
**Petroleum, petrochemical and
natural gas industries — Guidelines
on competency management for well
operations personnel**

*Industries du pétrole, de la pétrochimie et du gaz naturel —
Lignes directrices sur la gestion des compétences du personnel
d'exploitation des puits*

STANDARDSISO.COM : Click to view the full PDF of ISO/TS 17969:2017



STANDARDSISO.COM : Click to view the full PDF of ISO/TS 17969:2017



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Competency management system	3
4.1 General	3
4.2 Benefits of a CMS	3
4.3 Comparison of a CMS with an appraisal system	3
4.4 Development of a CMS	4
4.4.1 CMS cycle	4
4.4.2 Phase 1 — Establish requirements for the CMS	5
4.4.3 Phase 2 — Design the CMS	6
4.4.4 Phase 3 — Implement the CMS	7
4.4.5 Phase 4 — Maintain and develop competence	8
4.4.6 Phase 5 — Verify, audit and review the CMS	10
5 Application of CMS requirements to well operations personnel	11
5.1 General	11
5.2 Recommended risk-based approach for well operations	12
5.3 Competency model	13
5.3.1 Well competency catalogue	13
5.3.2 Proficiency levels	15
5.3.3 Competency profile	16
5.4 Team competence	16
5.5 Leadership skills	16
5.6 Contract personnel	17
5.7 Roadmap to ensure competency	17
6 Examples of competency profiles	19
Annex A (informative) Example competency assessment information	20
Annex B (informative) Example of competency profile for drilling supervisor	24
Annex C (informative) Example of competency profile for senior drilling engineer	25
Annex D (informative) Example of competency profile for well examiner	26
Annex E (informative) Example of competency profile for operations geologist	27
Bibliography	28

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

This document was prepared by ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*.

This second edition cancels and replaces the first edition (ISO/TS 17969:2015), which has been revised to incorporate the agreed changes that were mistakenly not taken into account in the publication of the first edition.

Petroleum, petrochemical and natural gas industries — Guidelines on competency management for well operations personnel

1 Scope

The purpose of this document is to help members of the oil and gas industry develop, implement, maintain and improve their own competency management systems (CMS) for well operations personnel. This document supports competency management general principles which can be applied to any operation within the industry.

The annexes to this document list example competence profiles for personnel responsible for well integrity. [Annex A](#) includes an example worksheet which can be used in performing a competency assessment, to help record the assessment results versus expectation, as well as the resulting action plan to address any gaps identified.

This document is applicable to all operators, service companies and drilling contractors working on wells and well operations.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

competence

ability to undertake responsibilities and to perform activities to a recognised standard on a regular, repeatable basis

Note 1 to entry: Competence is a combination of knowledge, practical and thinking skills, and a person's behaviour.

Note 2 to entry: Standards may be company specific.

EXAMPLE 1 McCoy's Law: competency = knowledge × skills × behaviours.

EXAMPLE 2 Bloom's taxonomy: competency = knowledge × skills × (technical + ability).

3.2

competence assessment

process of judging evidence of an individual's performance against agreed competence requirements

Note 1 to entry: The result of such an assessment, potentially in combination with other factors such as work experience, will determine whether that individual has demonstrated competence and to which proficiency level.

3.3

competency catalogue

hierarchical structured list of the competencies required to perform any task

3.4

competency profile

skills and behaviour, each specified at a level of proficiency, required to perform the role or activity in line with the associated risk

3.5

contractor

non-staff member

3.6

independent assessor

approved assessor that utilizes specified objective evidence of competency to assess an individual's skills

Note 1 to entry: The independent assessor shall be an approved individual competent in assessing one's skills based on predetermined and specified objective evidence of competence. This includes, but is not limited to, assessment and debrief techniques as well as competence in the skills being assessed.

Note 2 to entry: The independent assessor may not be the line manager or the direct supervisor of the individual.

Note 3 to entry: The independent assessor may or may not be from within the same company.

Note 4 to entry: Independence needs to be demonstrated to ensure that a balanced and fair assessment of a person's competency in the subject is completed.

Note 5 to entry: If no one at wellsite can fulfil the role of independent assessor, it is recognized that there may be challenges to have extra personnel at wellsite. Therefore, companies need to leverage modern technology, simulation, remote monitoring, etc. in order to perform independent assessments.

3.7

major accident

significant emission, fire or explosion resulting from uncontrolled events

3.8

proficiency level

level of ability and behaviour attributes within a specific skill

3.9

rubric

set of assessment criteria used to describe and evaluate the important components of a task

Note 1 to entry: A rubric is an effective assessment tool, because it allows different assessors to arrive at similar conclusions when comparing performance to the guidelines shown on the rubric.

3.10

safety-critical competency

type of competence required of personnel in order to carry out an operation which, if carried out incorrectly or inadvertently, can lead to a major accident hazard

3.11

safety-critical task

task performed on a safety-critical element which, if performed incorrectly due to lack of technical skills or knowledge or due to behaviour attributes, can lead to a major accident hazard

4 Competency management system

4.1 General

The purpose of a competency management system (CMS) is to control, in a logical and integrated manner, a cycle of activities within the organization that systematically and consistently promotes the development, assurance and maintenance of competent operations personnel, particularly in safety critical activities. The CMS will enable personnel to be assessed and further developed, contributing to the goal of competent performance at work. A CMS should be user-friendly, workable, auditable and practical.

If an organization has no CMS, the recommended first step is to garner support from the very top of the organization. The system should then be constructed, involving resources from multiple levels of the organization, to create a sense of ownership.

This document contains a number of examples of competency profiles which can be useful for an organization if it has to create profiles for its own staff.

4.2 Benefits of a CMS

An effective, appropriate CMS provides the following benefits:

- assists with compliance with regulatory requirements;
- provides a continuous performance improvement tool for the work force;
- provides a more comprehensive picture of the requirements for a job than a job description alone;
- provides an accurate development analysis, enabling targeted and effective development opportunities;
- provides a measure to calculate the success of training and development interventions;
- provides a framework for ongoing coaching and feedback;
- provides the measurement of proficiency in a specific competency;
- provides a measure of an individual's readiness for a role;
- helps in optimizing training resources and efforts targeting critical skills/competence requirements;
- provides an audit trail of competency assurance.

4.3 Comparison of a CMS with an appraisal system

Performance appraisals generally fall short of the rigour of a competency framework, and therefore are typically not sufficient in isolation to provide a true measure of competence. However, in more recent times many organizations have tried to move to a more competency-based appraisal system in order to provide a more specific measure of performance.

Some key differences between performance appraisals and competence assessment are summarized in [Table 1](#).

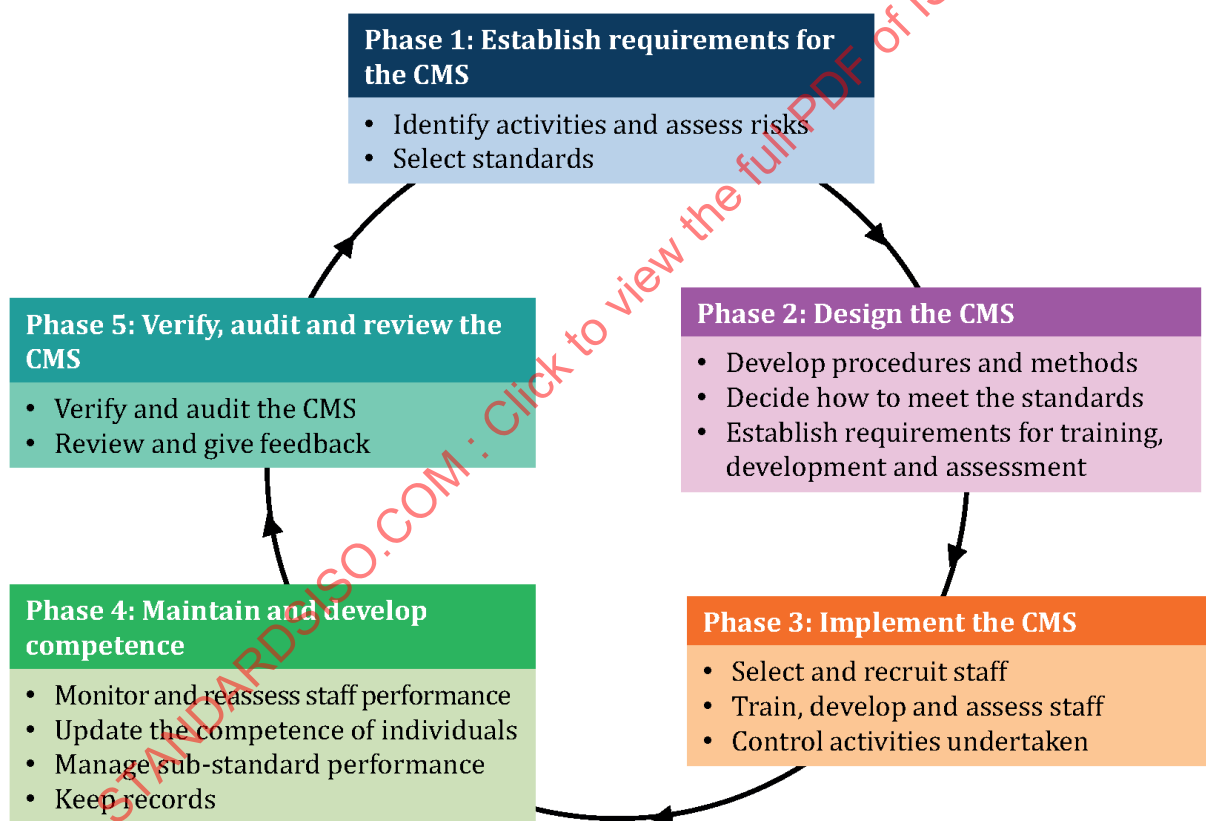
Table 1 — Comparison of performance appraisal and competence assessment

Performance appraisal	Competency assessment
Carried out by the line manager or supervisor	Carried out by a competent independent assessor
Subjective measure often based on opinion	Objective measure based on evidence
Measured against high level work areas often focusing on soft skills	Measured against defined standards of competence
A measure of attitude and general performance	A measure of skills, knowledge and behaviour
Quality of judgements rarely verified	Quality of judgements routinely verified

4.4 Development of a CMS

4.4.1 CMS cycle

The main steps or phases by which a CMS can be established, implemented and maintained follow the traditional quality cycle of 'Plan-Do-Check-Act'. These are illustrated in [Figure 1](#) and described in subsequent clauses.

**Figure 1 — Competency management system cycle**

Establishing a CMS 'from scratch' involves starting with Phase 1. However many organizations can already have some, if not all, elements already in place and so can commence at Phase 5 with a review/audit of the CMS, incorporating this guidance as reference.

For application to operational activities and personnel, the following key elements of an effective CMS have been identified within each relevant phase. Within this document, reference is made to specific guidance in these areas:

- a) definition of appropriate competency profiles, skills at specified proficiency levels required for operational activities;
- b) assessment of personnel and their individual competences;
- c) assessment of operational teams and their collective competence;
- d) assessment of contract personnel;
- e) recommendations for management of assessed shortfalls, gaps in competency, and subsequent development;
- f) recommendation for a system for the storage, management and verification of the collected information in a CMS.

4.4.2 Phase 1 — Establish requirements for the CMS

4.4.2.1 General

Best practice for CMS dictates that the system is tailored to manage the competencies involved with the organization's particular work activities, in proportion to the assessed risks. Nevertheless, it is possible to identify common considerations for a successful CMS.

These best practices are as follows.

- a) Description of the CMS in a 'stand-alone' controlled document, which forms a part of an organization's management system. Through the inclusion in the management system, the intent is that the CMS is periodically verified through standard processes.
- b) A clearly identified system 'owner' also with responsibility for the overall management system if possible, ensures the CMS is maintained.
- c) Clear identification of individual accountabilities for implementation and maintenance of the CMS helps ensure that the system is effective.
- d) Time-bound (expiration of) competence proficiency levels ensure that an individual's competency is current.

4.4.2.2 Responsibilities

Identification of suitable competence is the responsibility of management. The employer should ensure that the employee is competent for the tasks which the employer assigns. For this reason, an organization should ensure that its CMS is integrated into the management system as well as their operational methods throughout all levels. Personnel have the responsibility to develop, maintain and demonstrate the required competency for the role they perform.

Employers are required to provide information, instruction and training for their employees and contractors. This includes defining the format and content of competence profiles and standards to be met by employees and contractors, in order to competently perform their roles. The employer should ensure the competence of their personnel, as a part of the CMS, to ensure that the person can perform their work.

Employers are responsible for keeping records of training, certification, work experience and assessment of their employees. Personnel shall also take responsibility for developing and demonstrating their competence.

One critical area of management support is to ensure that personnel are given sufficient time to fulfil the requirements of the CMS. This means there is no expectation for personnel to complete the competence development and assessment tasks during their time off. Sufficient time should be allowed for within their workload.

In accordance with the assessed risk of a task or skill, a period of validity of a specific competence should be specified by the CMS. Thus, the organization is responsible to clearly document the criteria for retention/re-validation, in line with the risk associated with the skill.

4.4.2.3 Key success factors

The most successful CMSs exist where competence is at the core of an organization's operating culture, and the system is a part of the integrated management system. It is important that senior management endorse and drive the CMS with the usage of the CMS supported and encouraged throughout all management levels and departments.

One key to success is to clearly distinguish the population and activities covered by the CMS, for example safety-critical tasks only.

The development of a competence policy, or the inclusion of a commitment to competence assurance in other high level policies, can also provide a solid backbone for the system. The CMS works best if tailored to the organization, ensuring adherence to the operating culture as well as the risk and safety measurement for the tasks being carried out by personnel assessed under the system.

A clear line of sight from policy to the practice of competence management throughout operations is of the utmost importance to the success of the system. Ownership of the CMS is critical, especially for those carrying out key tasks within the CMS, such as assessment and verification. Equally important to success is that the population covered by the CMS embraces and understands the value of the system. The demonstration of competence should not detract from the task at hand, and should not become a job in its own right.

4.4.2.4 Risk-based approach

A CMS should address critical competencies commensurate with operational risk, consequence and complexity. Operators, service companies and rig contractors, including employers, self-employed persons and installation owners/operators, should assess the risks of their operations and identify critical tasks and risks. These risk analyses should underpin the eventual CMS, ensuring that at a minimum safety-critical tasks, those related to asset integrity through the asset life cycle, are covered by the system.

For organizations operating across a variety of asset types and environments, the CMS should take into account the full scope and range of the activities when requirements are established. For organizations operating within a more limited range of asset types and environments, it can be beneficial to define requirements that are 'fit-for-purpose' for specific work programs.

Some roles included in the CMS also carry business, HSE and relationship risks, and the inclusion of associated competencies can be considered. However, care should be taken to ensure that the CMS does not become complex and cumbersome; trying to encompass all potential variables will result in a system burdensome to operate, quickly becoming obsolete.

4.4.3 Phase 2 — Design the CMS

When designing the CMS, an organization should identify their particular activities, the processes to enable these activities, according to the risk assigned by the organization, and the activities to be included in the CMS, which is documented in a controlled management system.

Key stakeholders should be involved in the CMS design. Once completed, the CMS and its fundamental objectives should be clearly communicated across the organization.

A key decision is the extent to which the CMS is to be integrated within any existing human resources (HR) processes for recruitment, performance appraisals, training and development, etc. Depending on the nature of a particular organization's HR and management system, it can be appropriate to establish a CMS that is managed separately from the HR process, but which makes reference to beneficial and contributory elements of those systems.

The overall training and development requirements should be described within the CMS.

Critical elements of the CMS design, specifically related to operations, which should be clearly addressed in this design phase include the following.

- a) An identified overall process 'owner' for the CMS, to whom comments, observations and requests for change can be addressed.
- b) Assignment of accountabilities for implementing the CMS. This should include specific accountabilities for the technical authorities, as defined in the organization's management system and for line management.
- c) The process and responsibilities by which appropriate competency standards for activities are defined and maintained in the organization. This should be assigned to the technical authorities, as defined by the organization's management system.
- d) The process and responsibilities for assessment of personnel and their individual competencies.
- e) The process and responsibilities for assessment of each operational team and their collective competence. The CMS should be designed to provide line managers with assurance that the collective competence of all assigned teams is appropriate to the specific planned activities and their associated risks.
- f) The process and responsibilities for the managing and developing of means to address assessed shortfalls in competency, for both individuals and teams.
- g) The process and responsibilities for the competence management of contractors should be specifically set out within the CMS.
- h) Data protection issues.

The CMS can identify levels of competency (proficiency levels), such that individuals can undertake the tasks with varying levels of supervision. Individuals can then gain the additional experience, assessment and training as required by the CMS in order to progress their proficiency level. Individuals may be mentored by more competent individuals. Recent organization recruits or contractors might be assigned provisional levels of competency. This status would allow for supervision and/or mentoring, for a defined probationary period, after which their competency can be reviewed.

4.4.4 Phase 3 — Implement the CMS

A CMS implementation program should be defined and agreed by all parties responsible for its effective implementation. When developing the implementation schedule, the organization should review the following factors:

- a) the coverage of (and resulting requirement to merge or integrate with) any existing CMS;
- b) the operations program;
- c) any required synchronization with other management systems;
- d) formal management of change (MOC) process for implementation.

Review of these factors can require a staged approach for implementation. In any case, the implementation program should define milestones and measures, to ensure that the status can be clearly communicated and understood by all concerned. There is a specific need to elevate the

importance of communication and understanding by all when rolling out a CMS. There is also a need to develop and execute a well-designed MOC process to explain and gain support.

Once implemented, both employees and contractors should be assessed as soon as practical, per the risk level involved with each role.

If gaps are identified in an assessment, ensure that there is sufficient provision for competency development and/or training for individuals.

4.4.5 Phase 4 — Maintain and develop competence

4.4.5.1 General

Maintaining and developing competency are key objectives of a CMS. Competency is verified through the auditable competency record and validation appropriate to the risk level associated with the skill.

Responsibility should be assigned within the CMS to individuals and their supervisors respectively for the continual maintenance and monitoring of competency.

The CMS should define minimum periods for the conducting of formal competence assessments. Each particular competence should be risk assessed against the knowledge, skills and behaviour associated with that particular level of proficiency. Formal and auditable records shall be maintained of all assessments.

4.4.5.2 Competency record

The organization should keep auditable competency records, which comprise:

- a) degrees and other educational records;
- b) training records and certificates;
- c) presentations (internal or external papers);
- d) verifiable/attested work experience;
- e) assessments.

The organization may set minimum standards for each type of position to ensure sufficient minimum knowledge.

4.4.5.3 Competence assessment

4.4.5.3.1 General

The quality of any assessment lies in the skills of the assessor and in his/her understanding of the concepts and principles of a competence-based assessment. It is important that individuals responsible for carrying out assessment are trained and qualified in assessment and effective debrief techniques.

Equally important is a uniform methodology for performing and scoring an assessment, to ensure assessments are performed to the same criteria globally across an organization. Every assessment should be performed to a standard template. Grading rubrics should be created to ensure consistent scoring of the assessment. These rubrics should be periodically evaluated and updated to reflect any changes to the competence to be evaluated or the competency assessment tool or method.

4.4.5.3.2 Assessment methods

Various methods, listed below, can be used in assessing competence or allowing people to demonstrate their competence. The organization should use the appropriate method, with objective evidence that is right for the particular operation and situation.

- a) **Observation** is the most natural and typically used method of direct assessment as it is carried out in the workplace, by a trained assessor, does not interrupt the normal working routine and includes the pressures of work an employee typically encounters. Observational assessment should include assessment for required skills and abilities employed during the process or task, and behavioural attitude and aptitude displayed during a task or process.

NOTE Witness testimony is observation by a non-trained assessor, which can apply in certain circumstances if no other option is available.

- b) **Questioning** is used to confirm knowledge in relation to the task being assessed and should always be used in conjunction with other assessment methods.
- c) **Simulation** is used when assessment in the normal working environment is not possible. Demonstration of the task should replicate, as close as practical, the normal work activity.
- d) **Professional discussion.** Selected competence criteria can be assessed during a professional discussion; there should be a minimum of two peers and the candidate present at the discussion.
- e) **Candidate statements** should be used to measure the knowledge of the individual.
- f) **Work product** completed by the person being assessed that demonstrates competence (e.g. well plan or design that has been reviewed and approved and executed successfully).

Additionally, trade tests, such as external or internal well control tests and certifications, may be used as a part of competence assessment.

4.4.5.3.3 Carrying out assessments

An independent assessor should be used to carry out assessments. This independent assessor should have competence both in the technical skills to be assessed and in assessment and debrief techniques.

Independence is mandatory to ensure that a balanced and fair assessment of a person's competency in the subject is completed. Direct line managers may not assess their own staff. This will help to identify direct training and behaviour gaps instilled by direct supervision.

Following the assessment, a formal interactive debrief, whereby the assessor and the assessee discuss the results, should take place. The assessor should also debrief the designated supervisor or direct manager of the assessment result in order to identify risks, initiate remediation if required and set a new assessment time period. The results of the assessment should be documented in an auditable system.

4.4.5.3.4 Assessor requirements

Assessor competency should include the following.

- a) Competency management components:
- the concepts and principles of the competency management system;
 - the concepts and principles of assessment and assurance;
 - the requirements for assessment decisions;
 - effective debrief techniques;
 - risk identification and management of risk associated with the competency;

- a procedure for remediation or training if the candidate's assessment does not meet the identified requirements.
- b) Assessment components:
 - the range of information that should be made available to candidates before assessment;
 - the uses, benefits and drawbacks of the different methods which can be used in an assessment;
 - the procedure to handle disputes and appeals while maintaining confidentiality;
 - the assessment template and relevant grading rubric, to facilitate objectivity and consistency;
 - the application of quality assurance principles (validity, authenticity, reliability, currency, sufficiency).
- c) Technical knowledge (theory and application), including technical skill (technique and procedure) and technical ability (aptitude and behaviour):
 - proficiency in the technical competence to be assessed;
 - industry technical operational standards.
- d) Training:
 - the assessor should have completed training in assessment tools and preparation in verbal and written debriefing techniques and process to provide consistency.

4.4.6 Phase 5 — Verify, audit and review the CMS

4.4.6.1 General

The CMS should be subject to periodic formal review and audit as any sound management system. Verification of assessments and the results should also be performed on a regular basis.

4.4.6.2 Verification

Internal verification is the quality assurance of assessment scoring and decisions and is fundamental for the integrity of a CMS. This is not the same as internal audit, which is concerned with the competence system as a whole. This verification process is required to ensure a consistent level of assessment performance and grading across the organization.

The methodology involved in internal verification includes:

- sampling, in which the designated internal verifier checks a sample of an assessor's judgments to determine whether his/her decision was valid;
- standardization, in which exercises are conducted with assessors to ensure consistency in assessment decisions.

4.4.6.3 Audit

The integrity of a CMS can only be maintained if it is regularly audited, ensuring compliance with either internal or external standards. This audit should look at the system as a whole, sampling and checking performance and compliance over the entire scope against defined processes and procedures as well as any regulatory requirements.

A CMS should undergo a detailed audit at regular intervals, up to a maximum of five years. However, auditing can be required more frequently at the company's discretion. For example, more frequent audits are recommended when a system is new, significant changes are introduced, or where the performance or integrity of the system is found to deteriorate. The audit of a CMS should include a compliance

verification, i.e. that the organization's defined CMS is being implemented as designed. Additionally, the audit should incorporate an element of independent assessment of the defined competencies, in order to ensure that required levels of proficiency are appropriate to assigned tasks.

Internal audit of a CMS is the minimum requirement. However an external audit and approval of the system represents good practice.

4.4.6.4 Review

The effectiveness and success of a CMS should also be measured on a regular basis. This can be achieved by including the CMS in the management review process.

5 Application of CMS requirements to well operations personnel

5.1 General

All contractors and operators should read and fully understand regulations, and associated guidance, relevant to well operations for the country in which they are working, to ensure their compliance with the requirements.

[Table 2](#) provides, as an example, a list of the recommended well operation roles to include under a competency management system.

Table 2 — Recommended positions for competence management

Typical well-site team	Typical office-based team	Typical geological team
OIM	Drilling manager	Operations geologist ^a
Toolpusher	Drilling superintendent	Development geologist
Drilling supervisor ^a	Senior drilling engineer ^a	Reservoir engineer
Driller	Drilling engineer	Sub-surface lead/manager
Assistant driller	Senior completions engineer	
Directional driller	Completions engineer	
Derrickman	Petroleum engineer	
Mud logger	Rig manager	
Drilling fluids engineer	Well examiner ^a	
Roughneck	Subsea engineer	
Cementer		
Well service supervisor		
Well test supervisor		
Coil tubing supervisor		
E-Line supervisor		
Slickline supervisor		
Completions supervisor		
Subsea engineer		
BOP/LMRP engineer		
Well integrity engineer		
Production supervisor		
^a Example competency profiles are included in Annexes B to E .		

5.2 Recommended risk-based approach for well operations

Personnel working on well operations should have a range of competencies in order to carry out their job functions. It is not recommended to attempt to launch a new system which includes all three areas of competency (safety-critical, technical and business), as the system will immediately be extremely large and require significantly increased resources to launch and maintain.

In order to keep the task of setting up a competency system for well operations manageable, it is recommended that only safety-critical competencies are covered initially, allowing for an organization to gain familiarity with the system. Once a safety-critical competency system is up and running for a period of time, and personnel and assessors are experienced in using the system and performing meaningful assessments, then the system can be expanded.

Safety-critical competencies such as well design, well planning and well integrity are core competencies for well operations personnel. Examples are shown in [Figure 2](#).

STANDARDSISO.COM : Click to view the full PDF of ISO/TS 17969:2017

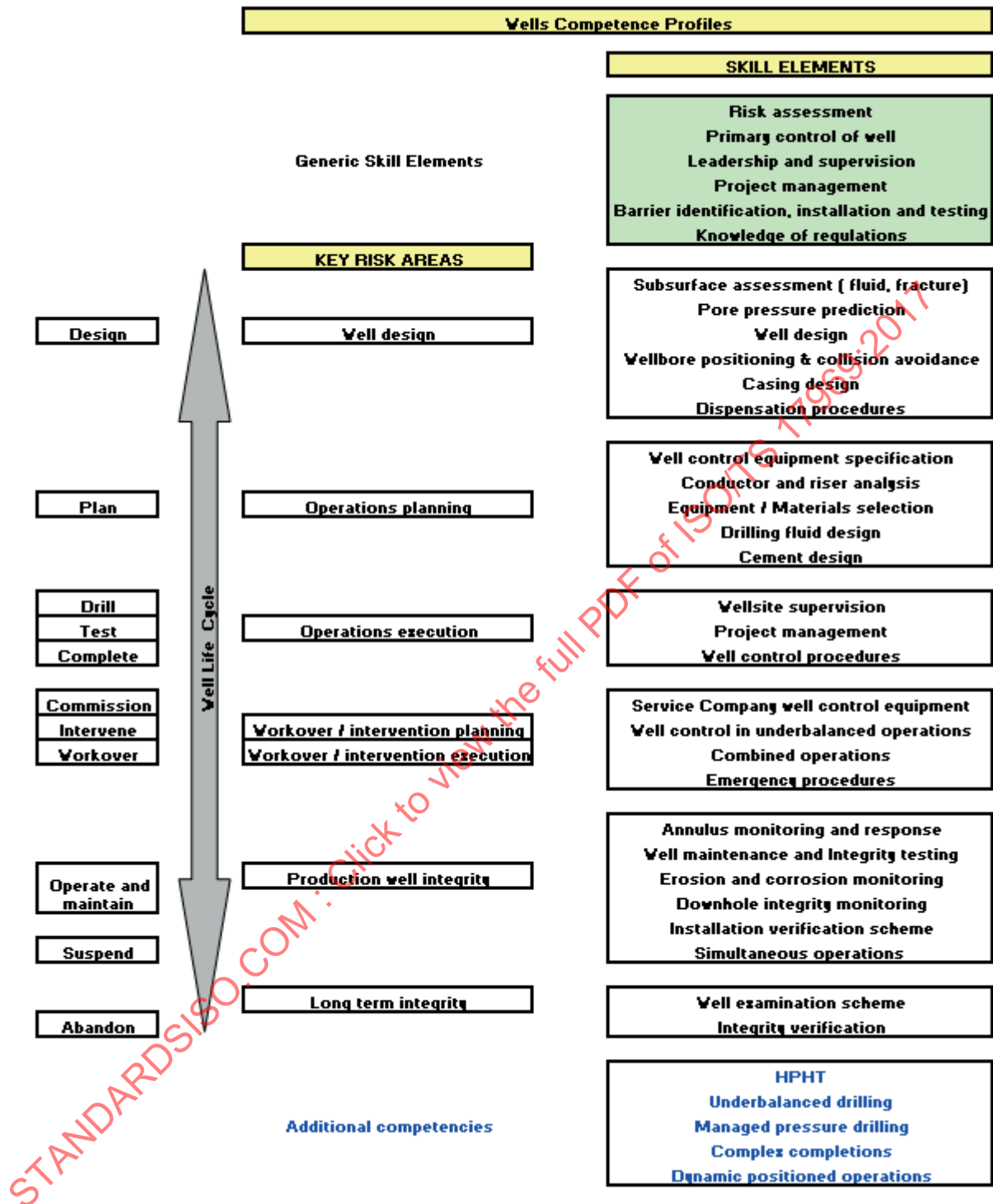


Figure 2 — Example of well operation skills

5.3 Competency model

5.3.1 Well competency catalogue

A well competency catalogue is the hierarchical list of skills which are required to deliver well operations covered by the CMS. Figure 3 shows examples of skills, and their interrelationships, that are applicable throughout the well life cycle, including:

- well design, planning and risk identification;

- well control (primary and secondary);
- project execution;
- barrier identification, installation and testing.

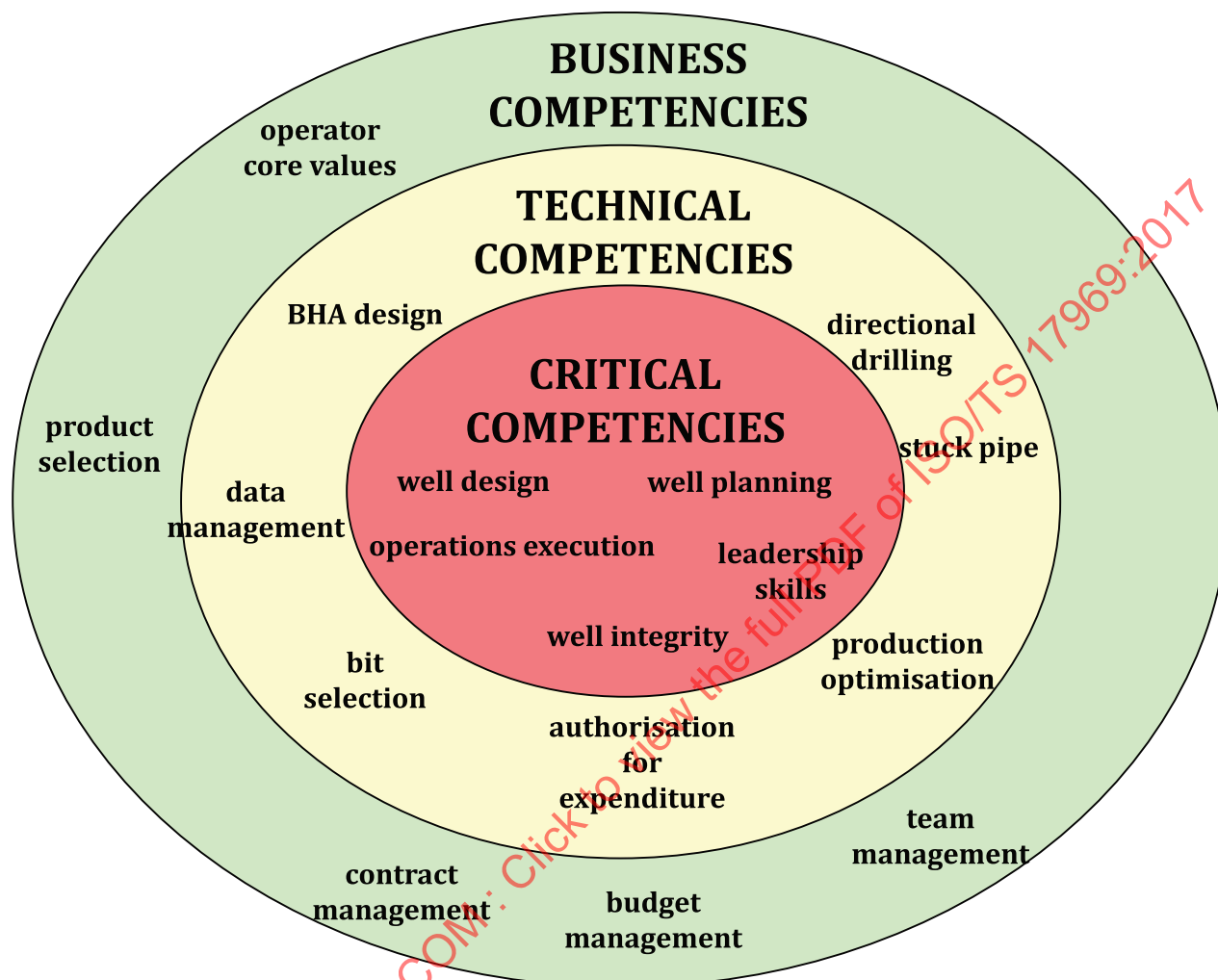


Figure 3 — Partial example of types of key skills

Certain skills are relevant to key safety risk areas within the well life cycle. Different roles are involved in these risk areas, depending on the stages of the life cycle and the nature of the well drilled.

5.3.2 Proficiency levels

Competencies may be required at different proficiency levels. Each organization can decide and design on the number of these levels and define these levels per its specific needs. An individual should be proficient at a specific level per skill. An example of proficiency levels and their definitions is given below.

- Level 1: Awareness
 - Basic work activities, most of which are routine and predictable. Work done under guidance. Product checked in detail by supervisor.
- Level 2: Basic application
 - Varied work activities performed in a range of contexts. Some individual responsibility or autonomy. Limited guidance needed. Results reviewed for quality but not in detail.
- Level 3: Proficient
 - Broad range of work activities in a non-routine context. High confidence in the results, work tested against broader business context. Significant personal autonomy and may check other's work. May possess formal nationally or internationally recognized certification in the subject areas.
- Level 4: Master/Expert
 - Broad range of work. Complex technical or professional activities in a wide variety of contexts. At the highest level, able to apply fundamental principles across a wide and often unpredictable variety of contexts. Substantial personal autonomy. It is recognized that this competence level may not be present in all organizations in all subjects, but access to this level is provided.
 - There are some level 4 profiles in the examples annex which are not detailed. This is due to the fact that this high level of competency would not be required for any personnel listed in [Table 2](#), who would be involved with the well construction process, but would be more of a shore-based expert. However this does not stop any organization specifying these requirements for any personnel they wish to assess.

For **operational and rig floor positions**, a two-level competency (competent or not yet competent) may be used.

For **technical professional roles**, skill elements can be assigned different proficiency levels, indicating the level of skill which is required for different tasks or roles within the teams.

Within each proficiency level for each task, there may be defined sectors of knowledge for the person to achieve. The satisfactory demonstration of these requirements is evidence that may be recorded in the employee's competency record. An example of a skill element broken down into requirements by proficiency level is given in [Table 3](#) for pore pressure analysis.

Table 3 — Example of skill proficiency levels (pore pressure analysis)

Level 1		Level 2		Level 3		Level 4	
Awareness		Basic application		Proficient		Master/Expert	
☐	Can describe the significance of pore pressure and how it impacts well design and operations	☐	Fully interprets and can describe the causes of abnormal pore pressure	☐	Fully interprets, can describe and has experience in which evaluation technique (e.g. sonic, D_{CS}) is appropriate for the planned well	☐	Fully interprets and can describe the underlying physics of the methods
		☐	Fully interprets and can describe the common methods and tools for analysing pore pressure			☐	Has the ability to modify techniques to suit new or unusual situations or create new or improved methods
☐		☐	Can identify zones of overpressure in offset wells data	☐	Has carried out pore pressure analyses for a variety of well types		
☐		☐	Can generate pore pressure profiles from offset well data (mud log, well test)	☐	Fully interprets and can describe uncertainties and limitations of each technique		

5.3.3 Competency profile

A competency profile may be defined for an individual role for a specific activity, per job role, or for a team. A full competency profile defines not only the skills required for the role and/or activity, but also specifies the proficiency level of each skill.

Below is an example of the varying levels of proficiency required for the competency, pore pressure analysis, for different roles.

- In the operations execution area (drilling phase) the mud-logging unit manager is expected to be competent to Level 3 and the drilling supervisor should be competent to Level 2.
- A drilling engineer employed to design the well is expected to be competent in Levels 1 and 2, working up to a target of Level 3. Their supervisor, well team leader or supervising drilling engineer should be competent to Level 3. The mud logging onshore advisor may be expected to be competent to Level 3 and have access to Level 4 expertise.
- Individuals at Level 4 can act as advisors in their field or mentor other staff. Few individuals are expected to reach this level, and they cannot be present in all organizations. However, if it is identified that this level of skill is required to operate safely, then an organization should seek individuals with these skills in the short term and build the existing personnel to a higher level of competence over a period of time.

5.4 Team competence

Well operations are generally team-based activities, rather than individuals working alone. Therefore, in addition to individual competency, team competency should also be ensured so that the appropriate competencies are present.

Team-based projects are managed operationally to ensure the right staff and the right skills are present to complete the task at hand.

5.5 Leadership skills

All roles requiring supervisory or project management skills should be assessed for competency. This is not just for the position at the top of the management pyramid, but for all levels with supervisory responsibilities.

Leadership should create an environment where interventions are positively received. Leadership should ensure that well operation team members are empowered to stop the job and voice their safety concerns.

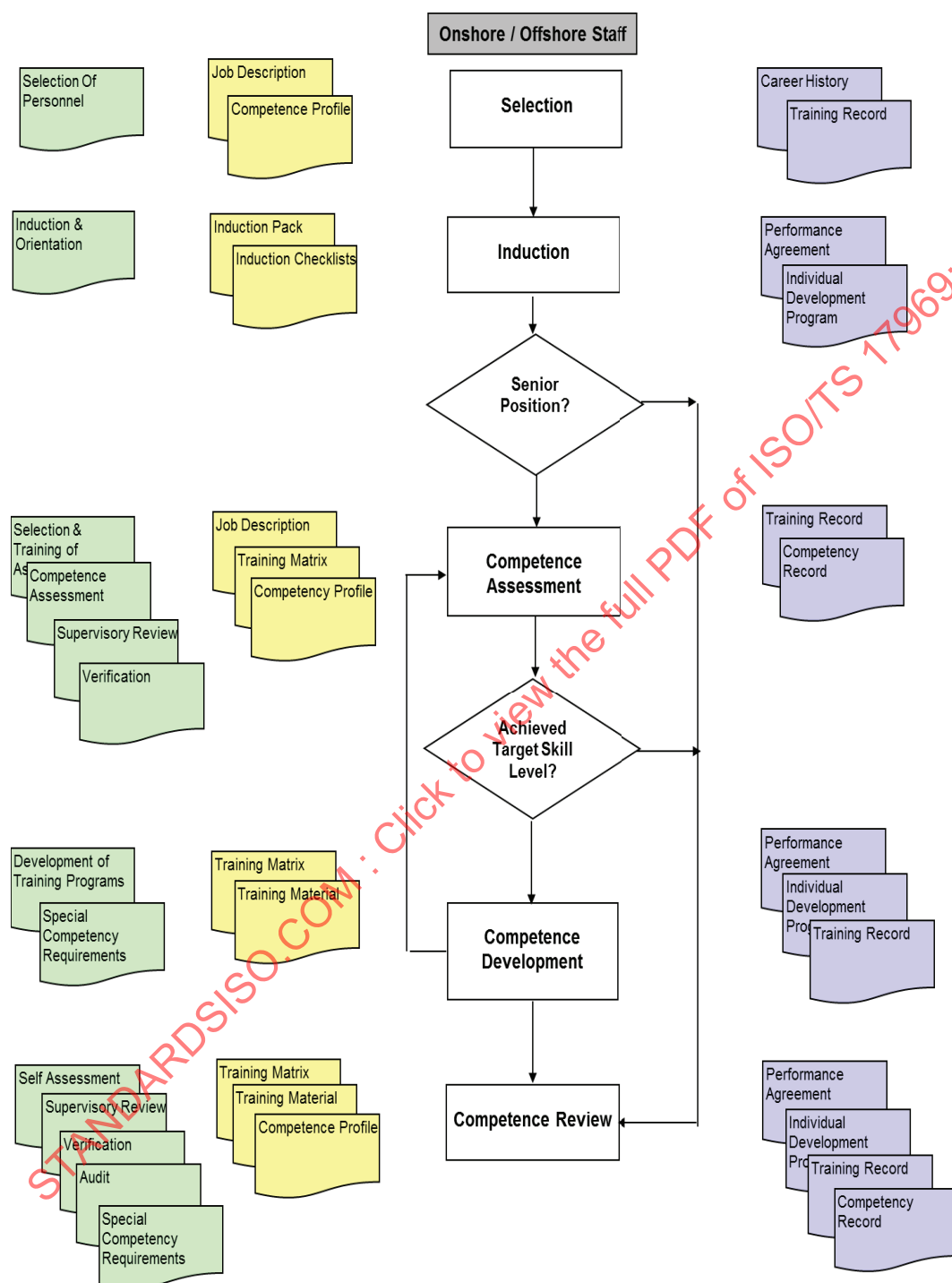
5.6 Contract personnel

The competence of self-employed personnel/independent consultants should be ensured by the organization who has contracted them, demonstrating equal management of competency as that applied to employees. This may be carried out at the start of the contract and periodically during operations. One option can be to include consultants in the organization's CMS on a temporary basis.

An individual's self-assessment of competence should not be considered as independent or reliable.

5.7 Roadmap to ensure competency

[Figures 4](#) and [5](#) illustrate an example of a competency roadmap in schematic form for staff ([Figure 4](#)) and contractors ([Figure 5](#)).

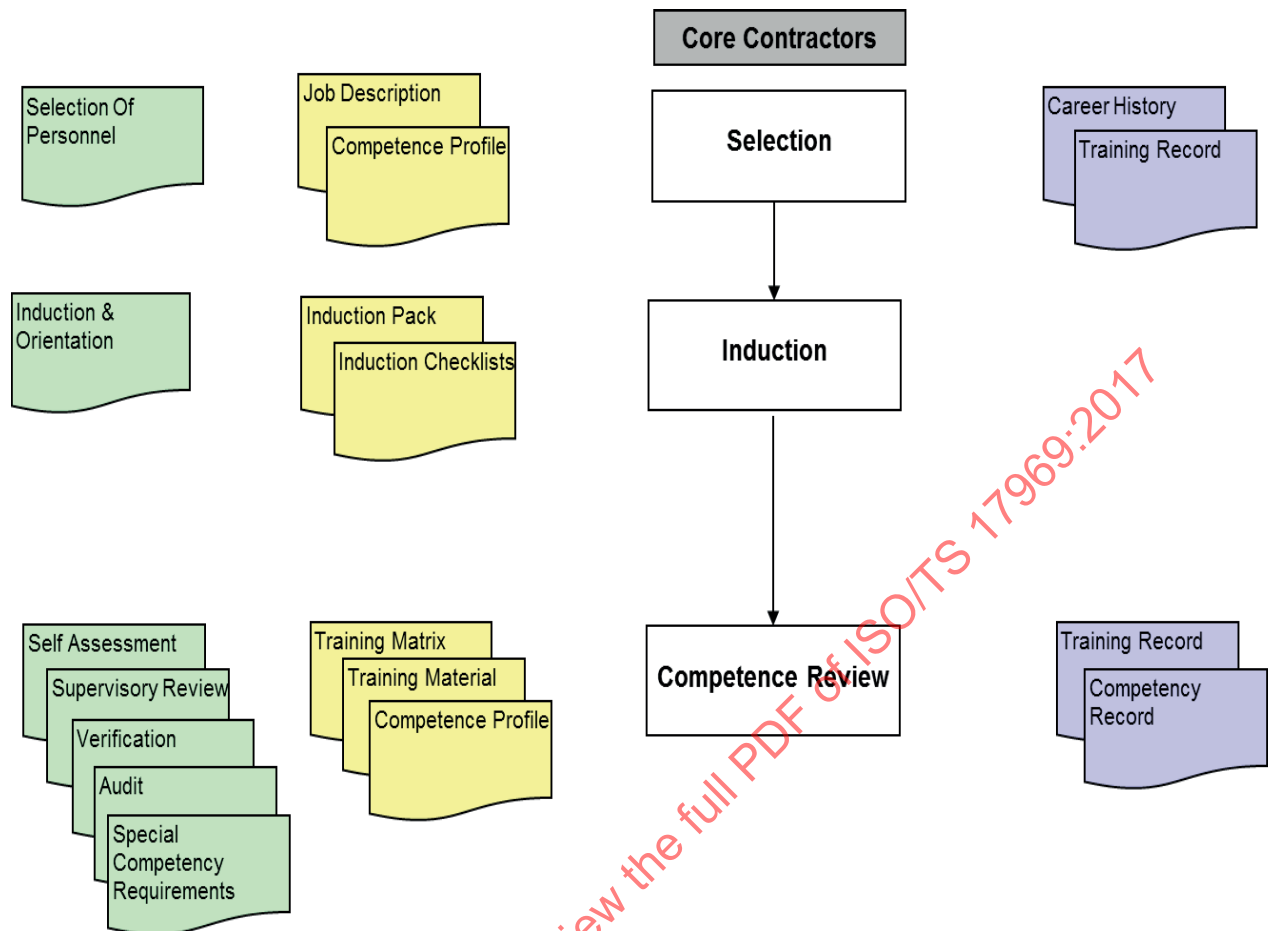


NOTE 1 The green documents represent the human resources handbook, or specific department procedures.

NOTE 2 The yellow documents are well operations department-specific, which describe the requirements for a fully competent candidate for the post in question.

NOTE 3 The blue documents are the candidate-specific documents which record the staff's actual progress against the green document requirements following the due process as described in the yellow procedures.

Figure 4 — Competency integrated into the on boarding of operational staff



- NOTE 1 The green documents represent the human resources handbook, or specific department procedures.
- NOTE 2 The yellow documents are well operations department-specific, which describe the requirements for a fully competent candidate for the post in question.
- NOTE 3 The blue documents are the candidate-specific documents which record the staff's actual progress against the green document requirements following the due process as described in the yellow procedures.

Figure 5 — Competency integrated into the on boarding contractors

6 Examples of competency profiles

[Annexes B, C, D, and E](#) contain competency profiles, at a very high level of proficiency criteria, for four well operation roles:

- [Annex B](#) for drilling supervisor;
- [Annex C](#) for senior drilling engineer;
- [Annex D](#) for well examiner;
- [Annex E](#) for operations geologist.

Annex A (informative)

Example competency assessment information

A competency record and assessment sheet can be constructed using the example profiles shown in [Annexes B](#) to [E](#). For clarity these have been omitted from the example profiles.

Signature and date boxes are provided for the individual and assessor, in addition to the supervisor. By allowing the assessment evidence to be recorded on the same sheet along with the assessment and target levels allows a development plan for the assessed to be agreed and recorded. This allows a simple gap analysis type approach and satisfies the documentary requirements of a CMS scheme.

Table A.1 — Completed example of an assessment record - Drilling supervisor

Individual		Name		Signature				
Assessor		Name		Signature				
Date								
Supervisor comments								
Supervisor		Name		Signature				
Date								
	Level 1	Level 2	Level 3	Level 4	Assessment evidence	Assessed level	Target level	Development plan
DRILLING SUPERVISOR	Awareness (understands the principles)	Basic application (can apply the principles)	Proficient (routinely carries out the task)	Master/Expert (can teach the subject)				
Well design								
Shallow gas assessment	☐ Fully interpret and can describe the risks associated with shallow gas	☐ Can commission and/or review a shallow seismic survey	☐ Has conducted shallow gas assessments for a variety of well locations/rig types		Passed technical standards training shallow gas (date). Reviewed shallow seismic survey and summarized findings at critical well review (date)	1, 3	3	Instigate shallow gas survey on next well. Review shallow gas procedures on next well
		☐ Fully interpret, can describe and has significant relevant experience in the potential for migrated gas in developed areas						

Table A.1 (continued)

			☐ Can optimize the well design based on shallow gas assessment						
			☐ Can develop shallow gas procedures appropriate to the risk and the rig						
P o r e pressure analysis	☐ Fully interpret and can describe the significance of pore pressure, and how it impacts well design and drilling operations	☐ Fully interpret and can describe the causes of abnormal pore pressure	☐ Fully interpret, can describe and has significant relevant experience in which pore pressure evaluation technique (e.g. sonic, density, resistivity and conductivity logs, seismic) is appropriate	☐ Fully interpret, can describe and has significant relevant experience in uncertainty associated with each technique.	Completed computer-based training module hydrocarbon properties (date). Formation evaluation (date). Reviewed offset wells, generated pore pressure plot for last well. Presented at critical well review (date)	2,0	3,0	Complete computer-based training	
		☐ Can describe the common tools and methods for evaluating pore pressure	☐ Has carried out pore pressure analyses for a variety of well types						
		☐ Can identify obviously over-pressured zones based on well data.							
		☐ Can generate pore pressure profiles based on offset data (mud log, well test)							

Table A.1 (continued)

Fracture gradient analysis	☐	Fully explain and can describe the significance of fracture pressure, and how it impacts well design and drilling operations	☐	Fully explain and can describe the principles of the formation fracture phenomenon	☐	Can tailor fracture gradient profiles based on predicted geology and well design (e.g. azimuth and inclination)	☐	Can apply rock mechanics principles	Reviewed fracture pressure first principles (date). Reviewed offset leak-off test plots etc. (date). Generated FG plot for last well. Presented at critical well review (date)	2.1	3,0	Participate in next rock mechanics study for next well
			☐	Fully explain and can describe the common methods used for estimating fracture gradients	☐	Has carried out fracture gradient analyses for a variety of well types						
			☐	Can estimate fracture gradients based on well data.								
			☐	Can generate fracture gradient profiles based on offset data (leakoff, formation integrity tests, fracture stimulations, mud losses)								

Table A.1 (continued)

Formation fluid analysis	☐	Fully explain and can describe the different types of formation fluids (oil, gas, water) and possible contaminants (e.g. H ₂ S, CO ₂ , salt)	☐	Fully explain and can describe the significance of formation fluid contaminants, and potential impact on well design and operations planning	☐	Can optimize well design based on assessment of formation fluids (e.g. materials selection, casing/tubing design)			Completed Computer-based training module hydrocarbon properties (date). Formation evaluation (date). Reviewed casing and tubing design Manual - sections 6 and 7 (date). Reviewed offset PVT/brine analysis with reservoir engineer (date)			
			☐	Fully explain and can describe the common methods used for evaluating formation fluids (e.g. logs, PVT, brine analysis)	☐	Has carried out formation fluid analyses for a variety of well types						
			☐	Can identify formation fluids based on offset data								