

EXAMPLES OF COMPETENCY STANDARDS

1. Competency Standards

Competency standards provide a common definition of a competency, with its minimum requirements, and are used to assess the competency of an individual. Their purpose is simple - they are used to provide objective evidence that individuals have the necessary skills and experience to conduct the tasks in a defined competency. There are examples in the literature (for example, [1-11]), and Table 1 gives examples of the standards listed in References 10 and 11.

Competency standards are an integral part of the process to qualify and certify staff as being competent [12-14]. They offer significant benefits to management as they provide objective evidence of staff competence, set measurable standards of performance, facilitate staff progression, and assist in staff appraisals.

2. Competency Levels

A competency standard must specify the level of the competency; for example [1]:

- Level 1: the individual is able to carry out work with supervision from someone more proficient.
- Level 2: the individual is able to carry out work without supervision from someone more proficient.
- Level 3: the individual is able to train and assess others.

The levels can then specify the required skills, knowledge, and experience, requirements. A review [10, 12, 14] of published competency levels and descriptions [1-9] concluded that three levels are both practical and convenient: 'foundation', 'practitioner', and 'expert' (Table 2). Additionally, an 'awareness' level can be used as an entry level into these three levels of competency [12, 14]. These increasing competency levels correspond with increasing job responsibilities, and cognitive characteristics.

3. Examples of Competency Standards

References 10 and 11 give details of these standards:

- Table 1 gives a listing of the standards in these references; and,
- Table 2 gives the competency levels used in these references.

Appendix A gives four examples of the content of these standards.

REFERENCES

1. Anon., 'Competency Framework'. Institution of Gas Engineers and Managers. IGEM/TD/102. Communication 1761. June, 2012.
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3. Anon., 'UK-SPEC UK Standard for Professional Engineering Competence', Engineering Council, UK. Third edition. 2013. www.engc.org.uk.
4. <http://www.opito.com/media/downloads/competence-assessment-and-verification-guidelines.pdf>. OPITO, the Offshore Petroleum Industry Training Organisation.
5. Anon., 'Pipeline Personnel Qualification', American Society of Mechanical Engineers. ASME B31Q-2016. New York, USA. 2016.
6. Anon., 'Competency Matrices', Society of Petroleum Engineers. <http://www.spe.org/training/competency.php>
7. Anon., 'Subsea Engineering Competency Assessment Framework', Joint Industry Project (members only), Wood Group Kenny. <http://www.ukmarinealliance.co.uk/sites/default/files/Bev%20Mackenzie%20MASRWG%20presentation.pdf>
8. Anon., 'Competence Assessment Portfolios', International Marine Contractors Association. <https://www.imca-int.com/core/competence-training/competence/assessment-portfolios/>
9. Anon., 'UKOPA Competency Framework Document'. UKOPA/2002/0076. September 2002. <http://www.ukopa.co.uk/pdfs/UKOPA-02-0076.pdf>
10. M Unger, P Hopkins, 'Competency Standards for the Pipeline Industry', 12th International Pipeline Conference, IPC 2018. Calgary, Alberta, Canada. American Society of Mechanical Engineers. Paper IPC2018-78477. 2018.
11. M Unger, P Hopkins, 'The Competency Standard Manual for Pipeline Integrity Management', Journal of Pipeline Engineering. September, 2018.
12. M Unger, P Hopkins, 'Competency' in Engineering', 28th International Pipeline Pigging and Integrity Management Conference Houston, USA, February 8-11, 2016.
13. M Unger, P Hopkins, 'The Lost Art of Mentoring', World Pipelines, December, 2015.
14. M Unger, P Hopkins, 'A Qualification Route Map for the Pipeline Industry', Pipeline Pigging & Integrity Management Conference. 27 February 2017 to 2nd March 2017. George R. Brown Convention Centre, Houston, USA.
15. https://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Pipeline%20Training/OQ%20Guide/e_Chapter_II.pdf
16. P Strahlendorf, "'Reasonably Practicable" in Health, Safety and Environmental Legislation', Report for Natural Resources Canada. Toronto University, Canada. 30th June, 2016.
17. Anon., 'Pipeline Transportation Systems for Liquids and Slurries', American Society of Mechanical Engineers. ASME B31.4-2016. 2016.
18. P Hopkins, M Unger, 'What is a 'Subject Matter Expert'?', Journal of Pipeline Engineering. December, 2017.
19. S Little, T Ray, 'Managing Knowledge', 2nd Edition. Open University. Sage Publications. London. 2011.
20. Anon., 'Cathodic protection - Competence levels and certification of cathodic protection personnel'. BS EN 15257:2006 (EN15257). December, 2006.

Standard	Title
CS_000	Subject Matter Expert
CS_001	Pipeline Engineering Principles
CS_002	Pipeline Engineers: Ethics & Responsibilities
CS_003	The Oil and Gas Industry
CS_004	Pipeline Project Control
CS_005	Pipeline Inspection and Surveillance
CS_006	Onshore Laws, Regulations & Standards
CS_007	Subsea Laws, Regulations & Standards
CS_008	Pipeline Hydraulics
CS_009	Pipeline Risk Management
CS_010	Onshore Pipeline Design
CS_011	Subsea Pipeline Design
CS_012	Pipeline Repair
CS_013	Pipeline Materials
CS_014	Pipeline Integrity Management
CS_015	Internal Corrosion Mechanisms
CS_016	Internal Corrosion Prevention and Monitoring
CS_017	External Corrosion and Prevention
CS_018	Onshore Pipeline Construction
CS_019	Subsea Pipeline Construction
CS_020	Pipeline Defect Assessment
CS_021	Non-Destructive Testing Technologies
CS_022	In-Line Inspection Technologies & Procedures
CS_023	Pipeline Inspection Technologies & Procedures
CS_024	Pipeline Preparation and Cleaning
CS_025	Cathodic Protection and Monitoring

Standard	Title
CS_026	ILI Data Analysis and Reporting
CS_027	Pipeline Inspection Data Management
CS_028	Onshore Pipeline Operation
CS_029	Subsea Pipeline Operation
CS_030	Stress Analysis
CS_031	Verification of Inspection Results
CS_032	Fracture Mechanics
CS_033	Failure Analysis
CS_034	Pipeline Welding
CS_035	Pipeline Testing
CS_036	Onshore Pipeline Routing
CS_037	Subsea Pipeline Routing
CS_038	Subsea Surveys
CS_039	Decommissioning and Alternatives
CS_040	Risers, Flexibles, Pipe-in-pipe, and Umbilicals
CS_041	Deep Water Pipelines
CS_042	Failure Modes and Mechanisms
CS_043	Risk Analysis
CS_044	Probability of Failure Analysis
CS_045	Consequence Analysis
CS_046	Pipeline Inspection Principles
CS_047	Health, Safety, Environment, Security
CS_048	Pipeline Defects
CS_049	Topside and Subsea Equipment and Control
CS_050	Crack Management
CS_051	Geotechnics

Table 1. Examples of Competency Standards from References 10 and 11.

Competency Level (characteristic)	Description	Knowledge	Supervision	Responsibility	Summary
Awareness (probation)	This level is for new or inexperienced individuals with no competencies, and individuals (such as senior managers) who only want an 'awareness' of a competency. These individuals can be considered in a ' probation ' or ' awareness ' period, where time is allowed for a job holder to demonstrate basic understanding of the job competencies, but is not required to carry out work without close and continuous supervision in all of the tasks associated with the competency.				Can interpret and evaluate the knowledge, and can both communicate it and present coherent arguments.
Foundation (knowledge)	Understanding of effects and consequences.	Knowledge and understanding of best practice ^[1] .	Is able to carry out work with supervision .	The Practitioner/ Expert supervises their work.	Critical understanding and analysis of the knowledge, and able to apply the knowledge .
Practitioner (application)	Demonstrates competence to select the most appropriate options.	Aware of current developments, and has demonstrated experience ^[2] , and can apply knowledge to new situations.	No supervision required.	Can supervise Foundation Level.	Able to self-manage, with a critical and systematic understanding of the knowledge, and can make judgements and propose solutions .
Expert (creation)	Breadth of experience and knowledge. Deep understanding of best practices.	Demonstrated managerial skills to undertake overall responsibility of a function, and can apply new knowledge to new situations, and deliver solutions.	Can train and assess others.	Can supervise Practitioner Level.	A self-learner with a critical awareness of current and complex issues and best practices, and is able to do original work, deal with multiple problems, able to explain theoretical bases and weaknesses, and can propose new solutions. A subject matter expert^[3].

Notes:

[1] 'Good practices' are practices, documents, and guidelines produced by: government departments; standards-making organisations (e.g. ISO, ASME, CEN); trade federations; professional institution; etc.. They are readily available, and recognized as current practice. They can be considered 'minimum' requirements. 'Best practice' goes beyond these 'good practices', and would be expected to be the best available practice, supported by other practices that give a measured and demonstrable improvement. Being 'the best' and 'best practices' are not the same thing. A 'best practice' may have been accepted by the profession or industry, but there may well be a better practice in existence somewhere in the world, which eventually will be accepted as the new best practice, but in the meanwhile, it is reasonable to continue with the existing best practice, and it is not necessary to search for this more novel best practice [16].

[2] 'Experience' is work activity accomplished under the direction of qualified supervision, but excluding time spent in organized training programs [17]. It indicates the workplace experience required to demonstrate competency. This will include years of experience, level of experience, and type of experience. Experience is the process of obtaining knowledge and skills from doing and/or participating in relevant projects, and the accumulation of knowledge and skills leads to a competency.

[3] A subject matter expert (SME) is often quoted in the literature and regulations [18]. The USA Department of Transportation (which regulates pipelines) defines 'subject matter expert' as [15]... 'An individual recognized as having a special skill or specialized knowledge of a process in a particular field, or of a piece of equipment.' It is likely that a subject matter expert will need at least 10 years of relevant experience [19, 20], although some caution is needed with older engineers: 'Old-timers have the wisdom... but are at risk if they don't keep up with the scientific and technical knowledge of the profession.' [16].

Table 2. Examples of Competency Levels [1-11].

APPENDIX A

Examples of Contents of Competency Standards, from References 10 and 11

Competency Title	Pipeline Risk Management
Competency Number	009
Document Revision	Rev F 2018

Competence Level (see Table 2)

	Awareness	Foundation	Practitioner	Expert
Competency Description/Purpose	The concepts and principles of risk management and the identification and analysis of pipeline risks using suitable assessment methods. This will give the individual an all-round understanding of pipeline risk management, the factors influencing pipeline risk, and why risk assessment is required.			
Competency Outcomes	Is aware of risk management methods and standards.	Can define , and distinguish between, differing risk analysis methods/techniques (both qualitative and quantitative), can list , the threats to pipelines leading to loss of containment, the consequences of pipeline failure, the role of mitigation in managing risk, and recognizes risk management concepts, particularly the role of regulatory pipeline integrity management programs.	Can relate risk assessments to risk management activities, produce risk management methods and procedures, choose pipeline risk management systems, concluding on best practice, apply cost-benefit analyses, NPVs, future values, etc., apply ALARP principles, can recommend system-wide and company-wide risk management strategies, and can facilitate risk management workshops, and extract risk information from other subject matter experts.	Can create risk management methods and procedures, and appraise pipeline risk and integrity management systems, recommending on best practice, can rule on weaknesses in existing company-wide risk management strategies, can adapt/select/appraise economic calculations such as NPV's and values of statistical life, can conduct risk management workshops, and evaluate due diligence work.
Qualifications (e.g., academic or professional)	None.	Progressing or completed CEng or PEng or equivalent (e.g., 'engineer in training' program).	CEng or PEng or equivalent.	CEng or PEng or equivalent.
Pre-requisites	None	Completed Awareness Level in this competency. CS_043 Awareness. CS_044 Awareness. CS_045 Awareness.	Completed Foundation Level in this competency. CS_010 or 011 Foundation. CS_014 Foundation. CS_043 Foundation. CS_044 Foundation. CS_045 Foundation.	Completed Practitioner Level in this competency. CS_043 Practitioner.
Co-requisites	CS_001 Awareness CS_002 Awareness CS_003 Awareness CS_010 or 011 Awareness CS_013 Awareness CS_014 Awareness CS_028 or 029 Awareness CS_047 Awareness	CS_027 Awareness CS_036 or 037 Awareness. CS_046 Awareness CS_048 Awareness.	CS_046 Foundation	
Certification available?	No ('Awareness' levels are not certified).	Yes.	Yes.	Yes.

Competency Elements ('Tasks') and Assessment

Skills (ability to do a task)	None.	Risk analysis (qualitative to quantitative), including probability and consequences of failure analysis, identification of risk acceptance criteria and perform ALARP assessments, with supervision.	Risk assessments and risk management development, without supervision.	Teach the competency.
Knowledge (understanding the task)	Risk management and risk assessment codes and standards.	Application of pipeline risk management and risk assessment standards.	Determining applicable risk management and assessment methods for pipeline networks.	Expert witness skills (giving evidence, writing reports, answering questions, preparing for Court).
	Pipeline failure hazards for onshore and offshore pipelines.	Hazard identification and failure probability analysis, applying qualitative to quantitative assessment methods.	Hazard identification methods (fault tree, HAZID, HAZOP, etc.). Use of industry failure statistics. Applicability of using qualitative to quantitative assessment methods for pipeline systems.	Able to participate in industry working groups, or standard committees.
	Consequences of pipeline failure, for gas and liquid lines (onshore and offshore).	Qualitative and quantitative assessment of consequences of failure (including safety, environmental and business fields of consequence)	Determine types of failure (leak/rupture) outflow modelling and types of rupture (fireball, crater, jet fire, pool fire, etc.) to assess consequences of failures.	Theoretical bases of pipeline failure probability and consequences, and best practices in risk assessment.
	Risk tolerability and risk acceptance criteria.	Risk acceptance criteria (risk assessment matrices), and regulatory risk assessment requirements.	Regulatory and company specific risk acceptance criteria, and calculation of individual and societal risk.	
	Risk mitigation measures and industry best practice.	Effect on risk levels of different mitigation options. ALARP assessment.	ALARP assessments including potential loss of life, cost-benefit analysis, cost per casualty averted assessments.	
		Review risk management documentation and control procedures.	Develop and review risk management documentation.	
Supervising and/or training	None.	None.	Supervisor for this competency.	Trainer for this competency.
Assessment	Quizzes (self-marked).	Summative.	Formative and Interview.	Formative and Interview.

Mentoring and Experience Requirements

Training	~2 hours	~18 hours	0	0
Mentoring (guided learning under the guidance of a mentor) [13]	~4 hours	~36 hours	Practitioners need 3 to 5 years mentoring to be proficient at a competency.	Experts need ≥5 years mentoring to be expert at a competency.
Experience (self-learning under the supervision of a line manager)	~14 hours	~100 hours	Practitioners need 5 to 7 years relevant experience to be proficient at a competency.	Experts need ≥10 years relevant experience to be expert at a competency.

Learning Program

The learning program describes in detail the purpose and outcome of this competency, and gives a detailed breakdown of training (type, and presentation platforms), mentoring and experience requirements. The program also gives timelines, trainer/mentor qualification requirements, and more detail on assessment criteria. The learning program is detailed in another document, and aims to satisfy all the stated outcomes in this Competency Standard, and address all the Competency Elements, Mentoring and Experience requirements.

Competency Standard Number 009 [10, 11].

Competency Title	Pipeline Integrity Management			
Competency Number	014			
Document Revision	Rev C 2018			
Competency Level (see Table 2)				
	Awareness	Foundation	Practitioner	Expert
Competency Description/Purpose	Manage the many and varied activities pipeline operators must undertake to ensure that releases of transported products do not occur, comprising integrity activities, in accordance with a written plan, within a management control system.			
Competency Outcomes	Is aware of differing integrity management methods/techniques, and understands pipeline integrity management and systems, and the threats to pipeline safety and the consequences of pipeline failure.	Can define , and distinguish between, differing integrity management methods/techniques, particularly pipeline integrity management and systems, and can list the threats to pipeline safety and the consequences of pipeline failure.	Can apply integrity management methods/techniques, formulate pipeline integrity management and systems, can produce an assessment of the threats to pipeline safety and the consequences of pipeline failure, and can review pipeline integrity assessment methods and conclude the risk implications of each.	Can create pipeline integrity management methods and procedures, and appraise pipeline integrity management systems, proposing best practice, can change weaknesses in existing company-wide integrity management strategies, can assemble integrity management workshops, and evaluate due diligence work.
Qualifications (e.g., academic or professional)	None.	Progressing or completed CEng or PEng or equivalent (e.g., 'engineer in training' program).	CEng or PEng or equivalent.	CEng or PEng or equivalent.
Pre-requisites	None.	Completed Awareness Level in this competency. CS_005 Awareness CS_006 or 007 Awareness CS_020 Awareness	Completed Foundation Level in this competency. CS_005 Foundation. CS_009 Foundation. CS_010 or 011 Foundation	Completed Practitioner Level in this competency.
Co-requisites	CS_001 Awareness CS_002 Awareness CS_003 Awareness CS_009 Awareness CS_010 or 011 Awareness CS_013 Awareness CS_028 or 029 Awareness CS_047 Awareness	CS_022 Awareness. CS_027 Awareness. CS_032 Awareness. CS_033 Awareness. CS_035 Awareness. CS_042 Awareness. CS_043 Awareness.	CS_020 Foundation. CS_022 Foundation. CS_042 Foundation. CS_043 Foundation CS_047 Foundation.	None.
Certification available?	No ('Awareness' levels are not certified).	Yes.	Yes.	Yes.

Competency Elements ('Tasks') and Assessment

Skills (ability to do a task)	None.	Arrange typical integrity management activities under supervision (use risk assessment outputs to develop integrity management plans, manage programmes, interpret results).	Design, propose and apply pipeline integrity management systems without supervision.	Teach the competency
Knowledge (understanding the task)	Pipeline integrity management system.	Different approaches to pipeline integrity management.	Compliance vs. goal setting regulations, prescriptive vs. risk-based programs, best practice.	Expert witness skills (giving evidence, writing reports, answering questions, preparing for Court).
	Safety Management Systems (SMS) and the role they play in Pipeline Integrity Management.	Standards' requirements (including ASME B31.8S, API 1160, API 1173, CSA Z662, DNV RP F116, BSI 8010-4, EN 16348).	Formulate a pipeline integrity management system, and develop and apply prescriptive or risk-based pipeline integrity management programs.	Able to participate in industry working groups, or standard committees.
	Threats to pipeline integrity (pipeline defects and their causes).	Interpreting inspection and survey reports, and inspection, testing, maintenance, and surveillance options (all methods).	Specifications, and quality management, planning and spares.	
	Inspection, testing, maintenance, and surveillance options (focus on in line inspection, above ground and subsea surveys and patrols).	Risk reduction options, preventive measures and mitigations.	Damage prevention, stakeholder communications, one-call systems.	
	Risk assessment (probability of failure, failure consequences).	Establishing baseline inspection and testing intervals.	Optimise inspection and testing intervals based on condition assessment data.	
	Integrity management planning (prescriptive, risk based).	Defect assessment, including fatigue assessment.	Data analysis methods, including corrosion and crack growth.	
	Pipeline integrity data management, data quality.	Pipeline repair and rehabilitation, and repair programme design.	Data management systems (inspection, maintenance, scheduling, geospatial systems).	
		Threats to pipeline integrity and the consequences of pipeline failure.	Advanced Safety Management Systems, and process management.	
		Critical data, missing data, treatment of uncertainty.	Management controls necessary for pipeline integrity management.	
	Emergency preparedness, emergency response, site investigation.	Failure statistics and sources (time dependent and stable threats, and random events).		
Supervising and/or training	None.	None.	Supervisor for this competency.	Trainer for this competency.
Assessment	Quizzes (self-marked).	Summative.	Formative and Interview.	Formative and Interview.

Mentoring and Experience Requirements

Training	~2 hours	~18 hours	0	0
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Mentoring (guided learning under the guidance of a mentor) [13]	~4 hours	~36 hours	Practitioners need 3 to 5 years mentoring to be proficient at a competency.	Experts need ≥5 years mentoring to be expert at a competency.
Experience (self-learning under the supervision of a line manager)	~14 hours	~100 hours	Practitioners need 5 to 7 years relevant experience to be proficient at a competency.	Experts need ≥10 years relevant experience to be expert at a competency.

Learning Program

The learning program describes in detail the purpose and outcome of this competency, and gives a detailed breakdown of training (type, and presentation platforms), mentoring and experience requirements. The program also gives timelines, trainer/mentor qualification requirements, and more detail on assessment criteria.
The learning program is detailed in another document, and aims to satisfy all the stated outcomes in this Competency Standard, and address all the Competency Elements, Mentoring and Experience requirements.

Competency Standard Number 014 [10, 11].

Competency Title	Pipeline Defect Assessment
Competency Number	020
Document Revision	Rev F 2018

Competency Level (see Table 2)

	Awareness	Foundation	Practitioner	Expert
Competency Description/Purpose	The underlying principles, concepts, technical parameters, and methods in assessing defects, such as corrosion, cracks, and dents, in high pressure oil and gas pipelines, giving the individual an all-round understanding of the effect of defects on pipeline integrity.			
Competency Outcomes	Is aware of pipeline defect assessments methods (for all common types of defects found in pipelines) and fatigue assessment, with a basic understanding of fracture mechanics.	Can describe pipeline integrity and pipeline defect assessments (for all types of defects found in pipelines), and can summarize and give examples of fatigue assessment.	Can perform, contrast and review pipeline integrity defect assessments (for all types of defects found in pipelines), and choose best practice without supervision.	Can develop and improve pipeline integrity defect assessments (for all types of defects found in pipelines), and elaborate on best practice.
Qualifications (e.g., academic or professional)	None.	Progressing or completed CEng or PEng or equivalent (e.g., 'engineer in training' program).	CEng or PEng or equivalent.	CEng or PEng or equivalent.
Pre-requisites	None.	Completed Awareness Level in this competency. CS_030 Awareness CS_032 Awareness	Completed Foundation Level in this competency. CS_010 or 011 Foundation CS_030 Foundation CS_032 Foundation	Completed Practitioner Level in this competency. CS_032 Practitioner.
Co-requisites	CS_001 Awareness CS_002 Awareness CS_003 Awareness CS_010 or 011 Awareness CS_013 Awareness CS_014 Awareness CS_028 or 029 Awareness CS_047 Awareness	CS_012 Awareness. CS_033 Awareness. CS_042 Awareness. CS_048 Awareness. CS_050 Awareness.	CS_014 Foundation CS_033 Foundation. CS_048 Foundation. CS_050 Foundation	
Certification available?	No ('Awareness' levels are not certified).	Yes.	Yes.	Yes.

Competency Elements ('Tasks') and Assessment

Skills (ability to do a task)	None.	Defect assessment, including fatigue assessment, of a variety of defects in pipelines, with supervision.	Defect assessment, including fatigue assessment, and predictions of failure modes, of all defects in pipelines, without supervision.	Teach the competency.
Knowledge (understanding the task)	Material properties (strength, ductility, hardness, and toughness).	Material properties (with a detailed focus on fracture toughness).	Consequences of pipeline failures (safety, environment, commercial, public image).	Expert witness (giving evidence, writing reports, answering questions, preparing for Court).
	Fracture mechanics: history, key parameters, methods, and published good practices.	Fracture mechanisms (brittle, transitional, ductile), and fracture mechanics approaches (including J integral and crack tip opening displacement).	Theoretical basis of fracture mechanics.	Able to participate in industry working groups, or standard committees.
	Stress analysis (internal pressure and external loading).	Assessment of corrosion using ASME B31G, assessment of cracks using API 579/BS 7910, and assessment of mechanical damage.	Assessment of defects in pipelines, and other related structures (e.g., storage tanks or pipework) up to the highest levels in API 579 and BS 7910.	
	Pipeline failure causes (with a focus on external interference, corrosion, materials defects, fatigue, ground movement, theft).	Pipeline failure causes (including external interference, external forces, corrosion, fatigue, ground movement, sabotage, theft, human error (including over-pressure, over-temperature), spanning, hydrodynamic loads, buckling, and thermal stressing).	Setting inspection and testing intervals using fracture mechanics.	
	Types of failure (including ductile, brittle, overload, and fatigue).	Effect of hydrotesting on defect behaviour.	Pipeline repair and in-line inspection.	
	Case studies in major pipeline failures.	Commercial, corporate, political, and sabotage threats to pipelines and facilities.	Crack assessment and management (including fatigue cracks and stress corrosion cracking).	
	Corrosion assessment, crack assessment, mechanical damage assessment.	Case studies in pipeline failures, modes, and mechanisms.		
	Crack management in pipelines.	Corrosion growth and fatigue crack growth models.		
Supervising and/or training	None.	None.	Supervisor for this competency.	Trainer for this competency.
Assessment	Quizzes (self-marked).	Summative.	Formative and Interview.	Formative and Interview.

Mentoring and Experience Requirements

Training	~2 hours	~18 hours	0	0
Mentoring (guided learning under the guidance of a mentor) [13]	~4 hours	~36 hours	Practitioners need 3 to 5 years mentoring to be proficient at a competency.	Experts need ≥5 years mentoring to be expert at a competency.
Experience (self-learning under the supervision of a line manager)	~14 hours	~100 hours	Practitioners need 5 to 7 years relevant experience to be proficient at a competency.	Experts need ≥10 years relevant experience to be expert at a competency.

Learning Program

The learning program describes in detail the purpose and outcome of this competency, and gives a detailed breakdown of training (type, and presentation platforms), mentoring and experience requirements. The program also gives timelines, trainer/mentor qualification requirements, and more detail on assessment criteria.

The learning program is detailed in another document, and aims to satisfy all the stated outcomes in this Competency Standard, and address all the Competency Elements, Mentoring and Experience requirements.

Competency Standard Number 020 [10, 11].

Competency Title	In-line Inspection Technologies and Procedures			
Competency Number	022			
Document Revision	Rev D 2018			
Competency Level (see Table 2)				
	Awareness	Foundation	Practitioner	Expert
Competency Description/Purpose	The underlying principles, concepts, and technical parameters in in-line inspection (ILI) technologies and procedures, as applied to pipelines and similar cylindrical pressure vessels, giving the individual an all-round understanding.			
Competency Outcomes	Is aware of in-line inspection technologies and procedures.	Can classify and summarize in-line inspection technologies and procedures.	Can apply and review in-line inspection technologies and procedures, and can assess and illustrate the specific importance of inspection thresholds, accuracies, probabilities of detection, sizing and identification for the different procedure.	Can evaluate and create in-line inspection technologies and procedures, and can construct inspection thresholds, accuracies, probabilities of detection, sizing and identification for the different procedures.
Qualifications (e.g., academic or professional)	None.	Progressing or completed CEng or PEng or equivalent (e.g., 'engineer in training' program).	CEng or PEng or equivalent.	CEng or PEng or equivalent.
Pre-requisites	None.	Completed Awareness Level in this competency. CS_021 Awareness CS_023 Awareness CS_048 Awareness	Completed Foundation Level in this competency. CS_010 or 011 Foundation CS_021 Foundation CS_023 Foundation	Completed Practitioner Level in this competency.
Co-requisites	CS_001 Awareness CS_002 Awareness CS_003 Awareness CS_010 or 011 Awareness CS_013 Awareness CS_014 Awareness CS_028 or 029 Awareness CS_047 Awareness	CS_006 or 007 Awareness CS_025 Awareness CS_026 Awareness CS_027 Awareness CS_050 Awareness CS_051 Awareness	CS_018 Foundation CS_019 Foundation CS_020 Foundation CS_024 Foundation CS_031 Foundation CS_048 Foundation	
Certification available?	No ('Awareness' levels are not certified).	Yes.	Yes.	Yes.

Competency Elements ('Tasks') and Assessment

Skills (ability to do a task)	None.	In-line inspection technologies and procedures.	Project management skills and the ability to evaluate detailed project plans and budgets. Able to work confidently with third party organisations at a senior and junior level.	Teach the competency.
Knowledge (understanding the task)	History of pigging, and in-line inspection.	Knowledge of different pipeline types used to convey hydrocarbon products (e.g., production, export, transmission and distribution), their key features, and general operating characteristics that affect pigging and in-line inspection.	Able to set up a project plan and cost budget for a standard ILI campaign incorporating all the key phases including preparatory pigging (proving and cleaning).	Expert witness (giving evidence, writing reports, answering questions, preparing for Court).
	Pipelines, pigs and ILI: current and future.	Knowledge of different line pipe types, pipeline construction concepts (e.g., launcher/receivers, and other related facilities).	Select appropriate ILI technologies and standard tool options for individual pipeline sections based on construction characteristics, operating conditions and perceived integrity threats.	Able to participate in industry working groups, or standard committees.
	Associated market including understanding the number of service providers and supply vs demand issues.	Familiarity with different ILI tools/technologies and their relative strengths and weaknesses.	Recognizing the different challenges between onshore and subsea ILI operations.	Capable of facilitating project workshops to address challenging ILI projects.
	Components of an ILI (the pipeline, its environment, the vehicle, the mechanics and electronics of the vehicle, and the data gathering, analysis, interpretation, and reporting) and how they affect performance.	Knowledge of the service providers, the major suppliers, and their individual capabilities.	Typical ILI data and final reporting formats.	
		Major pipeline threats and the associated damage mechanisms.	Standard post ILI integrity assessment methods, the key input data requirements and the impact of degraded ILI data.	
		Major project phases required to execute a successful ILI campaign.	Develop detailed project method statement documents, generic risk assessments, project WorkPacks.	
		Familiarity with standard ILI data analysis methodology.	Project HAZID exercise.	
		Industry standards pertaining to ILI pigging.		
Supervising and/or training	None.	None.	Supervisor for this competency.	Trainer for this competency.
Assessment	Quizzes (self-marked).	Summative.	Formative and Interview.	Formative and Interview.

Mentoring and Experience Requirements

Training	~2 hours	~18 hours	0	0
Mentoring (guided learning under the guidance of a mentor) [13]	~4 hours	~36 hours	Practitioners need 3 to 5 years mentoring to be proficient at a competency.	Experts need ≥5 years mentoring to be expert at a competency.

Experience (self-learning under the supervision of a line manager)	~14 hours	~100 hours	Practitioners need 5 to 7 years relevant experience to be proficient at a competency.	Experts need ≥10 years relevant experience to be expert at a competency.
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Learning Program

The learning program describes in detail the purpose and outcome of this competency, and gives a detailed breakdown of training (type, and presentation platforms), mentoring and experience requirements. The program also gives timelines, trainer/mentor qualification requirements, and more detail on assessment criteria.
The learning program is detailed in another document, and aims to satisfy all the stated outcomes in this Competency Standard, and address all the Competency Elements, Mentoring and Experience requirements.

Competency Standard Number 022 [10, 11].