AIGA

PROCESS SAFETY MANAGEMENT FRAMEWORK

GUIDANCE DOCUMENT

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1 Introduction

Process Safety Management (PSM) is of interest to many organisations looking to adopt a holistic and systematic approach to assuring the integrity of their operations.

As the starting point, AIGA has decided to adopt EIGA's PSM framework Doc 186 because it was found to be the most complete and relevant to the industrial gases industry. Acknowledgement and thanks are hereby given to EIGA for permission granted for the use of their document.

The AIGA PSM framework document is a modified version of the *High level framework for process safety management published by the Energy Institute* to make the document more specific to the industrial gases industry. At the highest level this document is essentially the same as the Energy Institute (EI) Process Safety Framework document (PSM framework). The layout of this document and substantial sections of the text are based on the Energy Institute (EI) document with the EI's permission. Changes to the EI PSM framework were only considered and incorporated where there was a unique aspect of the industrial gases industry operating in Asia with its diverse languages and legislative requirements that needed to be accommodated or addressed.

AIGA members may choose to follow other PSM systems such as the one developed by the American Institute of Chemical Engineers' (AIChE) Centre for Chemical Process Safety (CCPS).

2 Scope of document

The AIGA PSM framework is applicable to all processes within the industrial and medical gases industry. It is designed to address process safety hazards and be equally suitable for most of the processes that are found in the industry including:

- ASU production facilities

- Hydrogen and carbon monoxide (HYCO) production facilities including electrolysis facilities

- Acetylene production facilities

- Nitrous oxide production facilities

- Carbon dioxide production facilities

- Cylinder and container filling facilities

- Speciality gas production, package filling and storage facilities

- Distribution depots

- Pipelines

- Transportation

- Customer installations

A facility may include not just the main production plant but all other ancillary equipment that has process hazards.

The decision to apply various PSM elements to a given process needs to be made by evaluating the tolerability of risk and agreeing the management approach. For example, transportation risks may be managed by applying national and international codes which may not necessarily require all the elements of the AIGA PSM framework to be applied.

In some countries, there can be existing regulatory requirements for process safety management systems. This framework is not intended to replace these requirements but may be used to supplement them.

3 Purpose

The AIGA PSM framework is intended to provide a design basis for the development of a process safety management system where an organisation does not have one. It also may be used as a common basis for benchmarking existing process safety management systems.

Where an organisation has a process safety management system or an integrated management system incorporating health, safety and environmental and process safety management they should carry out a gap assessment versus the requirements of each element in order to identify any aspects of the system that need to be enhanced.

When the initial assessment has been completed, the significance of the gaps should be determined and a prioritised plan developed to address the identified issues. In some cases there can be a significant programme of work required to upgrade the management system to meet the requirements of the AIGA PSM framework. In these cases it should be recognised that this upgrade work can take many years to complete effectively.

Of the elements listed in this document the following are the minimum elements that form the basis of a robust process safety management system:

- Leadership, commitment and responsibility (Element 1)
- Compliance with legislation and industry standards (Element 2)
- Employee selection, training and competency (Element 3)
- Workforce involvement (Element 4)
- Hazard identification and risk assessment (Element 6)
- Documentation, records and knowledge management (Element 7)
- Operating procedures (Element 9)
- Management of change (Element 12)
- Operational readiness and Process start-up (Element 13)
- Emergency management (Element 14)
- Inspection and maintenance (Element 15)
- Work control, permit-to-work and task risk management (Element 17)
- Contractors and suppliers – selection and management (Element 18)
- Incident investigation (Element 19)
- Audit, management review and intervention (Element 20)

The remaining elements (5,8,10,11,16 and 21) will also need to be implemented to provide a complete process safety management system.

If an organisation does not have a process safety management system in place, the following are priority areas that should be addressed:

- Leadership, commitment and responsibility (Element 1)
- Compliance with legislation and industry standards (Element 2)
- Hazard identification and risk assessment (Element 6)
- Management of change (Element 12)

4   Definitions

Shall indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

Should indicates that a procedure is recommended.

May and Need Not indicate that the procedure is optional.

Will is used only to indicate the future, not a degree of requirement.

Can indicates a possibility or ability.

Process Safety: is a combination of engineering and management principles focused on preventing accidents, incidents and near misses, particularly explosions, fires and loss of containment, associated with releases of energy or hazardous substances.

PSM Elements: Elements set out the key aspects of the operation that organisations need to get right in order to assure their integrity.

PSM Requirements: Within each of the elements the requirements define what organisations should ideally address in order to meet the intent as stated in the overview of each element.

Safety Critical Device (SCD): A device whose failure to operate on demand could result in a fatality, serious injury or a catastrophic loss of containment of material or energy.

Record: An individual item of data stored on paper or in a computerized document system including relief valve test data, instrument callibration log sheets etc.

Records: Collections of data stored on a paper or in a computerized document systems.

Vulnerability: An adjective which means "exposed to being attacked or harmed".

Third Party: Groups of people or organisations that cannot be directly controlled or managed, for example members of the general public or those occupying neighbouring facilities or buildings.

5   Overview of PSM elements

The elements set out the key aspects to assure the integrity of operations. Each element contains an overview which states its intent and a number of requirements which define what organisations should address. The elements can be grouped as below:

5.1   Process safety leadership

There are five elements that set out how organisations should define and communicate the level of performance they are prepared to accept and how they should ensure that they put in place the necessary resources to achieve the required level of performance:

1. Leadership commitment and responsibility

2. Compliance with legislation and industry standards

3. Employee selection, training and competency

4. Workforce involvement

5. Communication with stakeholders

5.2   Risk identification and assessment

There are two elements that set out what organisations should do to identify and assess the risks that they need to manage in order to assure the integrity of their operations. The two elements identify the necessary control measures and how organisations should record and maintain the process safety knowledge developed from the risk identification and assessment activities:

6. Hazard identification and risk assessment.

7. Documentation, records and knowledge management.

5.3   Risk management

There are eleven elements that set out the control measures that organisations should use to manage key areas of risk:

8. Process and operational status monitoring, and handover

9. Operating procedures

10. Management of operational interfaces

11. Standards and practices

12. Management of change

13. Operational readiness and process start-up

14. Emergency management

15. Inspection and maintenance

16. Management of safety critical devices

17. Work control, permit to work and task risk management

18. Contractors and suppliers, selection and management

5.4   Review and Improvement

There are three elements within the review and improvement area that set out how organisations should measure and review their compliance with the AIGA PSM framework and how they should ensure that they learn from these measurements and the findings from investigations:

19. Incident investigation

20. Audit, management review and intervention

21. Measures and Metrics

6   PSM Elements

This section lists all of the elements in detail. Each element commences with an overview and contains a number of requirements which set out a more detailed definition of what organisations should ideally address.

6.1   Element 1: Leadership, commitment & responsibility

6.1.1 Overview

Assurance of the integrity of an organisation's operations requires visible leadership commitment and accountability at all levels of the organisation. Management shall establish a process safety policy, provide perspective, set process safety performance targets and provide the structure and resources to achieve them.

6.1.2 Requirements

1. A documented process safety policy, which may be a part of a general safety policy, is in place and signed by a senior company executive, e.g. the chief executive officer (CEO) or the responsible unit managing director (MD). These are living systems which are regularly reviewed and updated and communicated to all employees to reflect the needs of the organisation.

2. Process safety governance structure is defined and implemented at all levels from the board through to the workforce. Process safety functional support levels are consistent with the governance requirements.

3. Process safety risk management system is in place which meets applicable legislation, the EIGA process safety management framework requirements and other requirements to which the organisation subscribes with regard to its process safety activities.

4. Management establishes the scope, priority and pace for the process safety risk management system implementation, considering the complexity and risks involved with their operations and products.

5. Roles, responsibilities, authorities and accountabilities for the management of process safety are known and exercised.

6. Sufficient competent resources are in place to cover the defined process safety roles and responsibilities.

7. Clear process safety objectives, performance targets and action plans are established and performance is regularly evaluated.

8. Required process safety leadership attributes are defined, developed and integrated into the required competencies for leaders.

9. Directors and managers:

     • Visibly demonstrate personal commitment and accountability for process safety, leading by example and upholding core values and standards of the organisation;

     • promote an open and trusting environment and understand how their behaviours impact others;

     • maintain an understanding of what is happening in the workplace in order to identify and address key process safety issues and improvement opportunities;

     • recognise and reward positive process safety behaviours and performance and intervene to correct deviations from required performance at all levels in the organisation.

10. Managers responsible for sites operated by others, e.g. joint venture companies, encourage the adoption of the AIGA PSM framework.

6.2   Element 2: Compliance with legislation and industry standards

6.2.1 Overview

Compliance with legislation is a fundamental requirement for organisations.

Management shall ensure that the requirements of applicable legislation are identified, understood and complied with.

6.2.2 Requirements

1. Requirements of current and forthcoming, applicable legislation, regulations, licenses, permits, codes, standards, practices and other governmental requirements are identified, documented and kept current.

2. The operating requirements arising from legislation and industry standards are defined, documented and communicated to those affected.

3. Compliance with legislation and mandatory or applicable industry standards is systematically verified.

6.3   Element 3: Employee selection, training and competency

6.3.1 Overview

Control of operations depends upon having competent people in position.

Management shall ensure that existing and new personnel have the required competencies.

6.3.2 Requirements

1. The required process safety competencies and requirements are defined for all roles in the organisation.

2. A process is in place for evaluation, selection and placement of employees which confirms their compliance with the specified requirements for the role.

3. Individual and collective experience and knowledge of identified critical activities are maintained and are carefully assessed when personnel changes are made.

4. Roles and responsibilities should take into account human capabilities and limitations as well as human and organisational factors.

5. Appropriate induction is carried out for personnel taking up a new or revised position.

6. Staffing development requirements are in place for all positions with process safety management responsibility.

7. The organisational structure and continuity of process safety management critical positions is reviewed periodically to ensure that it can meet the AIGA PSM requirements.

8. Employee competency is regularly assessed against requirements of their assigned role and responsibilities, or is maintained via continuing professional development.

9. Employee training and development needs are identified through a systematic process.

10. Systematic and effective training and development programmes are put in place to ensure that each person is competent to understand and accept and deliver against the defined process safety responsibilities for their role.

11. Training and development programmes are formally reviewed to assess their effectiveness and to identify opportunities for improvement.

12. Training and development programmes are a combination of formal courses, coaching and practical work.

6.4   Element 4: Workforce involvement

6.4.1 Overview

Achieving the high levels of process safety performance requires the commitment of the whole workforce.

Management shall align, involve and empower the whole workforce, in the identification and management of process safety hazards.

6.4.2 Requirements

1. Employees and contractors are actively engaged in the improvement of process safety performance related to their work scope and have an understanding of process safety hazards, their identification and management / control.

2. Employees and contractors are engaged with management in two-way communication regarding process safety policies, objectives, performance targets, action plans and sharing of lessons learned related to their work scope from inside and outside the organisation.

3. Process safety promotion and engagement programmes are in place to continually increase the awareness, participation and commitment of employees and contractors.

6.5 Element 5: Communication with stakeholders

6.5.1 Overview

Establishing and maintaining stakeholders' confidence is a key factor in maintaining an organisation's licence to operate.

In relation to major hazards, management shall identify key stakeholder groups and develop and maintain a good working relationship with them, understanding and addressing their issues and concerns.

External stakeholders may include industrial neighbours, local communities, customers, enforcement authorities and agencies and local civil authorities.

Internal stakeholders may include business, operations, engineering and construction teams and worker representatives (unions or workers councils, etc).

6.5.2 Requirements

1. A defined communications system supports the organisation to develop and maintain a good working relationship with the identified stakeholders about its activities, including emergency response communications.

2. Organisations ensure and demonstrate that the consultation process with stakeholders is appropriate and proportionate and follows a defined process.

3. Appropriate safety information is shared to demonstrate the organisations' commitment to continually improving its performance.

4. Effectiveness of programmes for communication with stakeholders is regularly reviewed by management.

6.6   Element 6: Hazard identification and risk assessment

6.6.1 Overview

A fundamental requirement of any process safety management system is the identification and assessment of risk. Management shall ensure that a comprehensive risk assessment process systematically identifies, assesses and appropriately manages the risks arising from the organisation's operations.

6.6.2 Requirements

1. A structured process is applied to identify the hazards and ensure that the risks arising from the organisation's assets and operations are systematically assessed.

2. Appropriate risk assessments are conducted for:

    • Ongoing operations;

    • Hazardous materials;

    • Existing and new products and services;

    • New projects and new technologies;

    • All changes.

3. Risk control, prevention and mitigation measures are identified and implemented, using hierarchy of control principles, to manage the identified risks to a tolerable level.

4. The tolerable level of risk is defined for all risks (impact to human health, safety, environment and, where necessary, property) and is consistently understood and applied throughout the organisation.

5. Risk assessments consider process safety risk as well as risk to: environment; reputation; asset integrity; business interruption; security; third party assets and customers.

6. Risk assessments consider human (including organisational) factors, which could affect the likelihood or severity of outcomes.

7. Risk assessments are carried out by competent, independent personnel.

8. Risk assessments take into account learnings from incidents from both inside and outside the organisation.

9. Completed risk assessments are reviewed, approved and accepted by specific levels of management appropriate to the magnitude of the risk and any decisions are clearly documented.

10. Identified stakeholders are kept informed about the risk assessment process and results.

11. The status of risk control measures is reviewed at regular intervals by specified levels of management and risk assessment recommendations are resolved in a timely manner.

12. For businesses, installations or processes with elevated process safety risks (as defined by company criteria), the implementation of mitigation recommendations or measures is reviewed regularly by specified levels of management.

13. Risk assessments are updated as changes occur or are reviewed and updated at a defined frequency.

6.7   Element 7: Documentation, records and knowledge management

6.7.1 Overview

Accurate records and information is essential to identify, assessing and manage process safety risk.

Management shall ensure that the information required to support safe operation is identified, available and up to date.

6.7.2 Requirements

1. There are procedures to define, develop and maintain the required documentation and records necessary to support robust operation and maintenance of facilities.

2. Documentation and records are available to those who need to use them.

3. Documentation and records including those kept electronically are appropriately safeguarded.

4. There are procedures to ensure that documentation is regularly reviewed and kept up to date.

5. A policy defining retention period for all documentation and records.

6. The required documentation and records include those generated to meet the requirements of all other AIGA PSM framework elements, such as but not limited to:

   a. Process safety information including process design considerations and basis for safe operating limits, design drawings; (for example P&IDs, PFD, Single line electrical diagrams, hazardous area drawings, relief system data, ventilations system data for hazardous occupied enclosures)

   b. Equipment records (inspection, testing, maintenance and modification);

   c. Work and operating logs;

   d. Training and competency records;

   e. Incident investigation reports;

   f. Operating and maintenance procedures;

   g. Permits and licenses;

   h. Relevant legislation;

   i. Risk assessments;

   j. Management of change documents

   k. Hazard review information

6.8   Element 8: Process and operational status monitoring, and handover

6.8.1 Overview

Comprehensive process and operational status monitoring and effective handover between work groups is essential to assure the continued integrity of the organisation's operations. Management shall ensure that the process and operational status monitoring, and handover requirements are defined, understood and carried out.

6.8.2 Requirements

1. Safe Operating Limits (SOLs) are defined for equipment and processes.

2. There are procedures to ensure that SOLs are kept up to date as living systems.

3. Operating parameters are systematically monitored.

4. Excursions beyond SOLs are identified and followed up.

5. Handover arrangements for the following are defined, understood and implemented:

    • Operational and maintenance shift handover.

    • Successive work groups.

    • Job positions (one to another).

6.9   Element 9: Operating procedures

6.9.1 Overview

Facilities must be operated within established parameters and according to legislation. In order to achieve these requirements, management shall ensure that the operating manuals and procedures required to support operations are identified, available, accurate, up to date, understood and used.

6.9.2 Requirements

1. Approved operating manuals and procedures are identified, available, accurate, up-to-date, understood and used, and include human factors considerations.

2. Operating manuals are designed to maximise usability and minimise the likelihood of error and non-compliance.

3. Operating manuals and procedures should state: clear safe operating limits (SOL); the steps required to prevent an excursion outside the SOL, and clear instructions on actions to be taken if an excursion outside the SOL occurs.

4. Operating manuals should cover normal start up and shutdown and steady state operation as well as temporary operations and emergency shutdowns.

5. Operating manuals and procedures are regularly reviewed and updated; these reviews involve supervisors and personnel who are required to use them.

6.10 Element 10: Management of operational interfaces

6.10.1 Overview

Operational interfaces with customers, suppliers, contractors and those between internal departments, who provide or receive services, utilities or products can impact the organisation's operations. Management shall ensure that operational interfaces are identified, assessed and managed.

6.10.2 Requirements

1. Operational interfaces are identified, documented and risks from failures of the interface are assessed.

2. Management arrangements are established proportionate to the risk associated with failure of the operational interface processes.

6.11 Element 11: Standards and practices

6.11.1 Overview

Process safety performance is enhanced by using robust standards and safe working practices.

Management shall ensure that the required standards and safe working practices to support project, maintenance and operational activities are identified, developed and consistently applied.

6.11.2 Requirements

1. Design, inspection and maintenance standards are defined, which bring together legislative requirements, industry and the organisation's standards and good practices into a set of guidelines to be used when developing projects, inspection and maintenance plans.

2. Safe working practices are defined, which bring together legislative requirements, industry and the organisation's good practices into a set of guidelines to be used when developing construction, inspection and maintenance plans and method statements, and for operational activities.

3. Standards and practices:

   • Meet or exceed applicable legislative requirements;

   • embody responsible requirements where legislation does not exist, and

   • take into account possible human failures and other factors which could influence the likelihood of those failures.

4. Approved standards and practices are reviewed to take into account changes to legislation, industry standards, industry and the organisation's good practices and findings from incidents, and are regularly reviewed and kept up to date as living systems.

5. Approved standards and practices are available to those who need them, including contractors.

6. Authority to approve standards and practices is formally assigned to nominated competent individuals.

7. Deviation from design standards is permitted only after assessment, review and approval by nominated competent individuals and after the rationale for the decision is documented.

8. Procedures are in place to routinely monitor to ensure that materials and equipment received meet design standards.

9. When a new or updated standard or practice is issued, the requirements for retrospective application are defined.

6.12   Element 12: Management of change

6.12.1 Overview

The introduction of any form of change into an organisation, if not appropriately managed, can significantly increase the levels of process safety risk.

Management shall ensure that risks arising from any form of change are systematically identified, assessed and managed.

6.12.2 Requirements

1. A process is in place which systematically identifies, assesses and manages the risks arising from both temporary and permanent changes.

2. The process for managing change address:

    •   Authority for approval of changes;

    •   Compliance with legislation and approved standards;

    •   Acquisition of needed permits;

    •   Documentation including reason and technical basis for change;

    •   When process hazard analysis is required due to the complexity or scope of the change being proposed;

    •   Communication of risks associated with the change, and

    •   Mitigation measures, such as: time limitation; training.

3. Management of Change addresses changes to:

    •   Equipment not being Replaced in Kind;

    •   Interconnections between a new process and any existing processes;

    •   Operations or operating procedures;

    •   Organisation, reporting structures, working patterns

    •   Products, materials or substances;

    •   Software or control systems;

    •   Design or specifications;

    •   Standards or practices, and

    •   Inspections, maintenance or testing programmes.

4. Management of Change considers impacts to:

    •   Health and safety (including process safety);

    •   Environment;

    •   Reputation;

    •   Quality of final product;

    •   Security;

    •   Third party assets, and

    •   Business interruption.

5. Management of Change considers human and organisational factors, and ensures that responsibilities for critical tasks remain clearly assigned throughout the change.

6. Temporary changes do not exceed initial authorisation for scope or time without review and approval.

7. Changes are approved by nominated competent individuals commensurate with the risk associated with the proposed change.

8. Pertinent records covering all changes are maintained.

9. Project Management Work Processes ensure that key stages in the project development lifecycle are reviewed and approved by specified levels of management with due consideration of Process Safety Management practices. Work processes requirements include:

   - Project management procedures are documented, well understood, readily available to those who need to use them (including contractors) and executed by qualified personnel.

   - Criteria are established and procedures are in place for conducting and documenting risk assessment at specific project stages to confirm the integrity of new assets and existing assets which have been substantially modified (Element 6).

   - Any changes in the process safety impact of a facility on the local community are assessed and if required communicated to relevant authorities.

   - The design and construction of new or modified facilities use approved standards and practices that:
     o Meet or exceed applicable regulatory requirements;
     o Embody responsible requirements where legislation does not exist, and
     o Encompass robust Process Safety Management practices.
     o Address Vulnerability and Security.

   - A pre-commissioning review is performed (Element 13) and documented

   - Procedures are in place to identify and manage the process safety risks arising from the mothballing and decommissioning or disposal of assets including dismantling, demolition and site remediation.

   - Performance measures are established to monitor the success (or failure) of a change to meet its intended purpose and whether it has any unintended effect on safety.

6.13   Element 13: Operational readiness and process start-up

6.13.1 Overview

The commissioning and start-up of new, modified or existing plant and equipment is a high risk operation. Management shall ensure that there is a systematic process to verify that plant and equipment is in a safe condition and that personnel are prepared, before start-up or return to normal operation.

6.13.2 Requirements

1.   There is a systematic process for checking operational readiness and the integrity of systems before they are brought into service.

2.   The checking process addresses:

     • New or modified plant, processes and equipment;

     • Return from maintenance, and

     • Re-start after a trip or a planned shutdown of the full plant or a part of the plant.

3.   There are defined criteria for operational readiness. The criteria should cover, but are not limited to:

     • Equipment;

     • Control system and software;

     • Operating procedures and documentation;

     • Human and organisational factors.

     The selected criteria should address the following items:

     • Construction is in accordance with specifications;

     • Risk management recommendations have been addressed and required actions taken;

     • Regulatory and permit requirements are met;

     • Emergency, operations and maintenance procedures are in place and adequate;

     • Required training of personnel and communication related to Process Safety Management aspects has been accomplished, and

     • Necessary project documentation (safety file) is readily available to those who need to use it

4.   System checks are carried out and documented by competent personnel.

5.   There are defined criteria for categorising and handling identified issues and outstanding work items.

6.   Completed system checks are reviewed, approved and accepted by specific levels of management appropriate to the magnitude of the risk.

7.   Commissioning and start-up procedures have defined stages, hold/check points and progression criteria and review authorities.

6.14 Element 14: Emergency management

6.14.1 Overview

The consequences of an incident can be significantly reduced if the organisation is prepared to handle potential emergency situations. Management shall ensure that, in the event of an incident, the organisation is prepared for all necessary actions which may be required for the protection of the public, all personnel on site, the environment, plant, equipment and the organisation's reputation.

6.14.2 Requirements

1. Emergency procedures are prepared for all identified credible emergency scenarios including those on neighbouring facilities.

   Emergency response plans (ERPs) are based on risk assessments, documented, accessible and clearly communicated. The plans should cover but may not be limited to:

   • Response organisation structure;

   • Defined roles and responsibilities;

   • Internal and external communication procedures;

   • Procedures for accessing and mobilising personnel and equipment;

   • Procedures for interfacing with other organisations, including the general public and external emergency response organisations;

   • Public relations, and

   • Recovery and remediation.

2. A regular programme of training and drills involving internal and external resources is used to exercise, develop and improve capabilities for a range of emergencies.

3. There are arrangements to ensure that specified levels of management regularly review ERPs, using findings from drills and incidents to identify and address issues and opportunities for improvement, so that they are kept up to date as living systems.

4. Equipment and facilities needed for emergency response are readily available and maintained and information (e.g. site layout drawings, hazardous inventory data) that might be needed in an emergency is kept up to date.

5. Adequate numbers of competent personnel are available to fulfill the defined roles in the emergency plans.

6. Mutual aid schemes involving relevant third parties and external services are established and agreed.

6.15 Element 15: Inspection and maintenance

6.15.1 Overview

Maintaining the integrity of plant and equipment is an essential requirement for process safety. Management shall ensure that the necessary inspection and maintenance requirements are identified and carried out to reduce the likelihood of a significant incident as a result of failure of plant or equipment.

6.15.2 Requirements

1. Equipment is uniquely identified on an asset register which provides up-to date asset lists and equipment records, including location and equipment specification data. The asset register provides a basis for inspection and maintenance planning.

2. The equipment inspection and maintenance programmes are risk and or time based. Inspection and maintenance programmes should address and integrate long term equipment integrity and process safety compliance assurance.

3. There are procedures to ensure that equipment inspection and maintenance programmes are reviewed regularly, using findings from the programmes, industry experience and incidents to identify and address issues and opportunities for improvement so that they are kept up to date as living systems.

4. Plans and schedules are developed for execution of equipment inspection and maintenance programmes.

5. Competent personnel are available to carry out the inspection and maintenance programmes.

6. There are procedures to ensure that findings and recommendations from the equipment inspection and maintenance programmes are prioritised and followed up.

7. Inspection and maintenance programmes are established by competent individuals.

8. Deviations from established inspection and maintenance programmes are reviewed by competent individuals.

6.16 Element 16: Management of safety critical devices

6.16.1 Overview

An essential requirement for process safety is that safety critical equipment and devices (SCDs) are in service and functioning correctly. Management shall ensure that safety critical equipment and devices are identified and appropriately managed, so that they are in service and functioning correctly.

6.16.2 Requirements

1. SCDs are uniquely identified on a register which provides updated equipment records, including location and equipment specification data. The register provides a basis for the planning of SCD testing, inspection and maintenance.

2. SCD testing, inspection and maintenance programmes are in place and approved by competent individuals. There are defined standards or/and procedures and the programmes are proportionate to the risk associated with failure of the SCDs.

3. There are procedures to ensure that SCD testing, inspection and maintenance programmes are reviewed regularly using findings from the programme, industry experience and incidents to identify and address issues and opportunities for improvement, so that they are kept up to date as living systems.

4. Feasible plans and schedules are developed for execution of testing, inspection and maintenance programmes.

5. Competent personnel are available to carry out the testing, inspection and maintenance programmes against defined procedures.

6. There are procedures to ensure that findings and recommendations from the SCD testing, inspection and maintenance programmes are prioritised and followed up.

7. Procedures for disarming, deactivation or by-passing of SCDs are reviewed and approved by nominated competent individuals.

8. Secondary containment for which credit has been taken in the design of SCD's; for example barriers and bunds should also be managed to ensure that the levels of protection assumed in SCD design can be realised in actual operation.

6.17   Element 17: Work control, permit-to-work and task risk management

6.17.1 Overview

The execution of maintenance and other work activities, if not appropriately managed, can significantly increase the levels of process safety risk. Management shall ensure that effective work control, permit to work and task risk management arrangements are in place, and followed, to control the risks arising from work activities.

6.17.2 Requirements

1. Appropriate work control and permit-to-work arrangements, proportionate to the risk, are employed to assure the safety of personnel, plant, processes and the integrity of the equipment during work and maintenance activities.

2. There are procedures that ensure that process safety risks arising from work tasks are systematically identified and assessed, before work starts and as circumstances change and where new risks arise during execution of work.

3. Risk control measures are identified and implemented to mitigate and manage the identified risks.

4. Task risk assessments consider risk to:

   • Health and safety of employees, contractors, customers and members of the public;

   • environment, and

   • equipment.

5. Completed task risk assessments are reviewed and approved by nominated competent individuals and any decisions are clearly documented.

6. All of the workgroup are made aware of task risk assessments and required control processes.

7. Competent personnel are available to carry out the required work control, permit-to-work and task risk management arrangements.

6.18   Element 18: Contractors and suppliers - selection and management

6.18.1 Overview

Contractors and suppliers doing work on the organisation's behalf can impact its operations and its reputation. Management shall ensure that contractors and suppliers perform in a manner that is consistent and compatible with the organisation's process safety requirements.

6.18.2 Requirements

1. There is a process to ensure that services from contractors and suppliers are evaluated and selected against criteria that include an assessment of capabilities to perform work in a manner which meets the organisation's process safety performance requirements.

2. When necessary, process safety performance evaluation criteria are defined for contractors and suppliers. Contractor and supplier compliance with legislation is a mandatory requirement.

3. All contractors are inducted and informed/trained on relevant organisation procedures and practices for the work that they undertake.

4. Effective organisational, communication and control arrangements are in place between organisation personnel and contractor personnel to manage the risks effectively.

5. Contractor and supplier performance is routinely monitored and assessed, feedback is provided, and non-conformities are corrected.

6. Competent personnel are available to carry out the required contractor and supplier selection and management arrangements.

6.19   Element 19: Incident investigation

6.19.1 Overview

An essential aspect of process safety performance improvement is learning from incidents and 'near misses' and taking action to prevent their recurrence. Management shall ensure that incidents and near misses are consistently reported and investigated and that identified actions and learnings are implemented on a timely basis.

6.19.2 Requirements

1. A system is in place for incident reporting, investigation, follow-up and capturing lessons learned from incidents and near misses including but not limited to:

    • Injury to people;

    • environment incidents;

    • damage to assets;

    • loss of process containment;

    • energy release;

    • deactivation of safety critical devices

2. The reporting of incidents and near misses by all personnel including contractors and suppliers is mandatory.

3. Incidents and near miss are classified and investigated on the basis of actual and potential outcome.

4. Incidents and near miss are investigated according to a documented procedure on a timely basis.

5. Investigations identify root causes and management system failures, including technical, human and organisational factors.

6. Effective arrangements are in place to ensure that incidents or near miss are investigated when they involve customers, contractor or supplier personnel.

7. There are processes in place to learn from relevant incidents, near miss and good practices in other organisations and sectors.

8. Competent personnel are available to carry out the required investigations.

9. Completed investigations are reviewed and approved by specific levels of management appropriate to the classification of the incident.

10. Where appropriate and recognising legal and security constraints, identified stakeholders who may be impacted by hazards are kept informed about the findings and recommendations from investigations.

11. Recommendations are tracked to completion.

12. Senior management periodically reviews the effectiveness of corrective and preventive actions.

13. Process safety incident statistics and performance trends are reviewed by specified levels of management.

6.20 Element 20: Audit, management review and intervention

6.20.1 Overview

Regular review and audit of compliance with the AIGA PSM framework is vital to ensure that process safety performance continues to meet the defined targets. Management shall ensure that there is both routine review and independent audit of compliance with each element of the AIGA PSM framework requirements.

6.20.2 Requirements

1. Performance measures are established to monitor the degree to which the AIGA PSM framework requirements are being complied with for each implemented element.

2. The organisation's operations are routinely monitored, incorporating process safety management performance measures, and are regularly reviewed by specified levels of management.

3. PSM requirements implemented within the organisation are reviewed and updated as necessary to ensure that they continue to meet the needs of the organisation.

4. Audit criteria are defined to provide a consistent basis for audit and a consistent basis for development of the audit opinion.

5. A routine internal (2nd party) and or external (3rd party) audit programme is in place. The audit assesses compliance with PSM requirements and the effectiveness of the management review arrangements.

6. Audits are conducted by trained and competent persons. Whenever possible, multidisciplinary teams, including process safety professionals and personnel with operational and technical expertise should be used.

7. The frequency and scope of the audits should reflect the complexity of the operation, the level of risk and previous compliance history.

8. Audit findings are documented and reviewed with management.

9. Necessary interventions to correct identified issues, non compliances and deviations in performance beyond defined tolerance levels, are identified, appropriately prioritised, scheduled and tracked to completion.

10. The effectiveness of the audit arrangements is periodically reviewed and the findings are used to make improvements.

11. Understanding of the requirements of all elements and compliance with the requirements is regularly tested within the organisation.

12. Compliance and performance trends for all elements are reviewed by management.

6.21 Element 21: Measures and metrics

6.21.1 Overview:

Process safety performance indicators, measures and metrics should be numerical. Two types of indicators are required; leading and lagging. Leading indicators show if controls are working as intended while lagging indicators show whether or not an outcome is being achieved.

Monitoring and analysing performance enables companies to identify trends and to take rapid corrective action if needed. Indicators that are defined and understood can give companies confidence that the right things are being managed and tracked.

Correct selection of indicators is important since inappropriately selected indicators can result in knowledge gaps or can result in unwarranted confidence. Multiple indicators are needed to monitor the different dimensions of process safety operating discipline and management system performance.

6.21.2 Requirements*

1. Indicators should provide a means to measure activity, status, or performance against requirements and goals.

    - Lagging indicators should identify and classify incidents

    - Leading indicators should identify and classify conditions that could ultimately lead to more severe consequences.

2. Indicators should be tracked regularly and reviewed by management to identify corrective actions to drive improvement.

    *

Appendix A: Related AIGA & EIGA Documents and Publications

This Appendix lists other AIGA & EIGA publications (and documents) that are relevant to Process Safety Management and align with the specific PSM elements listed in this document. Some publications listed in this Appendix are in need of review, (in some cases specifically to integrate process safety related items) and will be updated in due course. Some publications listed cover multiple elements of Process Safety Management, the list below groups such publications under the most relevant PSM element.

Element 1: Leadership commitment and responsibility

EIGA Info HF 11   Organisation - Safety Culture

Element 2: Compliance with legislation and industry standards

EIGA Doc.60   Prevention of major accidents. Guidance on compliance with the Seveso II Directive.

Element 3: Employee selection, training and competency

EIGA Info HF 2   Individual - Training and Competence
AIGA 009   Safety training of employees

Element 4: Workforce involvement

No publication specific only to this element has been identified.

Element 5: Communication with stakeholders

No publication specific only to this element has been identified.

Element 6: Hazard identification and risk assessment

EIGA Doc.142   Major hazards
EIGA Doc.75   Determination of Safety Distances

Element 7: Documentation, records and knowledge management

No publication specific only to this element has been identified.

Element 8: Process and operational status monitoring, and handover

EIGA Info HF 7   Organisation - Communications on Safety
AIGA 0282   Unmanned airgas plants: design and operation

Element 9: Operating procedures

EIGA Info HF 4   Task – Design and Effectiveness of Procedures

Element 10: Management of operational interfaces

No publication specific only to this element has been identified.

Element 11: Standards and practices

There are numerous AIGA & EIGA practices that are documented and published. They are too numerous to reference in this document. The relevant publications are best searched for using AIGA & EIGA's website.

Element 12: Management of change

Info HF 10   Organisation - Managing Organisational Change
Doc.51   Management of change

Element 13: Operational readiness and process start-up

No publication specific only to this element has been identified.

Element 14: Emergency management

EIGA Info HF 6   Organisation - Site Emergency Response
AIGA 004   Handling gas container emergencies

Element 15: Inspection and maintenance

There are numerous AIGA & EIGA practices that are documented. EIGA Info HF 5, *Task - Maintenance error* is a specific example. The relevant publications are best searched for using AIGA & EIGA's website.

Element 16: Management of safety critical devices

Safety critical devices are referred to and discussed in several EIGA publications. AIGA 056 & EIGA Doc.147, *Safe practices guide for cryogenic air separation plants* are a specific example. AIGA & EIGA publications related to this PSM element are often specific to generic equipment such as storage vessels or specific to products such acetylene, nitrous oxide, oxygen and other compressed gases and liquids.

Element 17: Work control, permit to work and task risk management

AIGA 011   Work permit systems

Element 18: Contractors and suppliers, selection and management

AIGA 015   Safe Management of Contractors

Element 19: Incident investigation

AIGA 013   Incident/accident investigation and analysis
EIGA Info HF-3   Organisation - Human Factors in Incident Investigation
EIGA Info HF-1   Human Factors - An Overview

Element 20: Audit, management review and intervention
AIGA 015   Safety audit guidelines
EIGA Doc.135   Environmental Auditing Guide

Element 21: Measures and metrics

There is no AIGA and EIGA publication specific to this element.

General Process Safety Management related documents and publications

There are numerous EIGA publications that are related to Process Safety Management, examples include:

EIGA Info HF 8   Task - Alarm Handling
EIGA Info HF 9   Task - Fatigue from working patterns – Shift work and overtime
EIGA Info HF 12   Task - Human Factors in Design
EIGA Info HF 13   Organisation - "Human Reliability