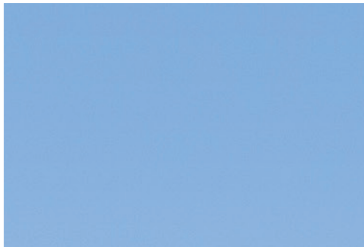
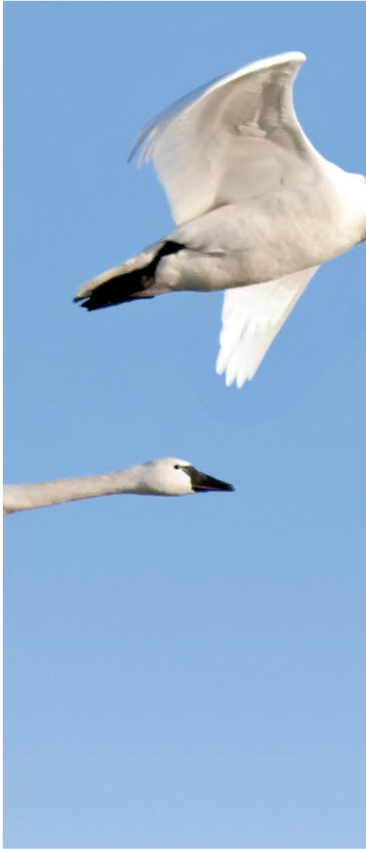
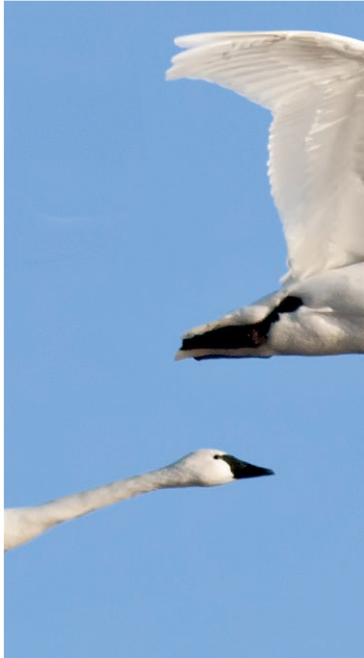
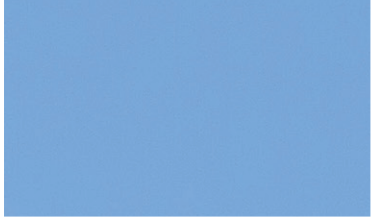


ISC Process Safety Competency Guidance

Edition 2, 2018





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Preface

The IChemE Safety Centre (ISC) is an industry-funded and led organisation, focused on improving process safety through sharing information and learnings. ISC members can nominate specific areas for action and ISC leads the development work in these areas, working with personnel from member companies. Process safety competency was identified as an initial area of work for ISC. Once a specific need was defined by the ISC Advisory Board and the project sponsor, the team set about the project. This consisted of reviewing the current guidance material available on this topic. There are several different organisations that have published guidance on how to establish a process safety competency framework. However, these documents stop short of actually defining different levels of competency for different roles – ie, developing the framework in a generic sense. ISC's guidance document takes the step to create the generic framework, for different types of roles in an organisation.

This guidance does not address how to establish competency or define certification processes. ISC anticipates further work in establishing how competency can be achieved, once a gap analysis is carried out on the current programmes available against the competency topics defined in this document.

The roles identified in this guidance document are those with an influencing focus on process safety; it is not mandated for an organisation to have these defined roles, nor for the roles to have these specified competencies. This is a guidance document that can be used to inform an organisation of the recommended process safety competences for each role, so that it can be incorporated into their existing competence framework. Organisations should have their own process safety competency profiles and programmes.

ISC believes that a functional approach to process safety is important to increase people's understanding of their requirements. Process safety is about managing the integrity of operating systems by applying inherently safer design principles, effective engineering and disciplined operating practices. It deals with the prevention and mitigation of incidents that have the potential for a loss of control of a hazardous material or energy. Such loss of control may lead to severe consequences with fire, explosion and/or toxic effects, and may ultimately result in loss of life, serious injury, extensive property damage, environmental impact and lost production with associated financial and reputational impacts. Effective management of process safety requires leadership across six functional elements in an organisation. These are:

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

These elements can be thought of as a chain of safety, rather than applied to James Reason's Swiss Cheese Model¹. This is because we do not need failures in all elements to have an incident, but rather multiple failures in one element could result in an incident. The integrity of the chain is in the multiple layers behind it, hence demonstrated knowledge and competency in all elements is required across an organisation.

Lastly, this is a living document and we expect that competency systems will evolve over time. If you have an established process safety competency system that is working well, and differs from the framework described here, please share your example, so we can continue to improve this guidance.

Edition 2 of the document incorporates feedback on the roles, competency matrix and competency definitions from the original document that was issued in 2015. Roles were revised to ensure all applicable ones were covered and competency topics were rationalised.

Contact ISC

email: safetycentre@icheme.org



Contact the ISC

email: safetycentre@icheme.org

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How to use this guidance

This document provides an example of a process safety competency model. Each organisation should determine the specific requirements for implementation.

This document can be used to support implementation of process safety competency criteria within a Competency Management System (CMS). There is a range of guidance available to assist in developing a CMS (eg Cogent and UKPIA Guidelines for *Competency Management Systems for Downstream and Petroleum Sites*²; European Process Safety Centre Process Safety Competence, *How to set up a Process Safety Competence Management System*³; Health and Safety Executive, *Managing competence for safety-related systems*, 2007⁴).

Recommended steps for implementation are detailed below:



1. Determine the scope

Is the framework to be applied organisation wide or for individual facilities?



2. Map current organisational roles to the generic roles matrix in Appendix 1

Review the corporate structure to identify alignment with those identified in Table 1.



3. Determine any role gaps

- a. Identify if existing organisational roles are covered adequately.
- b. Are any relevant roles from Table 1 missing from the organisation?

Note: roles may be assessed as part of recruitment processes or development planning.



4. Conduct gap analysis and identify lack of competencies and the required improvements for existing role defined competencies against the matrices in Appendices 1 and 2.

The gap assessment needs to address both the technical aspects as well as how the competency framework is administered in an organisation. This can be effectively done as a combined activity between the process safety lead in an organisation and the human resources organisational development specialist.



5. Develop action plans to address role gaps and competency gaps. Competency gaps may be addressed by one or more of the following improvement options:

- a. Formal training course
- b. Implementing a procedure/system
- c. Being part of a process/activity
- d. Audit of a procedure/system
- e. Closing a system gap
- f. Developing a link with another site
- g. Finding and working with a mentor
- h. Reviewing a best practice system



6. Monitor the process safety competency process – consider using metrics to monitor the implementation and health of the framework (refer to IChemE Safety Centre guidance *Lead Process Safety Metrics – selecting, tracking and learning*⁵).



7. Maintain the process safety competency process during organisational changes or periodically at defined intervals to ensure it stays relevant and accurate.

Organisational roles

Organisational roles in companies and industries vary significantly. This guideline provides a list of generic organisational roles that may apply across multiple industries. Organisational specific job titles may not appear in the list. However, you should be able to draw a parallel with them.

Roles described in Table 1 have been categorised into areas of an organisation and specific applications.

Table 1: Organisational roles

Area	Role	Description
Front line	Operator	Front-line personnel responsible for operating the facility. Sometimes called a process operator, panel operator or process technician. Note: Self-directed roles may need to be supervisor level across some competencies, depending on the nature of the operation, eg nature of hazards, level of supervision available etc.
	Maintainer	Front-line personnel responsible for performing maintenance on the facility. Note: Self-directed roles may need to be supervisor level across some competencies, depending on the nature of the operation, eg nature of hazards, level of supervision available etc.
	Supervisor	Front-line supervisor responsible for managing operators or maintainers on a day-to-day basis. Could also be referred to as Operations Team Leader or Maintenance Team Leader.
Engineer	Integrity/reliability	Specialist role responsible for maintaining the integrity or reliability of facilities, with expertise in areas such as corrosion management, rotating equipment, fixed equipment, etc. This also includes operational engineering activities eg safe operating envelopes.
	Technical authority	A technical specialist role that is a subject matter expert in a specific field. The technical authority owns the organisation's technical standards but should have no accountability for commercial performance of the organisation.
	Project	An engineer involved in projects for the organisation. May be in a design house, at a facility, and/or conducting site supervision for installation works. Project engineer is responsible for controlling project costs, managing schedule and ensuring compliance with regulations and technical standards.
	Information technology	This role manages critical communication and information management systems.
Support	Process safety advisor	Process safety specialist, responsible for advising organisations on process safety-related matters.
	Process safety lead/manager	Most senior process safety specialist in an organisation, responsible for advising organisations on process safety-related matters.
	HSE site	Site-based health, safety and environment specialist (non process safety specialist), responsible for advising organisations on their general HSE requirements (eg occupational health and hygiene issues).
	HSE corporate	Corporate-level health, safety and environment specialist, responsible for advising organisations on their HSE requirements (non process safety specialist, eg HSE Manager).
	Operational authority	The operational authority is a role that establishes and can approve deviations from operational procedures that impact process safety.
	Quality control	Personnel responsible for maintaining quality-based systems in an organisation, such as management systems, document control systems or assessing quality of supply chain.
	Corporate assurance	Personnel responsible for establishing corporate governance and assurance programs for process safety.
	Human resources	Personnel responsible for recruitment and training processes in an organisation. This is an influencer role, not a decision maker.
	Finance	Personnel responsible for financial management processes in an organisation. This is an influencer role, not a decision maker.
	Procurement	Personnel responsible for procurement processes in an organisation. This is an influencer role, not a decision maker.

Area	Role	Description
Management	Manager/ Superintendent	Managers responsible for day-to-day operations or for part of an organisation.
	General Manager / Site manager	Most senior leader at a facility, or a part of an organisation.
Executive	Leaders/MDs/ CEOs	Executive manager or director, responsible for the operations and strategy of an organisation.
	Directors	Non-executive directors appointed to a board, responsible for governing an organisation.
	Board chair	The chair of the board, or president, responsible for setting organisational direction and leadership.
	Safety committee chair	Board member delegated the authority to lead the safety or sustainability committee of the board, similar to the finance and audit committee chair, they chair a specific committee focused on the HSE performance of the organisation.
	Process safety specialist board member	Board members with specific process safety competence. This role has been recommended following several incidents, as it is important to have a person on the board who fully understands process safety, similar to having financially-trained people on a board. This could be delivered via multiple people having the range of competencies.

Developing the matrix

The matrix shown in Appendix 1 defines the required competencies for each organisational role. This detail is vital to ensure that people become competent in required topics to enable effective delivery of their role.



Establishing competency

In order to establish a competency framework, it is necessary to determine the topics of competency.



Competency topics

Eighteen topics were defined as requiring specific process safety competency, based on the following guidelines:

- Centre for Chemical Process Safety Guidelines for Risk Based Process Safety⁶
- Energy Institute Process Safety Management Elements⁷
- Cogent and UKPIA Guidelines for Competency Management Systems for Downstream and Petroleum Sites²
- European Process Safety Centre Process Safety Competence, How to set up a Process Safety Competence Management System³

These topics were then mapped against the six ISC functional elements. Some topics exist across more than one element, therefore the most significant element has been selected as the primary. Within an organisation, these elements and topics may form part of a Safety Management System.

Table 2: Competency topics

Elements	Topic
Culture	Safety leadership commitment, responsibility and workplace culture
Knowledge & competence	Process safety concepts
	Hazard identification and risk assessment
	Hazard awareness specific to the operation
Engineering & design	Safety in design
	Asset integrity
	Codes and standards
	Management of change
Human factors	Human factors
Systems & procedures	Systems, manuals and drawings
	Process and operational status monitoring and handover
	Contractor and supplier selection and management
	Safe systems of work
	Project delivery
	Management of major emergencies and emergency preparedness
	Incident reporting and investigation
Assurance	Legislation and regulations
	Audit, assurance, management review and intervention

Some elements have both technical and management aspects. Where this is the case, these aspects have been labelled in the competency definition in Appendix 2.

Competency definitions

Competency is defined across a four-tier scale, based on a combination of the tiers used by some ISC members. This allows for granular determination of the competency required across a varied workforce. The tiers are defined below:



Awareness

Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.



Basic application

Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.



Skilled application or proficiency

Independent contributor. Integrates work with other disciplines. Frequently mentors or coaches others. Assesses and compares alternative options.



Mastery or expert

Advanced experience in the particular skill. Applies creative solutions to complex problems. Defines and drives critical business opportunities and needs. Represents the organisation internally and externally on critical issues. Sets standards within the organisation. Recognised as a subject matter expert.

For each topic, the specific requirements at each level of competency were developed. The requirements for each competency level dictate that the requirements for the lower levels are met.



Appendix 1: Competency matrix

1. Awareness	Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
2. Basic application	Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.
3. Skilled application/ proficient	Independent contributor. Integrates work with other disciplines. Frequently mentors or coaches others. Assesses and compares alternatives and opportunities. Builds networks with others skilled in application or mastery.
4. Mastery/expert	Advanced experience in the particular skill. Applies creative solutions to complex problems. Defines and drives critical business opportunities and needs. Represents the organisation internally and externally on critical issues. Sets standards within the organisation. Recognised as a subject matter expert.
Not applicable	No role requirement.

Competency element	Front line			Engineering				Support functions							Management		Executives							
	Operator	Maintainer	Supervisor	Integrity/reliability	Technical authority	Project	Information technology	Process safety advisor	Process safety lead/Manager	HSE site	HSE corporate	Quality control	Corporate assurance	Human resources	Finance	Procurement	Operational authority	Manager / Superintendent	GM/ Site manager	Leaders/ MD/CEO	General board member	Board chair	Safety committee chair	Process safety specialist board member
Safety leadership commitment, responsibility and workplace culture	2	2	3	2	2	2	N/A	3	4	3	4	2	N/A	2	N/A	N/A	N/A	3	4	4	4	4	4	4
Process safety concepts	2	2	3	2	3	2	2	3	4	2	3	2	1	1	1	1	3	3	3	3	2	2	3	3
Hazard identification and risk assessment	2	2	2	2	4	2	2	3	3	2	2	1	1	1	1	1	2	2	2	1	1	1	2	2
Hazard awareness specific to the operation	2	2	3	3	4	3	3	3	4	2	3	2	2	1	1	1	3	3	3	2	1	1	2	2

Competency element	Front line			Engineering				Support functions									Management		Executives					
	Operator	Maintainer	Supervisor	Integrity/reliability	Technical authority	Project	Information technology	Process safety advisor	Process safety lead/Manager	HSE site	HSE corporate	Quality control	Corporate assurance	Human resources	Finance	Procurement	Operational authority	Manager/Superintendent	GM/ Site manager	Leaders/MD/CEO	General board member	Board chair	Safety committee chair	Process safety specialist board member
Safety in design	1	1	1	2	4	2	2	2	3	1	2	1	1	N/A	1	1	1	1	1	1	1	1	1	1
Asset integrity	2	2	2	4	4	2	2	2	3	1	2	1	1	N/A	N/A	1	3	3	2	1	1	1	1	2
Codes and Standards	1	1	2	2	3	2	N/A	3	4	2	4	1	N/A	1	N/A	N/A	N/A	2	2	1	1	2	1	3
Management of change	1	1	2	3	3	2	2	2	3	2	4	2	1	2	1	2	3	3	2	2	1	1	2	2
Human factors	2	2	3	1	4	2	N/A	3	3	3	4	1	N/A	2	N/A	N/A	N/A	2	2	1	1	3	3	4
Systems, manuals and drawings	1	1	3	4	4	4	N/A	2	3	1	3	4	N/A	N/A	N/A	N/A	N/A	1	1	N/A	N/A	N/A	N/A	1
Process & operational status monitoring & handover	2	2	3	2	4	1	N/A	1	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	3	1	1	1	1	1	1
Contractor & supplier selection and management	1	1	2	3	4	3	N/A	2	3	2	1	2	N/A	1	N/A	N/A	N/A	3	2	1	1	1	1	1
Safe systems of work	1	1	2	3	3	2	2	2	3	2	4	2	1	2	1	2	3	3	2	2	1	1	2	2
Project delivery	1	1	1	2	N/A	4	N/A	3	4	1	3	1	N/A	N/A	N/A	N/A	N/A	2	2	2	1	2	1	3
Management of major emergencies and emergency preparedness	2	2	3	2	2	2	N/A	3	4	3	4	1	N/A	1	N/A	N/A	N/A	4	3	3	1	3	3	3
Incident reporting and investigation	2	2	3	2	2	2	2	2	3	2	4	2	1	1	1	1	2	3	3	2	1	1	1	2
Legislation and regulations	1	1	2	2	3	2	N/A	3	4	2	4	1	N/A	1	N/A	N/A	N/A	2	2	3	2	3	3	3
Audit, assurance, management review and intervention	1	1	2	2	2	2	2	3	3	2	3	3	4	N/A	N/A	N/A	2	2	2	1	1	1	2	3

Notes:

T - Technical elements

M - Management elements

*for safety in design Process Safety Lead/Manager is level 2 operations phase, level 3 for design phase.

Appendix 2: Competency definitions

Proficiency rating	Description
1. Awareness	Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
2. Basic application	Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.
3. Skilled application/proficient	Independent contributor. Integrates work with other disciplines. Frequently mentors or coaches others. Assesses and compares alternatives and opportunities. Builds networks with others skilled in application or mastery.
4. Mastery/expert	Advanced experience in the particular skill. Applies creative solutions to complex problems. Defines and drives critical business opportunities and needs. Represents the organisation internally and externally on critical issues. Sets standards within the organisation. Recognised as a subject matter expert.
Not applicable	No role requirement.

Element	Competency required	Competency level 1 – Awareness	Competency level 2 – Basic application	Competency level 3 – Skilled application/proficient	Competency level 4 – Mastery/expert
Culture	Safety leadership commitment, responsibility and workplace culture	<ul style="list-style-type: none"> Aware of the importance of visible safety leadership. Aware of and participates in the company safety programmes. Demonstrates knowledge of workplace safety culture. Engaged and owns safety responsibilities and accountabilities. 	<ul style="list-style-type: none"> Understands the importance of visible safety leadership. Has the communication skills necessary to hold an effective safety intervention. Participates in safety-related conversations and suggests improvements. Initiates safety conversations. 	<ul style="list-style-type: none"> Identifies and clearly articulates behavioural requirements to workforce, contractors and subcontractors. Identifies and publicly recognises individuals who display the desired safety behaviours and attitudes. Identifies at-risk behaviour activators. 	<p>Technical elements</p> <ul style="list-style-type: none"> Mastery in designing and implementing safety leadership programmes. Measures and assesses culture. Designs and implements cultural change programmes. Designs and implements improvement plans. Develops culture definitions and norms in an organisation.

	<ul style="list-style-type: none"> • Reports safety incidents and understands the importance of accurate reporting. 	<ul style="list-style-type: none"> • Able to communicate: <ul style="list-style-type: none"> – why safety is important to the individual and the company. – what behaviours the individual is expected to consistently adopt. • Ensures that their communication and behaviour consistently sends a message that safety is embedded as a personal core value. • Understands human factors and their relationship to safety performance. 	<ul style="list-style-type: none"> • Sends clear and consistent messages about the importance of process safety. • Identifies and implements safety improvements. • Holds regular in-field safety conversations with front-line workers. • Undertakes regular in-field verification of controls and lessons learned from significant incidents. • Ensures that their communication and behaviour consistently sends a message that safety is embedded as a core value. • Involves their team and behaves in a manner that builds positive relationships within the workforce. • Understands and applies resourcing requirements to manage process safety. • Able to recognise change and manage it effectively. 	<p>Management elements</p> <ul style="list-style-type: none"> • Ensures leadership team is aware and committed to the provision of adequate levels of financial resources, staffing and supervision to ensure an effective safety culture to support safety. • Monitors HSE metrics to review effectiveness of the leadership programme (leadership time in- field, levels of supervision, behavioural-based interactions) and the link to adverse events. • Exhibits leader behaviours which will increase the likelihood of copied and reciprocated safety behaviours. • Communicates the importance of visible leadership in establishing an effective safety culture.
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Proficiency rating	Description
1. Awareness	Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
2. Basic application	Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.
3. Skilled application/proficient	Independent contributor. Integrates work with other disciplines. Frequently mentors or coaches others. Assesses and compares alternatives and opportunities. Builds networks with others skilled in application or mastery.
4. Mastery/expert	Advanced experience in the particular skill. Applies creative solutions to complex problems. Defines and drives critical business opportunities and needs. Represents the organisation internally and externally on critical issues. Sets standards within the organisation. Recognised as a subject matter expert.
Not applicable	No role requirement.

Element	Competency required	Competency level 1 – Awareness	Competency level 2 – Basic application	Competency level 3 – Skilled application/proficient	Competency level 4 – Mastery/expert
Knowledge & competence	Process safety concepts	<ul style="list-style-type: none"> Aware of process safety concepts, eg six elements. Aware of the similarities and differences between process safety, personal safety and their hazards. 	<ul style="list-style-type: none"> Understands the concept of process safety. Applies process safety concepts into daily work activities. 	<ul style="list-style-type: none"> Mentors others in process safety. Communicates process safety concepts with target audiences and stakeholders. Identifies learnings from past process safety events. 	<ul style="list-style-type: none"> Process safety subject matter expert. Designs process safety awareness sessions for various levels within company. Communicates process safety issues and programmes with leadership/management team and gains their support. Links learnings from past events to process safety framework.

<p>Hazard identification and risk assessment</p>	<ul style="list-style-type: none"> Aware of basic hazard identification processes (eg Step Back 5x5, Job Hazard Analysis (JHA), etc) and where they are used. Aware of the terms hazard, cause, consequence, control, risk and as low as reasonably practicable (ALARP). Aware of the hierarchy of controls, and what impacts a controls effectiveness, eg human factors, design etc. Aware of safety case major incident scenarios and what controls are safety critical. 	<ul style="list-style-type: none"> Participates in risk assessment processes. Understands the way process safety hazards are controlled, what those controls are and how effective they are. Understands the terms safety case, loss of containment (LOC), hazard identification (HAZID), hazard and operability study (HAZOP) and layers of protection analysis (LOPA). Identifies control improvements or new controls for risk reduction. 	<ul style="list-style-type: none"> Mentors others in conducting risk assessments. Identifies who needs to be involved in the development of hazard identification processes. Leads risk assessment processes. Applies the pros and cons of each assessment method in selecting the correct method. Demonstrates understanding and application of reducing public risk as it applies to process safety. Implements new or improved controls for risk reduction. 	<ul style="list-style-type: none"> Subject matter expert for hazard identification and risk control. Engages with leadership team to provide resources for identification and assessment. Mastery in consequence modelling concepts and details. Develops risk criteria. Develops control strategies – eg from inherently safer design through to emergency response. Develops strategies and guidance documents.
<p>Hazard awareness specific to the operation</p>	<ul style="list-style-type: none"> Applies to specific hazards of facility or organisation. Aware of the relevant processes occurring in area of plant/equipment. Aware of the risks associated with the process occurring in the area/equipment. 	<ul style="list-style-type: none"> Applies to specific hazards of facility or organisation. Understands the performance indicators that govern the safety of the process. Understands the triggers for action, the importance to act, and what action is required. Lists and implements all operating procedures. Able to describe and apply tools available. 	<ul style="list-style-type: none"> Applies to specific hazards of facility or organisation. Able to interpret what performance indicators mean in terms of the safety of the process. Able to make or authorise changes to correct the situation. Able to troubleshoot problems. Able to develop and recommend procedures. Recognises the physical and chemical properties of the materials that are being processed. 	<ul style="list-style-type: none"> Applies to specific hazards of facility or organisation. Mastery in describing the process physics and chemistry and how they are controlled and influenced. Mastery in defining the basis of safety for the facility including understanding previous incidents.

Proficiency rating	Description
1. Awareness	Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
2. Basic application	Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.
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4. Mastery/expert	Advanced experience in the particular skill. Applies creative solutions to complex problems. Defines and drives critical business opportunities and needs. Represents the organisation internally and externally on critical issues. Sets standards within the organisation. Recognised as a subject matter expert.
Not applicable	No role requirement.

Element	Competency required	Competency level 1 – Awareness	Competency level 2 – Basic application	Competency level 3 – Skilled application/proficient	Competency level 4 – Mastery/expert
Engineering & design	Safety in design	<ul style="list-style-type: none"> Aware of the following process safety related concepts for Safety in Design: <ul style="list-style-type: none"> Inherently safer design (ISD) Risk-based design ALARP principle Aware that there are legislative and regulatory requirements (eg Safety Case or equivalent report); codes and standards relating to safe process/facility design, construction and operation. 	<ul style="list-style-type: none"> Applies under supervision the relevant legislative and regulatory requirements, codes and standards relating to safety in design. Provides basic technical input to design requirements as applicable to their industry to meet safety in design objectives. Applies a basic knowledge of the following process safety related concepts for Safety in Design: <ul style="list-style-type: none"> ISD Risk-based design ALARP principle 	<ul style="list-style-type: none"> Provides comprehensive technical input to design as applicable to their industry to meet safety in design objectives including incorporation of all applicable legislation/regulatory requirements, codes and standards. Applies ISD principles. Provides design solutions that incorporate risk-based design and ALARP principle. Liaises with other disciplines (eg instrumentation, mechanical, etc) as to integrate safety in design solutions. Identifies Safety Critical Elements and develops Performance Standards. 	<ul style="list-style-type: none"> Leads, evaluates, and delivers technical safety requirements as applicable to their industry. Develops applicable corporate process safety design standards, guidelines and philosophies. Assesses detailed knowledge of applicable legislation, regulations, codes and standards. Manages external third-party service providers supplying specialist, complex process safety services (eg detailed explosion studies).

<p>Asset integrity</p>	<ul style="list-style-type: none"> • Aware that Safety Critical Elements require inspection and maintenance to ensure integrity. • Aware of which Safety Critical Elements form critical controls. • Supports condition monitoring regimes. • Aware of safety critical tasks and the likely effects should these not be carried out. 	<ul style="list-style-type: none"> • Able to track and report performance criteria and identify when Safety Critical Elements are not meeting criteria. • Understands/can explain reliability, availability and maintainability (RAM) study metrics. • Monitors reliability of safety critical elements. 	<ul style="list-style-type: none"> • Reviews maintenance and inspection results and trends. • Develops protocols for in-field performance measurement. • Conducts periodic performance reviews of Safety Critical Elements. • Promotes asset integrity. • Identifies potential failure modes of critical elements. • Assesses failure effects and determines criticality. 	<ul style="list-style-type: none"> • Identifies risks to asset integrity. • Defines maintenance and inspection regime. • Defines specific maintenance and inspection procedures and specifications. • Authorises life extensions or changes to inspection programmes. • Determines performance standards of Safety Critical Elements. • Conducts formal review of Safety Critical Elements and Asset Integrity processes.
<p>Codes and standards</p>	<ul style="list-style-type: none"> • Aware that standards, company/industry reference documents and their business unit equivalents exist. 	<ul style="list-style-type: none"> • Understands how to assimilate relevant company/industry reference documents into work efforts. 	<ul style="list-style-type: none"> • Proficient with company/industry reference documents affecting process safety across multiple disciplines as appropriate. • Implements systems to ensure compliance to codes and standards. • Uses industry reference documents and engineering tools to develop process/facility design. 	<ul style="list-style-type: none"> • Company and/or industry leader in one or more aspects of design. • Interfaces with outside contractors in use of, and deviations to, the company standards. • Leverages knowledge and acts as a contributing member of industry bodies, especially in developing industry reference documents that fulfil company's needs.

<p>Management of change</p>	<ul style="list-style-type: none"> • Aware of the need to manage change. • Aware of what is covered by management of change procedure: policies, procedures, work methods, personnel, etc. • Able to recognise what a change is and initiate the process. 	<ul style="list-style-type: none"> • Understands own role in change management. • Contributes to implementation of change management. • Able to initiate change management process. • Prepares management of change (MOC) documents. • Understands the change and is able to update information systems eg drawings, manual, procedures, etc. 	<ul style="list-style-type: none"> • Recognises theory of implementing change and how changes will affect risk. • Communicates changes as required. • Actively implements change management procedures. • Authorises change in their area/competency or is a reviewer on the change. 	<ul style="list-style-type: none"> • Subject matter expert across relevant cross-functional areas including hazard identification and risk control, human factors, systems, etc. • Develops change management process. • Actively involved in organisational changes and how they are managed.
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Proficiency rating	Description
1. Awareness	Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
2. Basic application	Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.
3. Skilled application/proficient	Independent contributor. Integrates work with other disciplines. Frequently mentors or coaches others. Assesses and compares alternatives and opportunities. Builds networks with others skilled in application or mastery.
4. Mastery/expert	Advanced experience in the particular skill. Applies creative solutions to complex problems. Defines and drives critical business opportunities and needs. Represents the organisation internally and externally on critical issues. Sets standards within the organisation. Recognised as a subject matter expert.
Not applicable	No role requirement.

Element	Competency required	Competency level 1 – Awareness	Competency level 2 – Basic application	Competency level 3 – Skilled application/proficient	Competency level 4 – Mastery/expert
Human factors	Human factors	<ul style="list-style-type: none"> Aware of what human factors are. Aware of how human factors influence human and safety performance. Manages self (fatigue, fit-for-work, at-risk behaviours). 	<ul style="list-style-type: none"> Manages self (fatigue, fit-for-work, at-risk behaviours) and monitors others. Identifies and responds to observed at-risk behaviours in self and others. Provides feedback on poor job and equipment design and suggests improvements. 	<ul style="list-style-type: none"> Recognises that human factors are concerned with task requirements and its characteristics, the individual's competence and workplace culture and the link to safety. Intervenes when at-risk behaviours are observed. Provides input into job design taking into account human factors. Communicates human factors to the wider workplace. Seeks to solve poor job and equipment design and welcomes suggested improvements. Recognises the impact of contractors on the workforce with respect to safety. 	<ul style="list-style-type: none"> Comprehends how human factors links to process safety. Ensures plant and equipment designs and tasks are designed to take account of both human limitations and strengths. Communicates how an individual's competence, skills, personality, attitude, and risk perception affect safety. Promotes how work patterns, the workplace culture, resources, communications, leadership, etc have a significant influence on individual and group behaviour.

Proficiency rating	Description
1. Awareness	Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
2. Basic application	Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.
3. Skilled application/proficient	Independent contributor. Integrates work with other disciplines. Frequently mentors or coaches others. Assesses and compares alternatives and opportunities. Builds networks with others skilled in application or mastery.
4. Mastery/expert	Advanced experience in the particular skill. Applies creative solutions to complex problems. Defines and drives critical business opportunities and needs. Represents the organisation internally and externally on critical issues. Sets standards within the organisation. Recognised as a subject matter expert.
Not applicable	No role requirement.

Element	Competency required	Competency level 1 – Awareness	Competency level 2 – Basic application	Competency level 3 – Skilled application/proficient	Competency level 4 – Mastery/expert
Systems & procedures	Systems, manuals and drawings	<ul style="list-style-type: none"> Aware of how to interpret piping and instrumentation diagrams (P&ID), cause & effect charts and process flow diagrams. Aware of how to interpret operations and equipment manuals. Aware of how to locate appropriate documents. 	<ul style="list-style-type: none"> Understand how the document control system works and how to make suggestions for improvement. Understands how to use process safety information in emergency situations. 	<ul style="list-style-type: none"> Contributes to the development and review of P&ID, cause and effect charts, process flows, manuals and other operational documentation. Uses MOC for communicating document changes. Able to use process safety information to explain actual process performance issues. 	<ul style="list-style-type: none"> Defines what process safety documentation is required. Defines authorisation process. Defines document management system and its use in training.

Systems & procedures	
Process & operational status monitoring & handover	<ul style="list-style-type: none"> • Aware that safe operating envelopes exist. • Aware of the process and what can go wrong. • Aware of what is required to keep the process under control. • Aware of what to do in an abnormal/emergency situation. • Aware that controls have performance criteria and they need to be monitored.
Contractor & supplier selection and management	<ul style="list-style-type: none"> • Aware of the process of contractor selection and management. • Aware of why specific types of contractors are engaged eg technical experts.
Safe Systems of Work	<ul style="list-style-type: none"> • Aware of the safe systems of work tools – Permit To Work, isolations, safe work method statements.
	<ul style="list-style-type: none"> • Utilises P&ID, cause and effect charts, process flow diagrams, and operations manuals to troubleshoot minor issues. • Able to safely operate the facility within the safe operating envelope. • Able to maintain a shift log. • Able to track and report control performance criteria.
	<ul style="list-style-type: none"> • Recognises how to recover from an abnormal situation and manages startups and shutdowns. • Able to conduct effective shift handover. • Able to interpret weak signals, eg shift log details. • Able to mentor new operators.
	<ul style="list-style-type: none"> • Understands and alters operating parameters using change management. • Monitors and or manages simultaneous operations. • Develops operations training materials and framework for competency. • Engages senior management in the development and review of process indicators.
	<ul style="list-style-type: none"> • Develops work scope information required to undertake and review work (scope of work, contract requirements, legislative requirements, competency of contractors). • Makes evidence-based decisions regarding process safety competency of company and suitability for project.
	<ul style="list-style-type: none"> • Establishes contractor and supplier selection processes/criteria in terms of process safety performance criteria. • Establishes system/criteria for evaluating contractor competencies (technical, safety attitude, relevant experience etc).
	<ul style="list-style-type: none"> • Identifies where safe systems of work need to be developed.

Systems & procedures

Project delivery	<ul style="list-style-type: none"> Aware of own deliverables and role in achieving process safety outcomes on projects. 	<ul style="list-style-type: none"> Understands the project performance criteria and how they relate to process safety. Understands process safety stages of the project eg risk assessments, siting studies, etc. 	<ul style="list-style-type: none"> Manages process safety related interfaces between projects, operations, vendors, designers, etc. Recognises when to apply relevant risk management processes. Reviews project performance against process safety criteria. Project lifecycle reviews incorporating process safety. 	<ul style="list-style-type: none"> Defines project management process and how it aligns with process safety needs. Able to identify and engage subject matter experts when required for process safety aspects.
Management of major emergencies and emergency preparedness	<ul style="list-style-type: none"> Aware of escape routes, muster points and emergency evacuation procedures. Aware of own role in an emergency. Aware of major incident scenarios. Aware of how to initiate emergency response 	<ul style="list-style-type: none"> Able to fulfil a role in emergency response as nominated. Understands how to escalate emergency alarm, eg calling emergency services/response. 	<ul style="list-style-type: none"> Ensures team members are aware of emergency response plan and their individual roles and that of the emergency response team. Able to decide on response actions and direct people. Able to plan and undertake emergency exercises. 	<ul style="list-style-type: none"> Develop emergency response plan based on major incident scenarios and results of consequence modelling. Able to monitor effectiveness of response activities. Engages with external emergency services and third parties.
Incident reporting and investigation	<ul style="list-style-type: none"> Aware of the incident reporting requirements and knows how to report an incident. Aware of why incidents are investigated. Aware of media policies and procedures (for major or prominent incidents). Understands what a process safety incident is. 	<ul style="list-style-type: none"> Contributes to the incident investigation process. Understands importance of preservation of site and evidence. 	<ul style="list-style-type: none"> Plans investigation of incident. Leads basic investigation. Analyses and uses root cause analysis to improve systems performance. Identifies potential consequences of incidents. 	<ul style="list-style-type: none"> Leads major incident investigations. Demonstrates consistent and visible leadership in supporting the reporting and investigation of incidents. Analyses incident statistics to predict trends. Ensures learning from incident investigations across the organisation/project/site. Determines investigation methodologies used.

Proficiency rating	Description
1. Awareness	Has knowledge of the theory and displays conceptual understanding. Actively participates in discussions regarding the skill. Performs routine tasks with significant supervision. Learns how to do things.
2. Basic application	Performs fundamental and routine tasks. Requires occasional supervision. Increased functional expertise and ability. Works with others.
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Not applicable	No role requirement.

Element	Competency required	Competency level 1 – Awareness	Competency level 2 – Basic application	Competency level 3 – Skilled application/proficient	Competency level 4 – Mastery/expert
Assurance	Legislation and regulations	<ul style="list-style-type: none"> Aware that there are laws, and regulations pertaining to safe process/facility design, construction and operation. 	<ul style="list-style-type: none"> Able to access relevant legislation and regulations. Able to comply with relevant legislation and regulations in work activities. 	<ul style="list-style-type: none"> Mentors others in implementing the relevant legislation and regulations. Informs relevant personnel of the impact of changes to legislation and regulations. 	<ul style="list-style-type: none"> Provides feedback to regulators as required. Interprets legislation in expert field. Liaises with regulators and industry bodies. Recognises when new legislation necessitates updated risk assessments, plant design, operations, etc
	Audit, assurance, management review and intervention	<ul style="list-style-type: none"> Aware there is an assurance process and be able to describe assurance activities relevant to their area. Observes or contributes to assurance activities where required. 	<ul style="list-style-type: none"> Understands why there are assurance processes. Participates in executing assurance activities and audits under supervision. 	<ul style="list-style-type: none"> Undertakes lead role in assurance activities such as audits and management reviews. Participates in the establishment of assurance plans. 	<ul style="list-style-type: none"> Plans assurance strategies on the basis of risk. Analyses assurance findings to develop organisation-wide responses to emerging trends. Drives process safety governance through the governance framework and assurance activities. Guides the organisation in effective implementation of continuous improvement initiatives.

Appendix 3: References and further information

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2. Cogent and UKPIA, *Guidelines for Competency Management Systems for Downstream and Petroleum Sites*, Cogent, UK, 2011
3. European Process Safety Centre, *Process Safety Competence – How to set up a Process Safety Competence Management System*, EPSC, UK, 2013
4. Health and Safety Executive, *Managing competence for safety-related systems*, 2007
5. IChemE Safety Centre, *Lead Process Safety Metrics – selecting, tracking and learning*, ISC, Aust, 2015
6. Centre for Chemical Process Safety, *Guidelines for Risk Based Process Safety*, CCPS, USA, 2007
7. Energy Institute, *High level framework for process safety management*, Energy Institute, UK, 2010
8. Kletz, T, *An engineer's view of human error*. 3e. IChemE, Rugby, UK, 2001
9. The OHS Body of Knowledge, Supported and maintained by the Safety Institute of Australia www.ohsbok.org.au
This reference contains a chapter on *Process Hazards – Chemical* and a chapter on *Managing Process Safety*

“It is not, of course,
sufficient to have
knowledge. It is necessary
to be able to apply it to
real-life problems.”⁸

Trevor Kletz

Appendix 4: Glossary

ALARP	As Low As Reasonably Practicable
CEO	Chief Executive Officer
CMS	Competency Management System
GM	General Manager
HAZID	Hazard Identification
HAZOP	Hazard and Operability study
HSE	Health, safety and environment
HR	Human resources
ISC	IChemE Safety Centre
ISD	Inherently Safer Design
JHA	Job Hazard Analysis
LOP(A)	Layers of protection (analysis)
MD	Managing Director
MOC	Management of Change
P&ID	Piping and instrumentation diagram
PS	Process safety
PTW	Permit to Work
QA	Quality Assurance
QRA	Quantitative Risk Assessment
RCA	Root Cause Analysis
SCE	Safety Critical Element

Led by members, supporting members
and serving society

Contact us for further information

UK

t: +44 (0)1788 578214

e: membersupport@icheme.org

Australia

t: +61 (0)3 9642 4494

e: austmembers@icheme.org

Malaysia

t: +603 2283 1381

e: malaysianmembers@icheme.org

New Zealand

t: +64 (0)4 473 4398

e: nzmembers@icheme.org

Singapore

e: singaporemembers@icheme.org



www.icheme.org

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