions should also be made for the verification of skills and qualification of contractors engaged to do work at the facility.

The occupier of an MHF has specific obligations under the DGSM Act with respect to education and training. Further information is available in ***Guidelines for Major Hazard Facilities, E – Education and Training.***

Emergency Preparedness

All potential emergencies, particularly hazardous material emergencies, at the facility should be identified and appropriate plans and procedures established to minimise the impact of such emergencies.

These plans should include:

- details of the potential major accident scenarios as identified from the SRA process;
- procedures for the safe evacuation of the facility and the accounting of all employees, contractors and visitors on site;
- roles and responsibilities of key employees in the execution of the emergency plans;
- training of all employees to ensure they are competent to perform their roles in an emergency;
- emergency communication provisions, including on site, liaison with emergency services and off-site community and other stakeholders; and
- the resources and equipment available to deal with the emergency.

A schedule of emergency drills and exercises for potential emergency situations should be established and implemented. The effectiveness of the emergency plans and procedures should be periodically assessed, reviewed and improved where appropriate.

The occupier of a MHF has specific obligations under the DGSM Act with respect to emergency planning. Further information is available in ***Guidelines for Major Hazard Facilities, D – Emergency Plans and Procedures*.**

Management of Change

Procedures should be established to ensure that changes/modifications to plant, systems, processes and people do not compromise safety.

These should cover:

- definition of what constitutes a change or modification;
- process for initiating change;

- authority for approving intended changes;
- documentation of the change;
- safety implications/assessment of risk associated with the change;
- communication processes established to ensure details of changes are appropriately disseminated; and
- post change review.

For modifications that significantly alter the risk associated with the operation of the facility, the occupier of the MHF has specific obligations under the DGSM Act. Further information is available in ***Guidelines for Major Hazard Facilities, H – Modifications*.**

3.5 Monitoring, Measurement and Evaluation

Regular monitoring, measurement and evaluation of the facility, plant, equipment, process, systems and procedures will ensure deficiencies are identified so that actions can be taken for rectification.

Typical components of a SMS that should be in place to address effective monitoring, measurement and evaluation are as follows:

Performance Criteria

Performance criteria or standards should be established as a benchmark to measure and monitor the performance of the system and specific areas of the system. Performance criteria for a system or procedure are simply the performance expectations of that system or procedure.

The performance criteria should be aligned to the safety policy and objectives, with the measurement of actual performance against such criteria providing a relative indication of compliance.

Performance criteria should be set for critical SMS components or procedures as indicators of the facility's progress toward achievement of established safety objectives.

The performance criteria should address risks identified during the hazard identification and risk assessment process, e.g. SRA.

These criteria may be based on company requirements, industry comparisons or international benchmarks.

Performance criteria should include the following basic elements:

- what is expected;
- by when or in what time frame; and
- who is responsible.

Two types of performance criteria measures may be established:

- lagging (negative or reactive measures); or
- leading (positive or proactive measures).

An appropriate mix of both lag and lead indicator measures should be adopted to provide the best indication of overall safety performance at the location.

Lagging performance based criteria rely on measures of the occurrence (or absence) of failures such as injuries, illnesses, losses, incidents, environmental releases etc. However, performance at a facility may appear good based on such measures, due to the infrequency of events, without providing sufficient feedback on the actual safety management performance.

Leading performance-based criteria rely on measures of inputs to safe practices, such as procedural compliance, adherence to training schedules, inspection and monitoring schedule compliance etc. Appropriate positive based measures are indicators that can

give assurance that the absence or reduction in frequency of incidents (losses, accidents etc.) is due to the systematic management approach aimed at preventing such incidents.

Inspection, Monitoring and Testing

Systems and procedures should be established for the inspection, monitoring and testing of work areas, plant, equipment and process conditions to ensure the integrity of the facility. These inspection, monitoring and testing programs undertaken at appropriately determined frequencies may include:

- critical parts and critical control devices;
- mechanical integrity of tanks, vessels, pipe-work, pumps or compressors;
- fire protection systems;
- emergency response equipment;
- workplace hazards and housekeeping;
- process conditions;
- environmental emissions; and
- employee health monitoring programs.

The results of such inspections, tests and monitoring programs should be compared against established performance criteria. Necessary corrective actions arising out of inspection, monitoring and testing should be raised, assigned and implemented.

Appropriate records of completion and test results should be retained, analysed and reported. Records of corrective action assigned and completion should be retained.

Provisions should be in place to ensure equipment used for inspection, monitoring or testing is appropriately calibrated and maintained.

Incident Reporting and Investigation

Procedures should be established and maintained to ensure that incidents resulting in deviation, near miss, injury or accident are reported, appropriately investigated and corrective actions put in place to minimise the risk of re-occurrence.

The investigation should identify the apparent and root causes that were the precursor to the occurrence of the accident or near miss. Corrective actions taken should address the identified root cause(s). These corrective actions should have responsibilities defined for implementation as well as defining appropriate completion time frames.

Appropriate records of incidents reported should be retained, and should include details of investigations and corrective actions taken. These records should be readily accessible through an appropriate document management system. Analysis of these records, such as causation breakdowns or trends, forms an important input into hazard identification, risk assessment and other risk management processes.

The leader and members of incident investigation teams should be appropriately trained and competent.

The occupier of the MHF has specific obligations under the DGSM Act for the notification and reporting of incidents. Further information is available in ***Guidelines for Major Hazard Facilities, J – Accidents and Near Misses.***

3.6 Auditing and Review

Regular management review of the safety management system is required to provide assurance of the effectiveness of arrangements in managing risk and in meeting the facility's safety policy and objectives. These reviews provide an opportunity for promoting, supporting and sustaining continual improvement in safety performance.

Typical components of a SMS, which should be in place to address effective auditing and review processes, are as follows:

Auditing

Formal audit arrangements should be established to verify that the systems and procedures in practice at the facility are consistent with those defined in the SMS.

These periodic audits of the SMS should be conducted as a normal part of the facility's business activities.

Appropriate auditing processes and schedules should be defined. The frequency and comprehensiveness of the scheduled audits should be based on factors such as:

- risk associated with particular activities as identified through the hazard identification and risk assessment process;
- organisational requirements based on corporate or facility policy; and
- reports of non-compliance from incident reporting and investigation process.

Sufficiently independent people, with the appropriate skills and training to conduct the audit effectively, should carry out audits.

The focus of specific audits may vary depending upon the requirements of the facility to effectively monitor and reinforce safety and minimise risk. The focus of audits can be narrow or broad and may include:

- management system;
- specific hazard; and
- procedural compliance.

The overall auditing process should provide:

- verification that established procedures, particularly those deemed to be critical, are being adhered to;
- identification of areas of non-compliance and opportunities for improvement; and
- input into the safety management system review process.

Corrective actions raised should have responsibilities for actions assigned and timeframes agreed and defined.

Appropriate records of audit reports should be retained, and should include details of deficiencies and corrective actions taken. These records should be readily accessible through an appropriate document management system.

Review and Improvement

The management review process is an evaluation of the effectiveness of the SMS in fulfilling the facility's safety policy and objectives.

The review should evaluate the performance of the facility and its SMS, with consideration of the following factors:

- performance against established performance criteria;
- results of audits conducted;
- review of hazard studies and risk assessments;
- completion of safety plans and progress against longer term plans;
- organisational, regulatory and community expectations – present and future;
- resource and technology changes; and
- recent incidents and accidents.

Reviews can be of two basic types:

- on-going reviews at different levels of the operation, continually monitoring compliance and implementing improvements to elements of the safety management system; and
- senior management reviews, monitoring the 'health' and overall performance of the safety management system and identifying areas for improvement. These improvements may extend to modifying the safety policy, objectives and strategy for control of major accidents at the facility.

Without an established review process, continual improvement in the safety performance of the facility and the effectiveness of the safety management system itself will be difficult to achieve.

Guide Note 7 - Summary of Typical SMS Core Components

Commitment and Leadership

- Safety Policy
- Resources
- Responsibility and Accountability
- Communication

Implementation

- Hazard Identification and Risk Assessment
- Safety Assurance
- Systems of Work
- Training
- Emergency Preparedness
- Management of Change

Planning

- Objectives and Targets
- Information Requirements
- Safety Plans

Monitoring, Measurement and Evaluation

- Performance Criteria
- Inspection, Monitoring and Testing
- Incident Reporting and Investigation

Auditing & Review

- Auditing
- Review and Improvement

4 Safety Management System - DGSM Act Requirements

4.1 Links from the Systematic Risk Assessment

The DGSM Act 2001 requires all MHFs to conduct a comprehensive, Systematic Risk Assessment (SRA). The SRA provides the platform for a MHF to develop new systems or refine existing systems so that they address and reduce the facility's potential for, and impact of, a major accident or hazardous materials emergency.

From the hazards and risks identified during the SRA, the risk reduction measures that are in place, or should be in place to minimise risk at the facility to an acceptable level, should be apparent. Each of these risk reduction measures should therefore be linked to a hazard or number of hazards identified during the SRA process.

There should be supporting management arrangements in place that are clearly linked to identified risk reduction measures. These management arrangements, such as work instructions or procedures, may directly manage the risk, or indirectly manage the risk by ensuring that hardware control items are designed, selected, installed, maintained and operated appropriately. A risk reduction measure, which if removed would result in a significant increase in the risk of a major accident, could be considered to be a *critical* risk reduction measure. (See Guide Notes 8 and 9)

The associated management arrangements, which support risk reduction measures, form the basis of the SMS components. Clearly management arrangements, which support critical risk reduction measures, are critical components of the SMS. These SMS components will need to be discussed in the occupier's submitted Safety Report. Included in this discussion should be the links to relevant hazards identified in the SRA, and the processes in place to continually monitor and improve the performance of these critical SMS components.

Guide Note 8 – Critical Risk Reduction Measure - Procedural Example

The chlorine inventory held at a facility has been identified as a significant hazard on the site. A release of this inventory has the potential for significant on-site and off-site toxic impacts. During the SRA, the frequency of release from the storage vessel was considered to be very low. This consideration was based on the excellent inspection and testing procedures in place at the facility to monitor the integrity of vessel.

However, poor adherence to these inspection and testing procedures could result in a failure to identify corrosion or other defects in the vessel, thereby increasing the potential for chlorine release. The inspection and testing procedures already in place are therefore considered to be a critical risk reduction measure and therefore a critical component of the SMS. These procedures need to be maintained, through monitoring and auditing, to ensure the assessed level of risk remains unchanged.

Guide Note 9 – Critical Risk Reduction Measure - Hardware Item Example

During a facility's SRA, over pressurisation of a reaction vessel has been identified as one of the potential precursors to the release of flammable vapours. A major release from this vessel has the potential for significant on-site and off-site impacts. Two of the key risk reduction measures identified during the SRA were:

- The process control system that maintains appropriate flow rates of reagents to the vessel – a critical *preventative* measure to maintain operating conditions within defined parameters; and
- The pressure relief system on the vessel which safely vents at pressures above a safe operating pressure – a critical *control* measure in the event of abnormal or upset conditions.

While these risk reduction measures rely on hardware items, such as pressure relief valves, control valves and flow transducers, to maintain safe operating conditions, the operation of these hardware items relies on supporting management systems and procedures. For such hardware items to work effectively and reliably, critical SMS components must be in place to ensure appropriate specification, selection, installation and on-going maintenance.

4.2 Requirements to be Demonstrated

The DGSM Act has specific requirements for an occupier's SMS. These requirements need to be established and be readily apparent to ensure the occupier's obligations under the Act are met.

For a MHF's SMS to be considered adequate in the management of safety at the facility, consistent with the requirements of the DGSM Act, the following must be demonstrable:

Documented System

- A system of written safety objectives, performance criteria and procedures must be established. There should be sufficient documentation of the system to provide evidence that the system is in place. This includes written documentation of items such as established procedures, safety plans, training programs, safety targets, standards, monitoring schedules, and appropriate supporting records.

- The system documentation should be presented in a form that is easily understood by, and readily accessible to employees and other intended system users. The structure and nature of the SMS should be such that validation and verification by third party audit is straightforward and not an unduly complicated process.

- Supporting SMS documents should be controlled by an appropriate document management system. This document management system should ensure appropriate identification, indexing, access, retrieval, maintenance, filing and storage of all pertinent documents such as procedures, task instructions and records, e.g. the DGSM Regulation requires that records of induction, education and training activities carried out must be kept for at least 5 years.

Comprehensive System

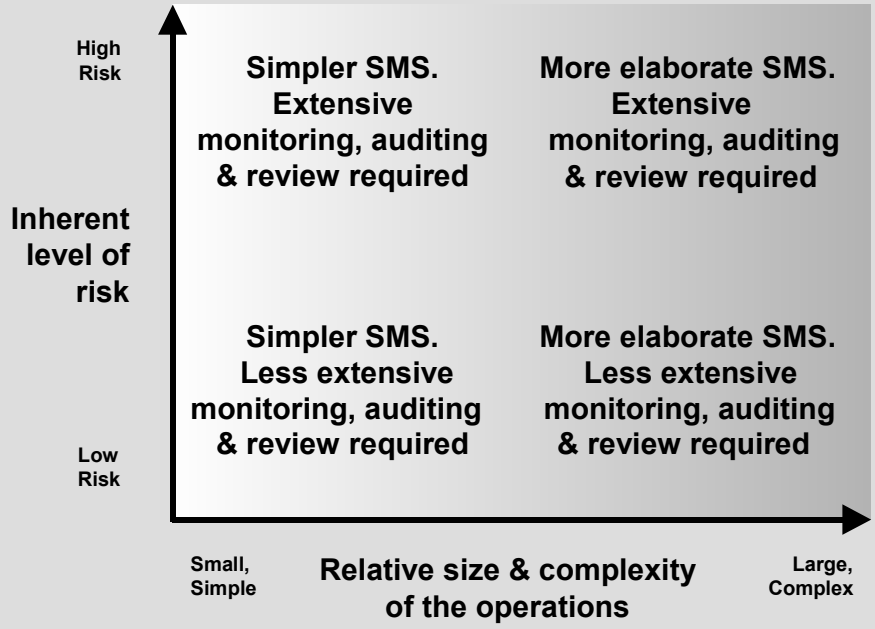
- The system should cover appropriate areas in sufficient detail commensurate with the nature and complexity of the operations. (See Guide Notes 10 and 11)

Guide Note 10 – Complexity of the Safety Management System

The safety management system should cover appropriate areas in sufficient detail commensurate with the nature and complexity of the operations.

As a general rule, the complexity and level of documentation of the safety management system should be similar to that in place at the facility for other management systems such as quality, finance or human resource.

However the higher the inherent risk, the more extensive monitoring, auditing and review of the safety management system are required.



- The system should cover the full range of activities that could have a significant impact on safety at the facility. Particular emphasis should be given to those activities and tasks that the SRA has identified as having the potential to lead to a major accident, i.e. identified critical SMS components.

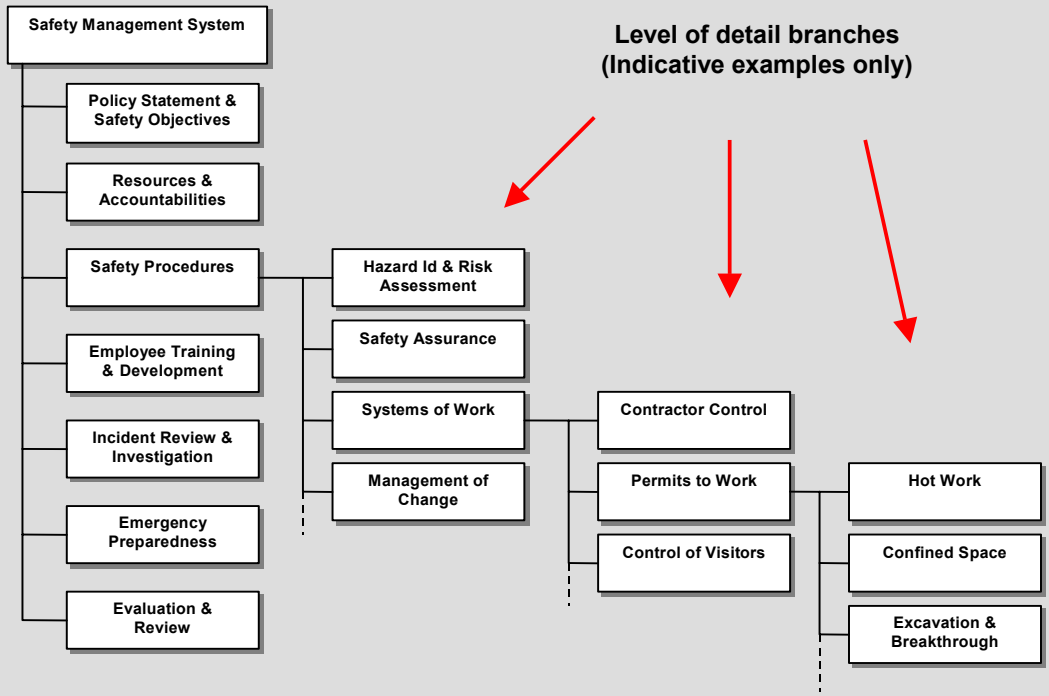
- The system should cover all phases in the life of a MHF, i.e. acquisition, design, construction, installation, commissioning, start-up, normal operation, abnormal operation, maintenance, emergency situations, shutdown and decommissioning of plant.

Integrated System

- The system should have appropriate links between SMS components rather than be a series of discrete activities, e.g. link from risk assessment processes to other SMS components.

Guide Note 11 - Documented, Comprehensive, Integrated System

A summary document outlining the structure of the SMS will provide information in support of the requirement for a documented, comprehensive integrated system. The structure may show varying levels of detail branching out from each main element of the SMS as indicated below. Appropriate brief discussion of key elements is also beneficial.



Safety Objectives

- Objectives, (including supporting targets, goals or milestones) should be established for the facility's operation and the safety management system.

- The establishment of safety policy, objectives and overall system implementation and maintenance should be based on the management of identified risks at a facility. The safety policy and the established objectives should be aimed at the minimisation of risk to people, property and the environment from the facility's operation. A safety management system which is not based on the specific hazards at a MHF and the management of associated risks, is fundamentally flawed.

- A clear link should be apparent between the established policy and objectives and the major risk contributors identified in the SRA conducted for the facility. (See Guide Note 12)

Systems & Procedures

- The development of new SMS procedures and/or the refinement of existing ones should be based on the minimisation of the facility's risks.

- The implementation of such systems and procedures should support the facility's safety objectives.

- Components consistent with those outlined in Section 3 of this guideline should be in place.

- The link between the development or refinement of the SMS and the SRA should be apparent, with particular emphasis on those components identified as critical.

Performance Criteria

- Performance criteria or standards should be established as a benchmark to measure and monitor the performance of the overall SMS and specific components of the SMS.

- Performance criteria should be set as indicators of the facility's progress toward achievement of established safety objectives. (See Guide Note 13)

- The link between the establishment of performance criteria and minimisation of risks from hazards identified during the SRA should be apparent.

Guide Note 12 – Safety Objective / Performance Criteria Example

During the SRA at a facility, specific areas identified as common precursors to potential major accidents included:

1. changes to plant and equipment;
2. human errors – skills, competencies and decision making;
3. mechanical integrity of plant and equipment; and
4. Non-routine work.

Based on the findings of the SRA, the following Safety Objectives with appropriate Performance Criteria (descriptive examples only) were established:

1. **'Harm to people, property and the environment from ill-conceived or badly-executed modifications should be avoided.'**
   - Modification procedure developed and implemented (time target)
   - Employees trained in Modification procedure (time target)
   - Compliance to Modification procedure verified by audit at appropriate frequency (audit compliance target)

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Guide Note 12 – Safety Objective / Performance Criteria Example (cont.)

2. **'The potential for human error to cause a major accident will be minimised as far as practicable.'**
   - Competency assessed training programs developed for all facility employees (compliance target)
   - Employees undergo training as per established training program (compliance target)
   - Assessment of employee/process interfacing conducted across all work areas (time target)
   - Implementation of changes agreed from employee/process interfacing assessment (compliance target)

3. **'The risk of major accidents arising from failure of mechanical integrity of process plant and equipment will be minimised as far as practicable.'**
   - Inspection and testing schedules developed and implemented for specific plant and equipment (time target)
   - Compliance to inspection and testing schedules verified by audit at appropriate frequency (audit compliance target)
   - Records of failures in mechanical integrity of process plant and equipment. (ceiling target)
   - Inspection and testing schedules reviewed for effectiveness at appropriate time intervals (compliance target)

4. **'Risk to people, property and the environment arising from non-routine work will be minimised as far as practicable.'**
   - Permit to work procedures, covering non-routine work, developed and implemented. (time target)
   - Employees trained in permit to work procedure (time target)
   - Compliance to permit to work procedure verified by audit at appropriate frequency (audit compliance target)

Effectiveness of Risk Reduction Measures

- A process should be in place to validate the appropriateness of established risk reduction measures in maintaining an acceptable level of risk. e.g. a review process checking that the established procedures are suitable, and are based on appropriate standards and practices for the process or task being undertaken. This validation process should challenge established norms and paradigms.

Adherence to the Criteria

- A process should be in place to verify that the systems and procedures supporting risk reduction measures are being adhered to. e.g. an auditing process checking adherence to procedures at a frequency commensurate with the criticality of the procedure being audited.

- Processes should be established to monitor performance, including comparison with the established performance criteria. This comparison provides the basis for performance evaluation of the SMS and identifies areas where improvement is required. (See Guide Note 13).

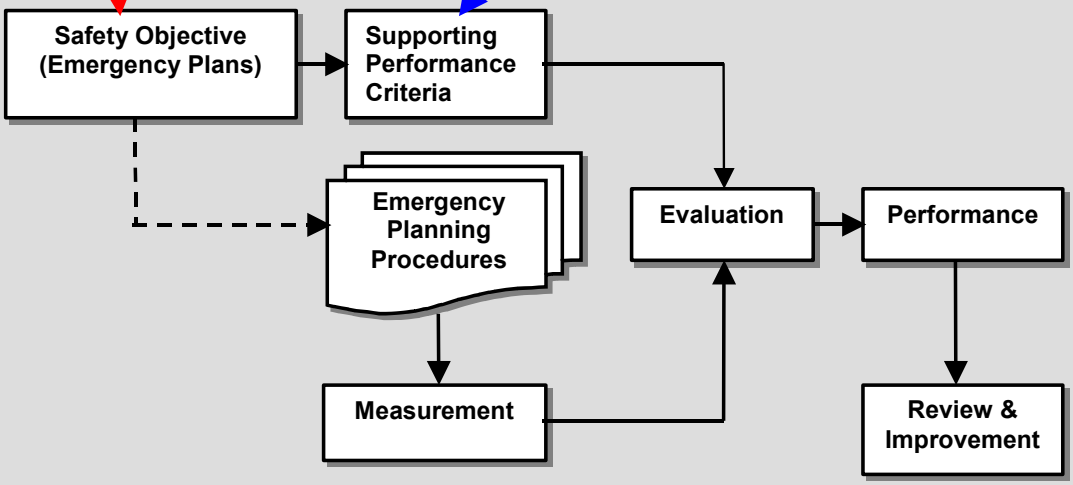
- Processes should be establised for the mangement of incidents, including identified non conformances. This should include systems for the reporting, recording, investigating and implementation of appropriate corrective measures.

Guide Note 13 – Adherence to Criteria Example

A facility has an established Safety Objective with supporting performance criteria for Emergency Planning as follows:

'The impact of hazardous material emergencies will be minimised through the development, implementation and maintenance of emergency preparedness and response plans.'

- Emergency plans reviewed at appropriate frequency (compliance target)
- All employees trained in emergency plans – general and specific roles – at appropriate frequency (compliance target)
- Emergency drills conducted at appropriate frequency (compliance target)
- Emergency drills conducted at appropriate proficiency (compliance target)



This performance evaluation demonstrates the level of adherence to established emergency planning criteria and supports achievement of the SMS safety objectives. This provides the basis for continual improvement in performance.

5 Summary of Occupier's Requirements

The occupier may use the following as a checklist.

The occupier should be able to demonstrate the following:

5.1 Documented, Comprehensive, Integrated System

Tick box

- Appropriate written documentation of the SMS. ☐
- The SMS is accessible and understandable by employees at the facility. ☐
- The SMS covers the full range of activities that impact on safety at the facility. ☐
- The SMS has components that cover all phases of the life of the facility. ☐
- Appropriate linkages between SMS components are in place. ☐

5.2 Safety Objectives

- Written safety objectives have been established. ☐
- The development of the safety objectives has been based on the management of risks identified during the SRA. ☐

5.3 Systems and Procedures

- The development of new SMS procedures and/or the refinement of existing ones is based on the minimisation of risks identified during the SRA. ☐
- Critical SMS components should be established with linkages from hazards identified in the SRA clearly apparent. ☐
- The established systems and procedures support the facility's safety objectives ☐

- SMS components, consistent with those outlined in Section 3 of this guideline have been established. ☐

5.4 Performance Criteria

- Performance criteria have been established against which performance can be assessed. ☐
- Assessment against performance criteria will indicate achievement of safety objectives. ☐
- The link between established performance criteria and hazards identified during the SRA is apparent. ☐

5.5 Effectiveness of Risk Reduction Measures

- Processes have been established to validate that risk reduction measures are appropriate in minimising risk to an acceptable level. ☐

5.6 Adherence to Criteria

- Processes have been established to verify and maintain compliance with established SMS components. ☐
- Processes have been established to monitor safety performance against established performance criteria. ☐
- Systems for the reporting, recording, investigation of incidents and non-conformances, and implementation of corrective measures have been established. ☐

6 Further Reading

Australia and New Zealand Hazardous Industry Planning Taskforce 1995
Safety Management
ISBN 0 7310 3082 6

National Occupational Health and Safety Commission
National Standard for the Control of Major Hazard Facilities
[NOHSC:1014(1996)]
Australian Government Publishing Service Canberra
Available at:
www.nohsc.gov.au/OHSInformation/NOHSCPublications/fulltext/toc/01397-01.htm
ISBN 0 644 45926 3

National Occupational Health and Safety Commission
National Code of Practice for the Control of Major Hazard Facilities
[NOHSC:2016(1996)]
Australian Government Publishing Service Canberra
Available at:
www.nohsc.gov.au/OHSInformation/NOHSCPublications/fulltext/toc/01497-01.htm
ISBN 0644 45926 3

Standards Australia
Occupational health and safety systems – Specifications with guidance for use
AS 4801 – 2000
Standards Australia and Standards New Zealand
ISBN 0 7337 3209 7

Standards Australia
Risk Management
AS/NZS 4360 – 1999
Standards Australia and Standards New Zealand
ISBN 0 7337 2647 X

Standards Australia
Management system integration – Guidance to business, government and community organizations
AS/NZS 4581 – 1999
Standards Australia and Standards New Zealand
ISBN 0 7337 2678 X

Frank P Lees
Loss Prevention in the Process Industries 2nd Ed
Volume 1 Hazard Identification, Assessment and Control
Butterworth Heinemann