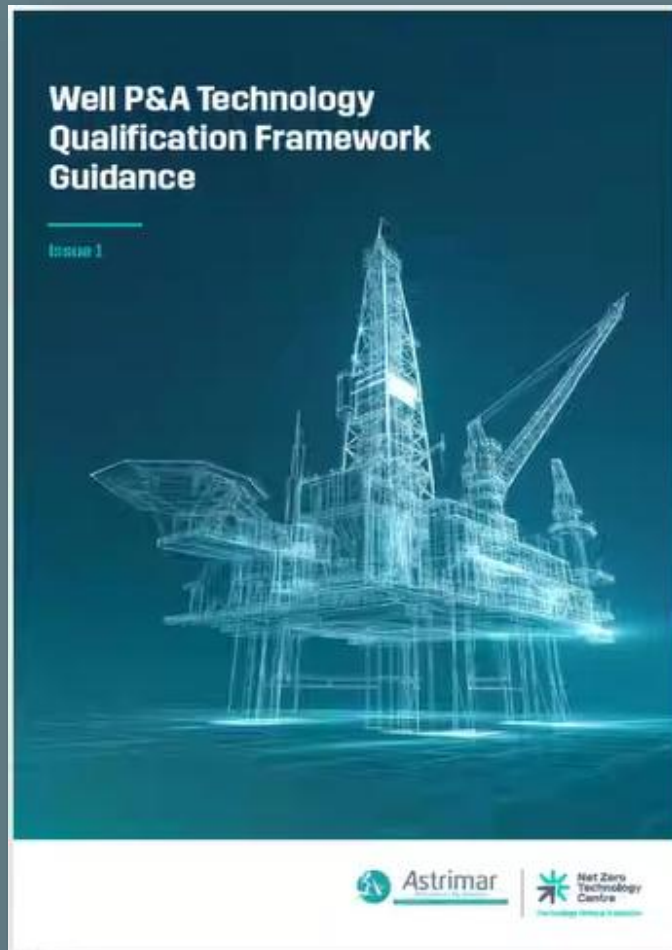


Technology Qualification Framework for Well P&A Technologies

SPE Well Decommissioning

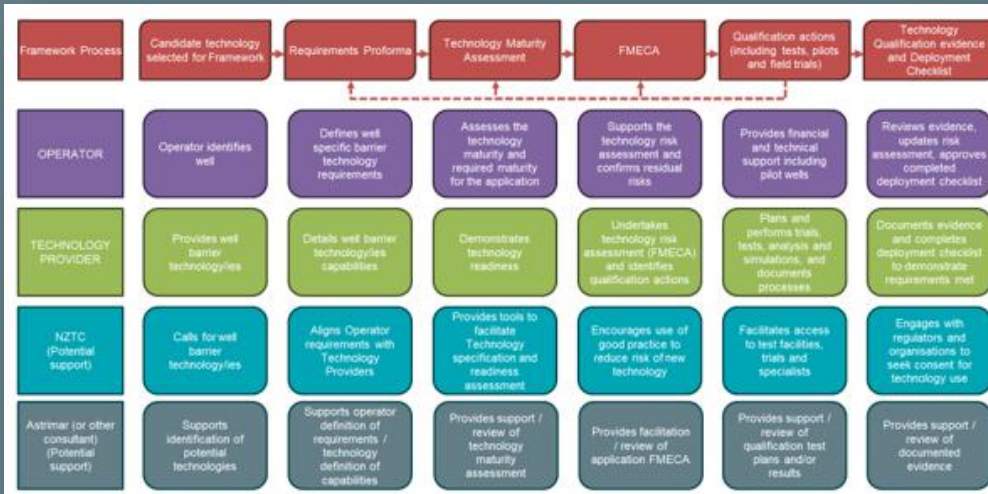
11 June 2025

Technology Qualification Framework for Well P&A Technologies



- Developed in collaboration with operators, technology developers and regulators
- Intended to streamline the acceptance process
- Supports adoption of alternative materials for use in permanent P&A of oil and gas wells
- Technology Qualification Framework Roadmap
 - Provides qualification process for alternative well plugging materials
 - Based on industry accepted TQ Processes
 - Addresses requirements from regulations and standards
- Intended to be applicable across multiple operators and regions, materials and barrier types

Framework - Alignment with Industry Requirements



Appendix 1.1. United Kingdom Regulations

The following regulations are expected to be applicable in the United Kingdom, The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996, Part IV (GOV, 1996).

General duty (GOV, 1996)

Regulation 13.

"(1) The well-operator shall ensure that a well is so designed, modified, commissioned, constructed, equipped, operated, maintained, suspended and abandoned that—
(a) so far as is reasonably practicable, there can be no unplanned escape of fluids from the well; and
(b) risks to the health and safety of persons from it or anything in it, or in strata to which it is connected, are as low as is reasonably practicable.

(2) The provisions of regulations 14 to 19 and 21 are without prejudice to the generality of the requirements of paragraph (1) save that, where regulation 17(2) places a duty on the duty holder for an installation, the well-operator is not under the same duty."

Interpretation

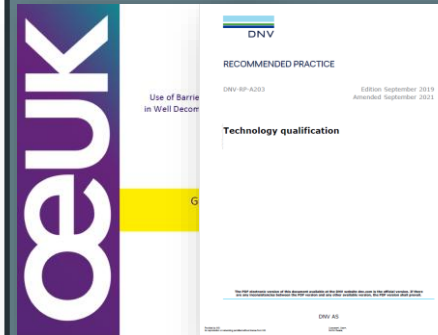
The well should be abandoned such that there is no leak from the well, so far as is reasonably practical (i.e. ALARP) i.e. residual risks are acceptable.
The ALARP principle implies that the risks should be as low as practical, as long as the cost and effort to reduce the risk are not disproportionate to the risk reduction achieved.
Note that no lifetime is prescribed, therefore it can be assumed that this regulation applies in perpetuity.

Framework Demonstration

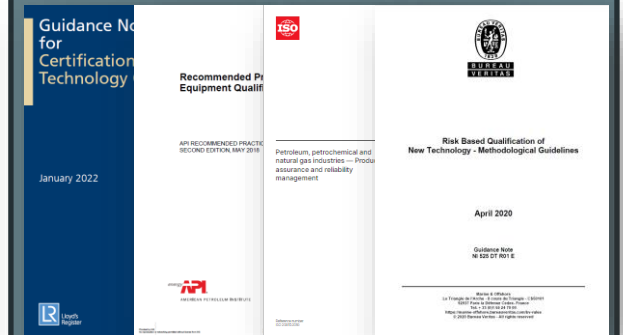
For a novel well barrier technology and well abandonment design, it is necessary to demonstrate that risks associated with the technology are ALARP. This will be assessed by a FMECA, and, if required a Quantitative Risk/ALARP Assessment of the well barrier envelope and abandonment design on a case-by-case basis. Qualification actions and risk mitigations arising from the FMECA assessed failure modes and mechanisms will support the appropriate management of risk.

Alignment with qualification guidance

Assessed

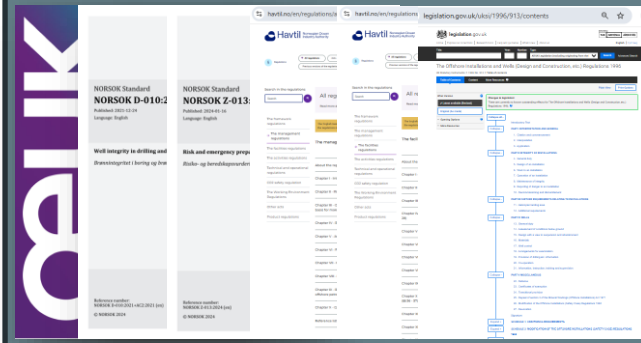


By implication

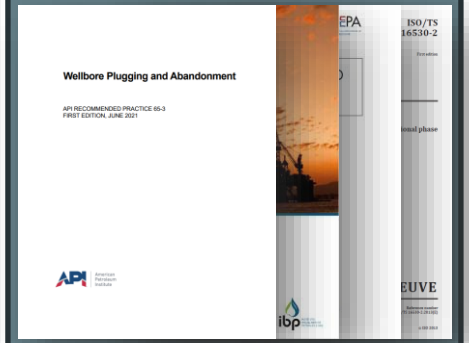


Well decommissioning guideline requirements

Assessed



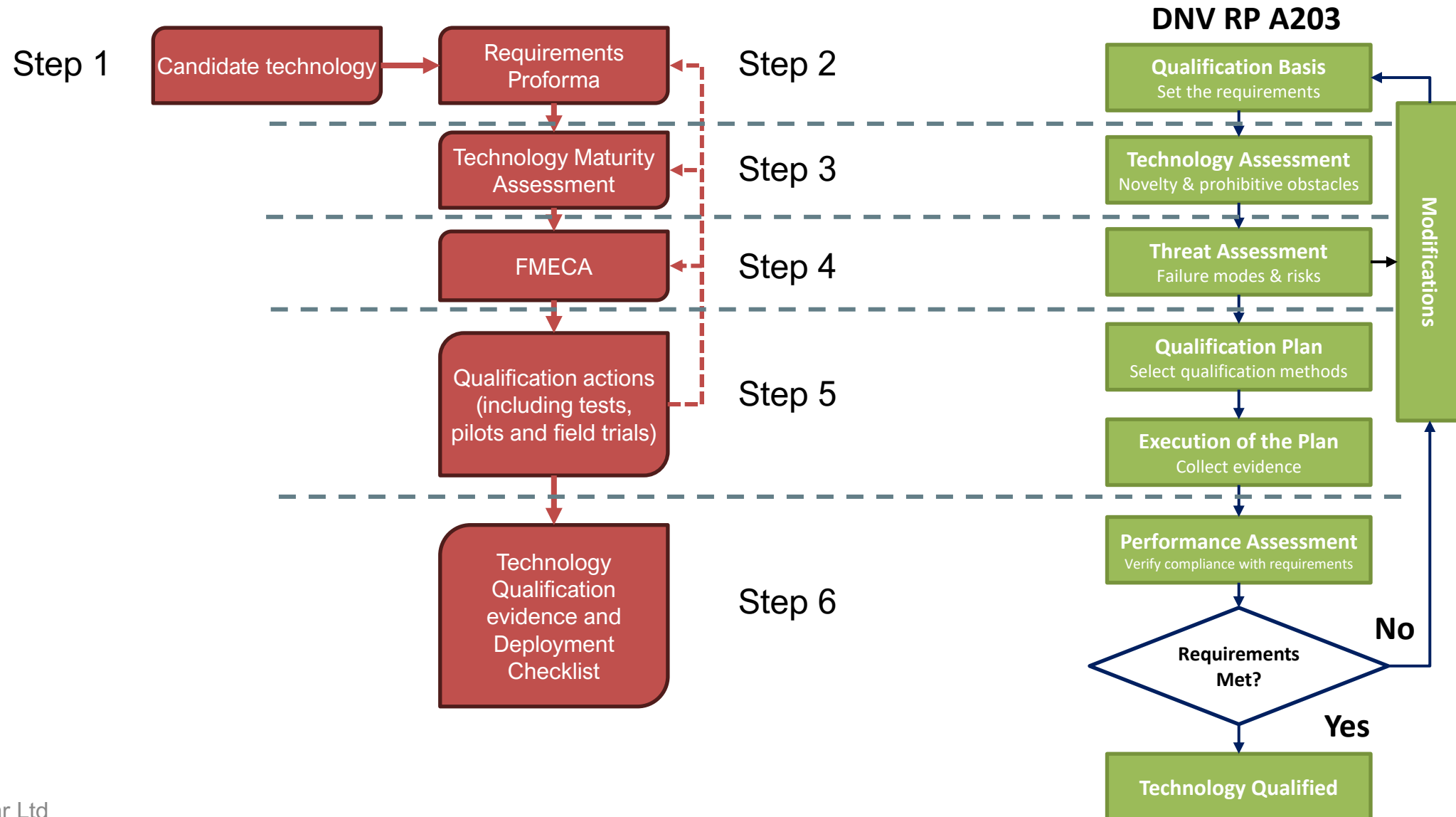
Planned



Aligned Countries



Framework Process - Alignment with DNV RP A203



Step 1: Candidate Technology Identification

Step 2: Requirements and Technology Specification

Organisation	Activity
Operator	Operator identifies well(s) where alternative barrier technology is of interest
Technology Providers	Technology provider(s) communicate capabilities and maturity of their well barrier technology/ies for the application(s). Understanding operator needs, helps refine their offering.
Tool	No specific tool is needed for this step. Requirements proforma could start to capture relevant information.

Organisation	Activity
Operator	Operator provides well specific requirements the barrier technology is required to meet
Technology Providers	Technology providers should compare their technology's capabilities with Operator's requirements to ensure compliance
Tool	The Requirements proforma should be used to capture both current capabilities and operator requirements

Defining Requirements and Capabilities

OPERATOR'S BARRIER TECHNOLOGY REQUIREMENTS PROFORMA

This requirements proforma provides a wide ranging set of requirements that may need to be defined to ensure a barrier technology is fit for the well abandonment scenario to which it is to be deployed. The list of requirements is not comprehensive, it may be beneficial to include additional requirements relevant to the well scenario or the technology. It may also be appropriate to omit some of the requirements listed below if they are not important or relevant to the abandonment scenario.

Overview of Barrier Technology

Requirements Sheet Completion Status

In progress

Date last updated

23/04/2024

Updated by

Brian Willis

Additional notes

Requirements Proforma

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Step 3: Assessment of Technology Maturity (TRL)

Step 4: Assessment of Failure Modes and Effects (FMECA)

Organisation	Activity
Technology Providers	Technology Provider uses TRL tool to assess TRL of their relevant technology for the specific application. This facilitates communication with operators on the technology readiness for the application.
Operator	Operator reviews TRL assessment for the application, to understand technology risk and qualification gaps to be addressed.
Tool	The Framework's Technology Maturity Assessment tool should be used.

Organisation	Activity
Technology Providers	Technology Provider undertakes detailed FMECA to evaluate potential Failure Modes, Mechanisms and Effects, for of each stage of the proposed application. Design, Qualification and Procedural mitigations may be identified.
Operator	Operator should participate in, or review and feedback on FMECA and proposed mitigations.
Tool	The Framework's FMECA template provides a consistent basis of scope and extent.

HIGH LEVEL WELL DESIGN TRL ASSESSMENT											
TRL Assessment Comparison Matrix											
Type of Assessment	TRL	TRL	TRL	TRL	TRL	TRL	TRL	TRL	TRL	TRL	TRL
TRL	1	2	3	4	5	6	7	8	9	10	11
TRL 1	1	2	3	4	5	6	7	8	9	10	11
TRL 2	2	3	4	5	6	7	8	9	10	11	12
TRL 3	3	4	5	6	7	8	9	10	11	12	13
TRL 4	4	5	6	7	8	9	10	11	12	13	14
TRL 5	5	6	7	8	9	10	11	12	13	14	15
TRL 6	6	7	8	9	10	11	12	13	14	15	16
TRL 7	7	8	9	10	11	12	13	14	15	16	17
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Step 5: Identification Qualification and Risk Mitigation Actions

Step 6: Qualification evidence and Deployment Checklist



Organisation	Activity
Technology Providers	Technology Provider plans and performs identified trials/tests/analyses to address qualification gaps and risks to advance their technology's TRL to the required level.
Operator	Operator provides support to the further qualification, This may include technical, financial and access to pilot well(s).
Tool	The FMECA template facilitates the documentation and management of qualification and risk mitigation actions.

NOTE:
The default risk matrix includes example risk categories. The developer should check against relevant technology, process and sector codes and standards for definitions more relevant to the technology and its application.
Please see the help sheet for further guidance, particularly in relation to changes to the risk matrix definitions.

Default risk category descriptions		Consequence severity					
		Financial consequence	People	Environment	Technical	ES&H	ES&H
		No or superficial injuries	Slight injury, a few lost work days	Major injury, long term absence	Single facility or permanent damage	Minor effect	Major effect
		Slight effect on environment < 1 BB, (damaged)	Minor effect	Major effect	Minor effect	Major effect	Major effect
		Notifiable	Notifiable	Significant	Major	Major	Major
Likelihood	Occurs several times per year per facility	$10^{-1} < p$	Frequent				
	Occurs several times per year per operator	$10^{-2} < p < 10^{-1}$	Probable				
	Has been experienced by most operators	$10^{-3} < p < 10^{-2}$	Occasional				
	An incident has occurred in industry or related industry	$10^{-4} < p < 10^{-3}$	Remote				
	Failure is not predicted	$p < 10^{-4}$	Very Unlikely				

Completion of risks and activities

FMECA Template

Organisation	Activity
Operator	Operator reviews the evidence of completed qualification and risk mitigation actions from technology provider, updates risk assessment and completes deployment checklist
Technology Providers	Technology Provider submits TRL compliance documents to operator as evidence of fulfilling all requirements and creates deployment checklist for technology deployment and verification.
Tool	The Deployment Checklist tool is used to confirm all risk mitigations, procedures, and compliance checks are in place before installation

Closeout of evidence and remaining actions

Deployment Checklist

DEPLOYMENT CHECKLIST TEMPLATE

This checklist provides a general framework. The specific requirements will vary depending on the individual well characteristics, regulatory environment, and chosen technologies. Regularly review and update the checklist based on lessons learned from previous PSA operations.

Item	Section	Checklist	Comments	Notes	References to procedures/documents	Sign off	Name	Date
		Comprehensive review of well history, construction and intervention activities to identify to get core and potential challenges, testing results, logs, completion details, workover records	<input type="checkbox"/>					
		Review of well integrity data (pressure, leaks, corrosion, cement bond logs)	<input type="checkbox"/>					
		Target casing pipe evaluation and advice for use with live barrier element	<input type="checkbox"/>					
		Target annular properties are suitable for well barrier technology (accidentals, etc.)	<input type="checkbox"/>					
		Identification of potential challenges (shut pipe, casing damage, annular pressure)	<input type="checkbox"/>					
Well Data Review		Detailed analysis of the wellbore environment and available conditions (temperature, pressure, fluid composition) to ensure compatibility with the barrier technology specifications	<input type="checkbox"/>					



- Aspects of the NZTC TQ Framework have so far been used to provide support / feedback to a number of technology developers including:
 - Wellstrom T1000
 - Resolute Assure ® EPG
 - Isol8 Fusion Alloy
 - Peer-review of DNV-RP-A203 document qualifying the Local Casing Expander tool with Shell
- NZTC TQ Framework to be used to support further 2025/2026 pilot deployments
 - Multiple pilots being planned



The Wells Decommissioning Collaboration

A Problem Shared is a Problem Solved.

Sponsored by:

ConocoPhillips



Harbour Energy

OKEA

PETROBRAS

REPSOL



Discover more



Multi-Operator **collaboration** accelerating the rate in which technology is developed, tested and piloted **for well decommissioning**.



Alternative Barrier Materials

Alternative materials used solely or in composite barriers have potential to provide more reliable and resistant isolation compared to cement.



Inspection and Verification

Reliable barrier design and construction relies on assessment of the integrity through existing well construction. Through tubing evaluation allows for this to be completed in advance of the abandonment programme.



Enabling Technology

Enabling technologies provides through tubing services to perform a wide range of task to support barrier placement.

7 Wdc

The Wells
Decommissioning
Collaboration

3000



Net Zero
Technology
Centre

Technology Driving Transition

A problem shared is a problem solved.

Lewis Harper
Programme Manager - Collaborations
lewis.harper@netzerotc.com

ConocoPhillips



Harbour
Energy



What's happening next

- NZTC TQ Framework will be available on the NZTC website from the end of June for developers and operators wanting to use it.
- Second Party Peer-Review by DNV
- Ongoing collaboration with NSTA, Havtil, GRaPA to support wider adoption
 - Review of guidelines and regulations from additional regions (e.g. Brazil, Australia, Malaysia etc)
- Incorporation of feedback and continuous improvement
- Potential extension of framework for enabling technologies

Register your interest
in the Framework



Thank you

Register your interest
in the Framework



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