

Managing competence for safety-related systems

Part 1: Key guidance

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This guidance is issued by the Health and Safety Executive, the Institution of Engineering Technology and the British Computer Society. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law in Great Britain where this is regulated by the Health and Safety Executive (HSE). HSE inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.¹

Introduction

1 This guidance on competence applies to everyone, in all industry sectors, whose decisions and work with safety-related systems can affect health and safety. The aim is for all people within scope to be suitably qualified and experienced for their own work activities, roles and responsibilities.

2 A safety-related system according to this guidance is a system whose correct operation is necessary for ensuring or maintaining safety. It uses electrical, electronic, and/or programmable electronic technologies and may include software and people. In general, safety-related systems can be classified as protection systems or control systems.

3 Example safety-related systems include a trip-switch that disconnects power from a press on close approach to moving parts, traffic lights, vehicle engine management, boiler management, medical devices, fire management in an intelligent building, gas detection on an industrial chemical plant, emergency shutdown on an offshore gas platform, remote operation of a network-enabled process plant, access protection for nuclear reprocessing, fly-by-wire operation of aircraft flight control surfaces and any information system where erroneous results can significantly affect safety.

4 New technologies, particularly programmable electronics, have enabled such systems to function more effectively and allowed more sophisticated ways to make them safe. At the same time, the new technology has brought its own challenges – particularly increased design complexity. This has thrown the spotlight on the role of staff engaged in the design, development, maintenance and use of these safety-related systems. The achievement of sufficiently low levels of risk is critically dependent on individual and team competence.

¹ The effort expended in meeting the principles of this guidance should be in proportion to the risk associated with inadequate competence (see Risk and proportionality).

5 In parallel, the pace of change in industry continues to accelerate, with frequent restructuring and much movement of staff between roles, between companies and even between sectors. Ever newer technology requires new skills. Even if new staff possess these skills, they may be unfamiliar with the organisational culture in which they are to be exercised, and specifically the safety culture. Long term familiarity of managers with the capabilities of their staff can no longer be assumed, so increasingly organisations need to establish competence management systems in order to satisfy themselves, their customers and regulators that their staff are competent for the tasks to which they are assigned.

6 Standards makers have recognised the growing importance of competence. For example, in the latest committee draft [Ref. 1] of the international standard on '*Functional safety of electrical/electronic/programmable electronic safety-related systems*' (IEC 61508), the requirement for staff competence is upgraded from a recommendation to a mandatory requirement for compliance.

7 The form of this guidance is based on that of an already published railway-specific HSE publication, the *Railway Safety Principles and Guidance Part 3 Section A: Developing and maintaining staff competence* [Ref. 2]. Its scope, however, differs significantly and it does not replace the railway publication.

8 HSE inspectors will take into account the principles of this document when judging the adequacy of a duty holder's arrangements for competence management. This will take into account additional legislation and regulatory practice where applicable (see Legislative Background).

9 All companies should periodically review their arrangements and achievements in managing competence, and implement improvements as required. A review can start with any part of the competence management process. Well-managed companies will already be doing this, but this document provides a benchmark for such reviews.

Who is this guidance for?

10 This guidance is aimed primarily at those who are responsible for managing and assuring the competence of individuals and teams that might have an impact on the functional safety of safety-related systems, during any phase of design, development, manufacturing, operation, maintenance or modification.

11 Hence, the following personnel will find the guidance relevant:

- those responsible for functional safety in an organisation,
- those responsible for setting up a new competence management system for functional safety or further developing an existing competence management system (CMS),
- those responsible for operating an established CMS,
- those responsible for career development of staff in an organisation,
- staff in an organisation that are employed, or might be employed, on projects that require formal management of competence.

12 Indeed, anyone with an interest in competence management will also find useful advice in this guidance. Directors and senior managers responsible for the overall policy of their organisation need to be aware of the CMS's objectives and the benefits that may result from its use.

13 Staff who are working in an environment that requires formal assurance of competence, or who might in the future move into such an area, will gain insight into the reasons for the competence management processes, and an understanding of the expectations on them.

14 The guidance is relevant to organisations carrying out training, development and competence assessment for functional safety; and will also be of interest to employee representatives, health and safety professionals, designers and other service providers.

15 The guidance is applicable to all staff whose work activities involve safety-related systems. It should be applied to the competence of staff at all levels of the organisation – not just those who are directly involved in development, maintenance or use, but also to those who manage the competence management system, and to those managers whose main contribution to functional safety is decision making about financial and commercial matters. Through their competence (or otherwise) they will all affect the safety of the workforce, the public and themselves.

16 While the focus of this guidance is the functional safety of safety-related systems, it is written to allow broader application where desired, and to be compatible with competence management systems with more general scope and with career development and professional development schemes.

Objectives

17 This guidance aims to describe the core requirements for a competence management system (CMS), for all staff at all levels of responsibility within an organisation that work on safety-related systems (including those in the supply chain), to enable the organisation to meet the UK legal requirements for competence for safety-related systems in general (i.e. without going into detail for any one particular industry sector).

18 A secondary supporting document [Ref. 3] gives ideas on how to set up and operate a CMS in a way that achieves these requirements and is efficient, effective, minimises administrative overhead, and can be audited efficiently. Note that the ideas in this secondary document may not be applicable to your own organisation; for example, the resources necessary for some of the solutions suggested may not be proportionate to the risk, or appropriate for the size of your undertaking.

Risk and proportionality

19 The effort expended in meeting the principles of this guidance should be in proportion to the risk associated with inadequate competence. Factors likely to be influenced by the risk include

- rigour in defining competence criteria
- type of assessment and its frequency
- extent of monitoring and supervision
- use of independent assessment
- formality and breadth of documentation.

20 The size of your organisation and of its undertaking within the scope of the CMS will affect the necessary extent and formality of procedures. In general, the effort expended in competence management should be commensurate with that required for other safety management activities.

Competence

21 Competence plays a very important role in ensuring functional safety. Safety-related systems rely on a complex mix of hardware (eg automatic guards and trips), software (eg traffic monitoring on road networks), human factors (eg safety culture) and safety management systems. Competence is also vital in abnormal and emergency situations.

22 For a person to be competent, they need qualifications, experience, and qualities appropriate to their duties. These include:

- such training as would ensure acquisition of the necessary knowledge of the field for the tasks that they are required to perform

- adequate knowledge of the hazards and failures of the equipment for which they are responsible
- knowledge and understanding of the working practices used in the organisation for which they work
- the ability to communicate effectively with their peers, with any staff working under their supervision, and with their supervisors
- an appreciation of their own limitations and constraints, whether of knowledge, experience, facilities, resources, etc., and a willingness to point these out.

23 In addition, professional engineers with responsibility for design or for supervision of operators should have:

- a detailed working knowledge of all statutory provisions, approved codes of practice, other codes of practice, guidance material and other information relevant to their work; an awareness of legislation and practices, other than these, which might affect their work; and a general knowledge of working practices in other establishments of a similar type
- an awareness of current developments in the field in which they work.²

24 Competence involves much more than technical training, including attitude and behaviour as well as experience and knowledge of the application domain.

25 Competence might be transferable from one work situation to another, but the extent to which this is possible depends very much on the *context* in which apparently similar competence is required. At one extreme, such as making wiring connections in accordance with a wiring diagram, they may be very largely transferable. Such competence can readily be assessed and certified. At the other extreme, the extent of the knowledge and ability that is transferable may be very limited. For example, an individual considered competent to develop computer software for a vehicle engine management system may not know of the particular failure modes and hazards of a computer-based suspension system, and until they do they cannot be considered fully competent to develop the software for such a system, even if it is in the same industrial sector.

26 A competence management system developed in accordance with this guidance should enable staff to fulfil responsibilities and to perform activities to recognised standards of competence on a regular basis, in order to

- reduce risks
- satisfy legal and regulatory requirements
- meet the organisation's business objectives
- enable the organisation to meet contractual commitments.

27 The purpose of a competence management system is to control in a logical and integrated manner a set of activities within the organisation that will assure competent performance in work. The aim is to ensure that individuals

- are clear about the competence expected of them,
- have received appropriate training, development and assessment,
- have appropriate experience, and
- maintain or improve their competence over time.

² The requirements in paragraphs 22 and 23 are reproduced from the *Hazard Forum Guidelines* [Ref. 4].

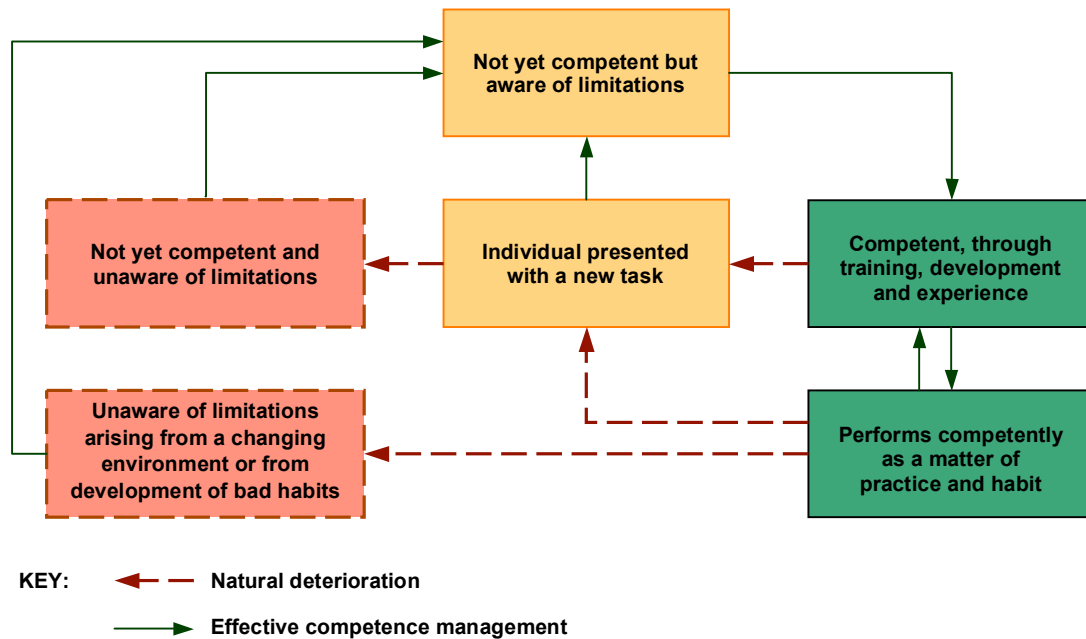


Figure 1: Competence stages for the individual

28 To assure an effective and consistent standard of competence in individuals and teams requires a process of continuous improvement, shown diagrammatically in Figure 1. When people begin to acquire competence for a new task, or begin progressing to a higher level of competence, they will be unaware, at least to some extent, of what they can and cannot do. Through training and development activities, they will first become aware of their limitations and then overcome those limitations to become competent. Gradually, their work becomes second nature, and they become well practised even in situations that they encounter less often. In effect, people reach a level of almost automatic performance to a high standard.

29 The danger is that, without realising it, people can again become unaware of their limitations, whether because of external developments – such as the advance of good practice or new technologies – or because of a drift to bad habits in routine work. It is to avoid this – or to detect it and redress it – that monitoring and assessment of performance is required at the individual level, and verification, audit and review is needed at the system level.

Fitness

30 The intrinsic competence of some staff, eg for operations and maintenance, can be compromised by poor physical, medical or mental fitness. While this document provides no further guidance, organisations will need systems in place to monitor staff fitness – as it might affect risks – and be alert and responsive to potential problems.

Competence model

31 This competence model sets out the relationships between the concepts used in this guidance, in particular the relationships between roles, work activities and competence criteria. See Figure 2 for an illustration of the concepts and process.

32 Members of staff, working either individually or in teams, perform one or more **roles** – such as procurement, software design, or instrumentation testing.

- 33** Each role is broken down into a set of **work activities**, each of which requires particular technical skills, behavioural skills and knowledge.
- 34** Each role has its own set of **competence criteria**, derived from the work activities that make up the role.
- 35** An individual's role is specified in terms of the work activities that they must be able to undertake. The associated competence criteria specify the knowledge, skills, experience and behaviour that is necessary for the individual to be considered competent for the role.
- 36** To determine if an individual is competent to carry out their role, they are assessed against the predetermined competence criteria. (Note that the assessment may consider all work activities that the individual is likely to be competent for, so as to demonstrate their additional suitability for alternative or future roles.)
- 37** The person is deemed competent for the role if their evidence demonstrates that the competence criteria for the role have been met.
- 38** If the assessment discovers minor shortfalls in competence, it may be possible for the individual to perform a very similar role with the addition of well-defined precautionary measures such as increased supervision.

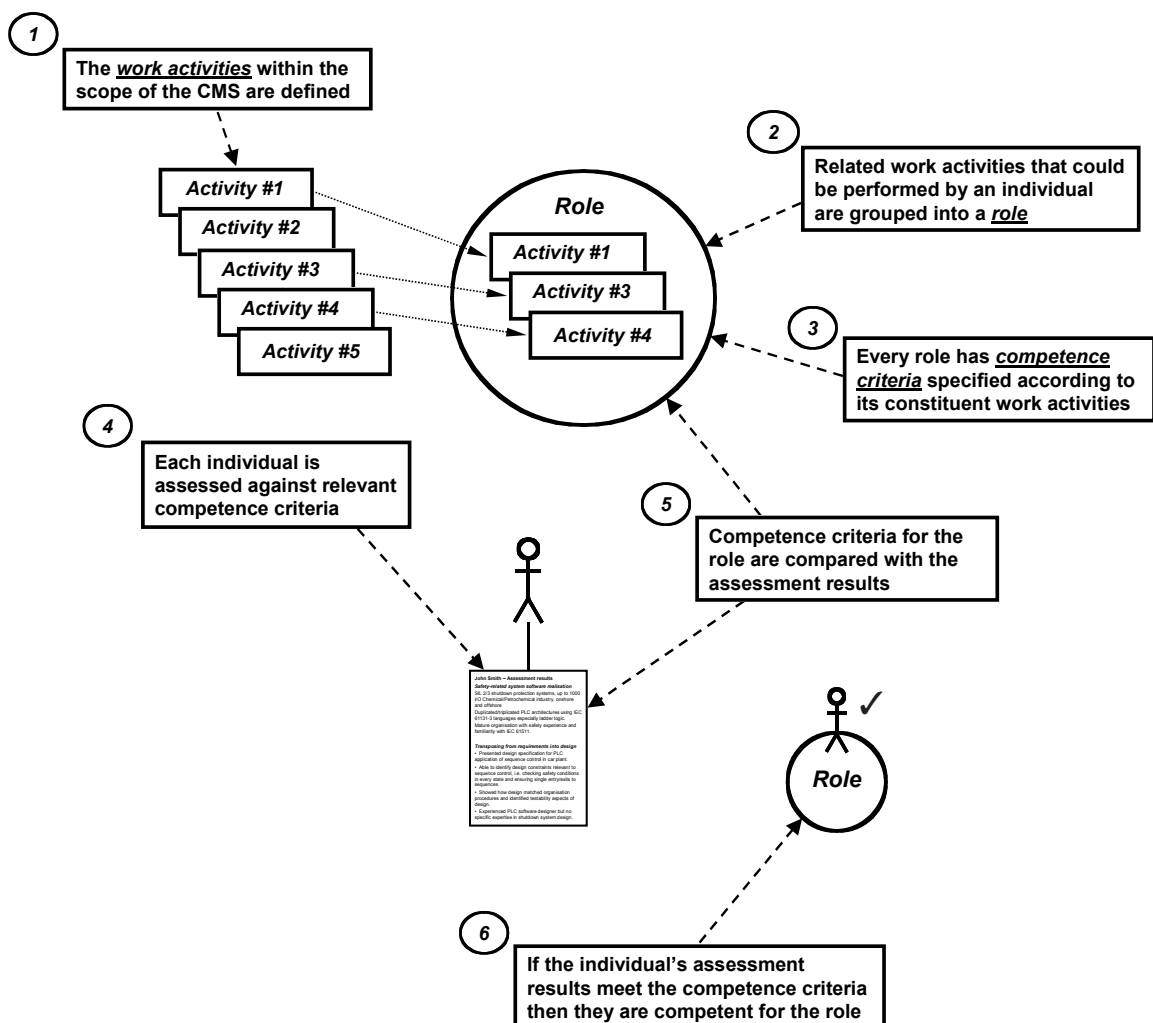


Figure 2: Essentials of the competence model

Competence criteria

39 This guidance does not specify competence criteria. The criteria may be selected from existing external sources or developed by your own organisation. New sets of competence criteria may be developed in response to this guidance. Further guidance is given in [Principle 2](#); some potential topics for criteria are listed in [Appendix 1](#); and additional guidance is given in Reference 3, which also introduces an example set of published criteria.

Legislative background

40 The Health and Safety at Work etc Act 1974 (HSW Act) places general duties on employers and the self-employed to ensure that employees and others who may be affected by the work of their undertaking, are not, so far as is reasonably practicable, exposed to risks to their health and safety. In particular this includes the provision of safe systems of work, supervision and training.

41 The Management of Health and Safety at Work Regulations 1999 (MHSW Regulations) require employers to undertake a suitable and sufficient assessment of the risk that their activities present to their employees and others, including contractors and the public. Measures developed from such a risk assessment need to encompass training, knowledge and experience. Employers should also appoint a 'competent person' (as defined in the MHSW Regulations) to help them comply with the statutory provisions. This guidance is underpinned by the requirements for risk assessment derived from the MHSW Regulations. [See Ref. 5]

42 For a summary of other health and safety regulations that contain requirements for competence see [Appendix 2](#).

43 Some sectors, such as Medical Devices, have their own product legislation and associated regulation. In the nuclear sector, Licence Condition 12 contains specific detailed requirements.

44 If you operate internationally, you will have to comply with the laws of other countries and be aware of requirements relating to competence.

Industry standards

45 Where legal duties are expressed in general terms, such as in the HSW Act, these may be determined for particular circumstances through reference to accepted good practice, often represented in international, European, national and industry standards and associated published guidance.

46 IEC 61508, Functional safety of electrical/electronic/programmable electronic safety-related systems [Refs. 6 and 7], is an important international standard in this regard. It requires that *"All persons involved in any overall, E/E/PES or software safety lifecycle activity, including management activities, should have the appropriate training, technical knowledge, experience and qualifications relevant to the specific duties they have to perform."* In addition, it requires that competence be documented and assessed. Other related sector standards (such as IEC 61511 [Ref. 8]) similarly require competence.

47 The guidance in this present document is intended to help your organisation to establish a competence management system that will enable you to meet such requirements.

Outline of the principles

48 In this guidance we identify 4 phases for a CMS - planning, design, operation and review. Each phase contains one or more management principles. For each principle, there is a set of recommendations giving the activities necessary for its successful attainment.

49 The phases and the principles are presented in the table below. Each phase and principle is colour-coded to facilitate navigation through the remainder of the document.

| | | |
|---|----------------------------|---|
| PHASE 1 <i>Plan</i> | <u>PRINCIPLE 1</u> | Define purpose and scope according to risk Specify all work activities to be included in the CMS, based on the risk associated with those activities. |
| PHASE 2 <i>Design</i> | <u>PRINCIPLE 2</u> | Establish competence criteria Select or develop a suite of competence criteria that covers all activities within the scope of the CMS and gives sufficient confidence that all staff that meet particular criteria are competent to perform the related work activity. |
| | <u>PRINCIPLE 3</u> | Decide processes and methods Establish efficient and consistently repeatable processes, procedures and methods that implement the requirements of the principles in this guidance. |
| PHASE 3 <i>Operate</i> | <u>PRINCIPLE 4</u> | Select and recruit staff Select internally, and recruit externally, staff that have an appropriate and demonstrable competence profile. |
| | <u>PRINCIPLE 5</u> | Assess competence Determine the extent to which staff currently meet the established competence criteria. |
| | <u>PRINCIPLE 6</u> | Develop competence Extend and maintain the competence of staff so that they are able to meet relevant competence criteria. |
| | <u>PRINCIPLE 7</u> | Assign responsibilities Ensure that staff and suppliers undertake only work for which they have been assessed as competent. |
| | <u>PRINCIPLE 8</u> | Monitor competence Monitor whether or not staff assessed as competent are continuing to perform competently and to initiate corrective action where appropriate. |
| | <u>PRINCIPLE 9</u> | Deal with failure to perform competently Respond to any failures to perform competently so that the impact on safety is minimised, including initiating actions to restore the competence of individuals. |
| | <u>PRINCIPLE 10</u> | Manage assessors' and managers' competence Ensure that senior managers, managers of the CMS and assessors are competent to support and fulfil the requirements of the CMS. |
| | <u>PRINCIPLE 11</u> | Manage supplier competence Ensure that all relevant work activities of suppliers are always performed by competent staff. |
| | <u>PRINCIPLE 12</u> | Manage information Maintain accurate information from the operation of the CMS, in sufficient detail to enable efficient operation and to demonstrate that its requirements are being met. |
| | <u>PRINCIPLE 13</u> | Manage change Monitor changes in the external environment and the internal operation of the organisation, to determine implications for the CMS and to initiate changes to the CMS as appropriate. |
| PHASE 4 <i>Audit and review</i> | <u>PRINCIPLE 14</u> | Audit Audit the CMS with sufficient frequency to give confidence that it is meeting its objectives and operating as intended, and to initiate improvement action where appropriate. |
| | <u>PRINCIPLE 15</u> | Review Review identified changes and the combined evidence on the operation of the CMS generated from dealing with competence failures and from audits, and to initiate improvement action where appropriate. |

Acknowledgements

The guidance provided in this draft for consultation is partially derived from a previous HSE publication for the railway industry, *Railway Safety Principles and Guidance Part 3 Section A: Developing and maintaining staff competence*. That document was produced by a working group of the Health and Safety Commission's Railway Industry Advisory Committee.

PHASE ONE: Plan

Principle 1: Define purpose and scope according to risk

Objective: To specify all work activities to be included in the CMS, based on the risk associated with those activities.

- 1.1** Define the purpose and scope of your CMS in terms of work activities where competence is critical (as determined from following 1.2 to 1.4 below).
- 1.2** Identify the work activities of your organisation relating to functional safety of safety-related systems, including abnormal situations such as emergencies. Assess the implications for hazards and risks if each work activity is not performed correctly.
- 1.3** Determine the extent to which consistently applied competence in carrying out the activity is relied on. Consider introducing new measures to reduce dependence on competence for these activities.
- 1.4** Optionally, you may consider and allow for other factors that could affect the scope of your CMS, including
 - specific legislation or guidance material
 - business risks
 - contractual obligations (eg specified standards)
 - the interface between your CMS and those of your customers.

P1: Define purpose and scope according to risk

PHASE TWO: Design

Principle 2: Establish competence criteria

Objective: To select or develop a suite of competence criteria that covers all activities within the scope of the CMS and gives sufficient confidence that all staff that meet particular criteria are competent to perform the related work activity.

- 2.1** Identify and define a complete set of roles performed by your staff and/or by teams (eg hazard and risk analysis, system architect, safety assurance manager) that covers all activities within the scope of the CMS.
- 2.2** Select or develop a suite of competence criteria that encompasses every role. The criteria should cover technical and behavioural skills, and underpinning knowledge and understanding. They should be written to facilitate clear-cut assessment.
- 2.3** Show how the criteria relate to roles within your organisation, how they match your management and team structures, and how roles are broken into constituent activities. When selecting or developing the criteria and matching them to the roles in your organisation, you may wish to optimise these roles according to your business objectives and the roles specified or catered for in available competence criteria.
- 2.4** When selecting or developing criteria, allow for:
 - portability – so that someone assessed as competent in another organisation or context can easily be matched to your own needs; and
 - modularity – so that any particular person's competence profile can be built up by selecting and combining sets of competence criteria.
- 2.5** Test the criteria for your specific work situation (eg using a representative pilot study, benchmarking or independent review).

P2: Establish competence criteria

Principle 3: Decide processes and methods

Objective: To establish efficient and consistently repeatable processes, procedures and methods that implement the requirements of the principles in this guidance.

- 3.1** Nominate a person, who has the necessary competence and senior authority, to manage the introduction and operation of the CMS and to ensure its continued effectiveness.
- 3.2** Specify the CMS in terms of transparent and repeatable processes and methods, derived from the requirements of the principles in this guidance, describing how all the activities needed for the operation of the CMS will be carried out.
- 3.3** Specify how the CMS processes and methods will interoperate with those of suppliers and other staff not directly included in your own CMS.
- 3.4** Establish processes for effective communication between all those included in the system, with clear standards for what information is to be communicated and when.
- 3.5** Define the roles required for those operating the CMS, and the associated responsibilities and competence requirements for each role.
- 3.6** Consider existing management systems or procedures (for example quality or safety management, staff review), relevant external development schemes (eg of professional institutions or industry bodies) and existing practice within the organisation (which may not be formally specified) and make the CMS as consistent as practicable with these systems and practices.

P3: Decide processes and methods

PHASE THREE: Operate

Principle 4: Select and recruit staff

Objective: To select internally, and recruit externally, staff that have an appropriate and demonstrable competence profile.

- 4.1** Apply the CMS to recruitment and selection activities for staff that may be required to carry out activities within the scope of the CMS.

P4: Select and recruit staff

Principle 5: Assess competence

Objective: To determine the extent to which staff currently meet the established competence criteria.

- 5.1** Plan each assessment in consultation with the individual, including
 - when the assessment will take place
 - its objectives and its implications for the individual's work
 - which competence criteria the individual will be assessed against (emphasising any criteria that have changed since a previous assessment)
 - how the criteria will be assessed and who by (ensuring as far as possible that the assessor is impartial and not subject to conflicts of interest)
 - the context in which the criteria will be applied (eg industry sector, application, technology, safety integrity level, applicable standards, safety culture, abnormal situations).
- 5.2** Collect available evidence of performance (including, where applicable, evidence of previous shortfalls and any subsequent improvements).

P5: Assess competence

5.3 The presence of competence certificates or qualifications should not be used as an alternative to assessment within your organisation. Rather, they are a source of evidence that can reduce the effort required for your assessment. Where such results of third-party assessment are used as evidence, clarify their applicability and context; for example

- did assessment take place immediately after training (in which case it may be evidence of short term information retention and application rather than long term knowledge and experience)
- to what extent did the assessment consider actual experience rather than theoretical knowledge
- to what extent did the assessment consider skills and behaviour in real-life situations
- how well did the context of the assessment (eg sector, application, technology, industry practices) match the context of your work activities
- how well do the criteria used for the assessment match your own competence criteria (eg in terms of specific work activities or abnormal situations).

5.4 Carry out the assessment against the available evidence and record the results, including

- the competence criteria that the assessor judges the individual has complied with
- the context of that compliance
- any restrictions, such as the need for supervision
- the action plan (including any development activities – see [Principle 6](#))
- any deviations from the normal specified process for individual assessment
- the period of validity of the assessment (this may be affected by the characteristics of the individual or of their work situation)
- the name of the assessor.

5.5 Give the individual a copy of the assessment record (or a summary adequate for the individual to demonstrate their competence and identify work for which they are not competent). Communicate the results to the appropriate team leaders and managers.

5.6 Plan reassessment so that it takes place before the validity period expires.

Principle 6: Develop competence

Objective: To extend and maintain the competence of staff so that they are able to meet relevant competence criteria.

6.1 For each individual, create, implement and maintain a personal development plan. This may be affected by the results of recruitment and selection ([Principle 4](#)), competence assessment ([Principle 5](#)), anticipated responsibilities ([Principle 7](#)) and/or monitoring activities and their response ([Principle 8](#) and [Principle 9](#)).

6.2 The personal development plan gives details of proposed actions for training and development. Example actions include

- participation in a core training programme
- attending external courses
- acquisition of experience through on-the-job supervision and training
- structured development activities such as supervision through a representative or comprehensive set of work activities or operating conditions
- refresher training
- limited-term placement in a specialised team or another department or organisation
- mentoring.

- 6.3** In the description of each action, include
- its objectives, in terms of which competence criteria it will help meet and to what extent
 - timing
 - present status
 - planned and actual outcomes
- 6.4** Establish a schedule to review progress against the personal development plan and update as appropriate.

Principle 7: Assign responsibilities

Objective: To ensure that staff and suppliers undertake only work for which they have been assessed as competent.

- 7.1** Ensure that each individual (ie including suppliers and managers) is aware of the roles and range of activities that they are currently assessed as competent to carry out, including
- the maximum level of responsibility for which they are competent for each activity, including any requirements for them to be supervised,
 - the context (application domain, criticality, applicable standards etc) in which the competence is applicable, and
 - the validity period of their assessment.
- 7.2** Ensure that individuals are aware of the importance of carrying out only those activities for which they have been assessed as competent.
- 7.3** Assign individuals only to work for which they have been assessed as competent (ie including the aspects listed in 7.1 above).
- 7.4** Do not allow individuals to carry out any work activities within the scope of the CMS for which they have not been assessed as competent. Empower them to refuse to carry out such work.
- 7.5** Provide supervision for each individual in each activity in accordance with the results of the individual's competence assessment. For example, a supervisor may need to control the work activities, check the results and take corrective action where necessary and take overall responsibility for the work.
- 7.6** Where staff work together in teams, establish and satisfy the competence requirements for the team as a whole as well as for constituent roles within the team.
- 7.7** Whenever there is a change to an individual's responsibilities, to the context of their work or to other activities or staff on which the individual's work depends, consider whether the individuals' assessed competence is still adequate for all the work to which they are assigned (see also [Principle 13](#)). If not, revise as appropriate
- the work activities and responsibilities assigned to the individual
 - team structure and supervision
 - the individual's personal development plan
 - timing and scope of the individual's next assessment.

Principle 8: Monitor competence

Objective: To monitor whether or not staff assessed as competent are continuing to perform competently and to initiate corrective action where appropriate.

- 8.1** For all individuals within the scope of the CMS (eg including managers), establish proactive mechanisms for monitoring competence and reactive mechanisms that capture other indications as they arise, which may include
- self-assessment by individual staff
 - observations by supervisors or managers
 - appraisals and performance reviews (although any connection here with the CMS needs to be managed carefully to avoid an undue emphasis on the CMS penalising staff)
 - investigating incidents and accidents
 - recognition by an individual or his colleague that competence in a particular area has deteriorated (eg due to lack of practice) or has been exceptionally good
 - observations of repeated mistakes
 - a perceived lack of commitment (perhaps through recognition of low morale or motivation, an unhelpful attitude or recurring rule violation)
- 8.2** Initiate corrective action as appropriate (see [Principle 9](#)).
- 8.3** Encourage and enable staff to accumulate and track evidence of their competence as part of their work.

P8: Monitor competence

Principle 9: Deal with failure to perform competently

Objective: To respond to failures to perform competently so that the impact on safety is minimised, including initiating actions to restore the competence of individuals.

- 9.1** Determine the reasons for the failure of an individual or a group of individuals to perform competently, including consideration of
- organisational culture (eg time or commercial pressures to ‘cut corners’)
 - team relationships (eg poor leadership, communications or inter-personal relationships)
 - other circumstances that affect the work environment (eg general morale; actions of other staff, suppliers, customers or the public; defects in equipment; extreme weather conditions; or problems with the infrastructure – transport, telecommunications etc)
 - personal situation (eg illness, stress, fatigue, reduced fitness, relationship problems, death or illness in the family, financial problems, trauma following an accident)
 - failure of the CMS (eg staff performing activities for which they have not been assessed as competent, inadequate supervision, failure to meet training schedules, omissions or deficiencies in assessment or unclear or insufficient competence criteria).
- 9.2** Plan, implement and review corrective action as appropriate. Possible remedies include directed toolbox talks or workshops, team restructuring, defining and/or communicating required standards, alleviating unhelpful pressure, counselling, revising CMS procedures and practice, increased monitoring and attending to an individual’s competence failures.
- 9.3** Where failures in the competence of an individual have also been determined, update the competence profile of the individual and all associated records as necessary, and reassign responsibilities or increase supervision as appropriate. If the failure is found not to be the fault of the individual (eg because of a failure in the CMS procedures outside the individual’s responsibility), make this clear and record appropriately. Revise the individual’s personal development plan and schedule reassessment.
- 9.4** Feed all relevant findings into the review of the CMS ([Principle 15](#)).

P9: Deal with failure to perform competently

Principle 10: Manage assessors' and managers' competence

Objective: To ensure that senior managers, managers of the CMS and assessors are competent to support and fulfil the requirements of the CMS.

- 10.1** Ensure that the principles in this guidance are applied as appropriate to senior managers up to director level, for example
- assigning responsibility for functional safety at director level
 - ensuring senior managers have sufficient awareness of the implications of their decisions on the achievement of functional safety and staff competence.
- 10.2** Ensure that the requirements of the other principles in this guidance are fully applied to managers of the CMS, including
- assigning overall responsibility for the CMS to one person who has sufficient competence and senior authority (see [Principle 3](#))
 - assigning responsibilities to the managers for operating the CMS
 - establishing competence criteria for the managers and carrying out regular assessments against these criteria
 - effective monitoring of managers' competence.
- 10.3** Ensure that the requirements of the other principles in this guidance are fully applied to assessors, including
- establishing competence criteria and carrying out regular assessments against these criteria
 - guarding against potential conflicts of interest
 - effective monitoring, verification and review
 - adequate management of assessors' competence where they belong to an external organisation (see [Principle 11](#)).

Principle 11: Manage supplier competence

Objective: To ensure that all relevant work activities of suppliers are always performed by competent staff.

- 11.1** Ensure that all work activities of suppliers of products or services (eg contractors), relating to functional safety of safety-related systems, are always performed by competent staff, by either
- incorporating suppliers' work activities and staff in your own CMS and applying all the same processes, or
 - gaining sufficient confidence that the suppliers' staff are competent through available evidence that each relevant organisation has its own understanding of the competence required to carry out its work and that it has an effective system in place to ensure that its employees meet these requirements, or
 - delegating some competence management activities to the supplier, resulting in a combination of the above two options (retaining your own responsibility to gain sufficient confidence that delegated requirements are in fact met).
- 11.2** Agree division of competence management activities (in accordance with 11.1) with the supplier.
- 11.3** Where practicable, verify and audit any competence management actions of the supplier and consider keeping copies of individuals' competence records.

Principle 12: Manage information

Objective: To maintain accurate information from the operation of the CMS, in sufficient detail to enable efficient operation and to demonstrate that its requirements are being met.

12.1 Ensure your CMS operating procedures ([Principle 3](#)) include instructions for keeping and maintaining records in sufficient detail (including appropriate configuration management, version control and long-term storage)

- to enable consistent and efficient implementation of all requirements of the CMS and
- to enable you to demonstrate to all relevant parties that requirements of the CMS (eg specific to an individual or to an activity, or concerning the CMS as a whole) have been and continue to be met.

12.2 Establish requirements for access, security and disaster recovery (eg who may read and change each item of information, time limits from a request for information to the information becoming available, what information can be passed on to other future employers).

12.3 Consider the extent to which you allow staff to access, update and own evidence of their individual competence (eg updating their evidence after project completion, and taking evidence with them if they leave your organisation), bearing in mind that increased ownership and wider career advantage will facilitate acceptance and personal motivation for the CMS.

P12: Manage information

Principle 13: Manage change

Objective: To monitor changes in the internal operation of the organisation and its external environment, to determine implications for individuals, teams and the CMS and to initiate changes as appropriate.

13.1 Monitor your organisation for changes that may be relevant to your CMS or to individuals' or teams' competence, including changes in

- team structures
- management
- communications chain
- working practices
- tools, techniques and equipment
- job requirements.

13.2 Monitor your external environment for changes that may be relevant to your CMS, including additions and changes in

- legislation
- interpretation or guidance on legislation
- standards and industry guidance
- published incidents
- external contracts
- organisations (eg suppliers) on which you depend.

P13: Manage change

- 13.3** Decide how best to accommodate identified changes, such as through revisions to
- CMS procedures
 - competence criteria
 - organisation-wide training
 - individual staff assignments, team structure and supervision
 - personal development plans
 - competence reassessment schedules
 - plans or schedules for CMS audit or review.

13.4 Communicate changes to everyone who is likely to be affected by them. Feed findings into the review of the CMS ([Principle 15](#)).

PHASE FOUR: Audit and review

Principle 14: Audit

Objective: To audit the CMS with sufficient frequency to give confidence that it is meeting its objectives and operating as intended, and to initiate improvement action where appropriate.

14.1 Plan and implement an audit programme to check that the overall objectives of the CMS are in fact being attained and that the CMS procedures are being consistently followed.

14.2 Initiate improvement action as appropriate based on the results. Feed findings into the review of the CMS ([Principle 15](#)).

Principle 15: Review

Objective: To review identified changes and the combined evidence on the operation of the CMS generated from dealing with competence failures and from audits, and to initiate improvements to the CMS as appropriate.

15.1 Regularly review (eg annually) the operation of the CMS at a senior management level, taking into account the results of

- dealing with failures to perform competently ([Principle 9](#))
- managing change ([Principle 13](#))
- audits ([Principle 14](#))
- any available benchmarking data on competence
- any previous reviews and follow-up actions.

15.2 Use the review as a means towards proactive continuous improvement of the CMS. Create an action plan for proposed changes and communicate the plan and its rationale as necessary.

15.3 Implement the plan and monitor the effectiveness of the actions in addressing the issues identified.

Appendix 1 Example topics for competence criteria

The following list gives a very general outline of topics for which competence criteria for safety-related systems are likely to be required:

Engineering knowledge, training and experience appropriate, specific to lifecycle phase, for example

- hazard and risk analysis
- safety requirements allocation
- safety requirements specification
- human factors
- architectural design
- hardware realisation
- software realisation
- installation and commissioning
- validation
- operation and maintenance
- modification
- decommissioning
- verification

Engineering knowledge, training and experience appropriate to the technology used, for example

- sensors
- logic system
- proprietary programming or configuration language
- communications protocol
- final elements

Engineering knowledge, training and experience appropriate to the project and/or site, for example

- lifecycle planning
- safety management (eg safety culture, incident learning, managing competence)
- safety assurance
- independent safety assessment
- procurement
- project management

Application domain knowledge

Knowledge of the legal and safety regulatory requirements

Management, leadership and professional skills

Appendix 2 Regulations containing competence requirements

A2.1 Listed here are several regulations that contain requirements concerning competence for health and safety that could apply to safety-related systems, depending on their function and industrial setting. The list provides a guide only and should not be considered as exhaustive.

A2.2 For further details consult the published regulations and, where available, the relevant approved code of practice.

- The Management of Health and Safety at Work Regulations 1999
- Provision and use of Work Equipment Regulations 1998
- The Control of Major Accident Hazards Regulations 1999
- The Offshore Installations (Safety Case) Regulations 2005
- The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995
- Quarries Regulations 1999
- Railways (Safety Case) Regulations 2000
- The Railways (Safety Critical Work) Regulations 1994
- The Control of Substances Hazardous to Health 1999 (COSHH)
- The Health and Safety (Display Screen Equipment) Regulations 1992
- The Ionising Radiation Regulations 1999
- The Noise at Work Regulations 1989
- The Lifting Operations and Lifting Equipment Regulations 1998
- The Electricity at Work Regulations 1989
- Offshore Installations and Wells (Design and Construction, etc) Regulations 1996
- The Construction (Design and Management) Regulations 1994
- The Diving at Work Regulations 1997

References

- 1 IEC 61508 Ed.2 CD, Parts 1 to 4, *Functional safety of electrical/electronic/programmable electronic safety-related systems*
- 2 *Railway safety principles and guidance: Part 3 Section A Developing and maintaining staff competence* HSG197 HSE Books 2002 ISBN 0 7176 1732 7
- 3 *Managing competence for safety-related systems: Supplementary material*, HSE/IET/BCS, 2006
- 4 *Safety-related systems: Guidance for engineers* (Issue 2, 2002) The Hazards Forum, ISBN 0 9525 103 0 8
- 5 *Management of health and safety at work: Management of Health and Safety at Work Regulations 1999: Approved Code of Practice and guidance* L21 HSE Books 2000 ISBN 0 7176 2488 9
- 6 BS EN 61508, Parts 0 to 7, *Functional safety of electrical/electronic/programmable electronic safety-related systems*, British Standards Institution
- 7 *The Functional Safety Zone* (An area of the website of the International Electrotechnical Commission providing guidance on functional safety and the application of IEC 61508 and related standards). http://www.iec.ch/zone/fsafety/fsafety_entry.htm
- 8 BS EN 61511, Parts 1 to 3, *Functional safety – Safety instrumented systems for the process industry sector*, British Standards Institution