Norsk olje&gass

Recommended practice for Qualification of new technology and barrier elements for use in P&A

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FOREWORD

After discussion in the Plugging and Abandonment Forum (PAF), the decision was taken to establish a recommended practice for Qualification of new technology and barrier elements for use in P&A

The manager drilling is responsible for the practice.

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1 INTRODUCTION

This recommended practice may serve as a reference for companies without a defined qualification process in their business management system.

2 PURPOSE

The practice was developed for use for new technology and barrier elements for use in P&A on the NCS, but it is a generic process applicable for any technology qualification.

3 RULES AND REGULATIONS

PSA Regulations
Facility Regulation section 9 Qualification of new technology and new methods.

"Where the petroleum activities entail use of new technology or new methods, criteria shall be drawn up for development, testing and use so that the requirements for HSE are fulfilled.

The criteria shall be representative for the relevant conditions of use, and the technology or methods shall be adapted to already accepted solutions.

The qualification or testing shall demonstrate that applicable requirements can be fulfilled using the relevant new technology or methods".

Guideline Facility Regulation section 9 Qualification of new technology and new methods

*"**DNVGL RP-A203** and **Oil & Gas UK Guidelines on Qualification of Materials for the Abandonment of Wells, issue 2** can be used to fulfil the requirements regarding methods for the qualification of new technology".*

NORSOK D-010 (2021)
Sub clause 5.2.4 states: *"To qualify as a WBE, a well component shall conform to the acceptance criteria requirements specified in its corresponding EAC table. EACs shall be in place for all WBEs used."* and *"A new EAC table shall be developed in cases where an EAC table does not exist for a specific WBE. The level of detail shall be defined by the user"*.

As an example, PWC (Perforate/wash/cement) cement plug was included in this revision and the acceptance criteria for PWC is shown in EAC Table 61.

Builds on experience with emphasis on establishing a track record, best practice and qualification matrix

Emphasis on limitations of application
Reference to establish track record

4 OPERATOR' ROLE IN TECHNOLOGY QUALIFICATION

For an Operator, technology qualification might start at any point in the TRL table depending on its maturity.

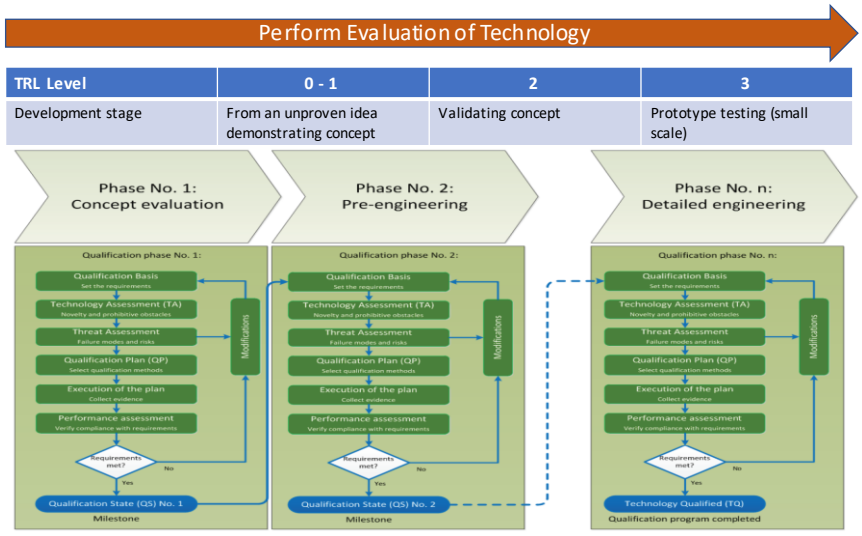
1. Identify technology need (use-case)
2. Make business case for use-case
3. Identify stakeholders and internal approval matrix
4. Perform TRL assessment
5. Perform qualification activities
6. Implement new technology

Technology Readiness Level (TRL) - comparison of different scales

Sirous F. Yasseri, Hamid Bahai / IJCOE 2018, 2(2); p.31-44

	API 17N's TRL	API 17N's TRL	Development Stage Completed	Definition of the development stage	NASA Like TRL
Concept	initiation	0	Unproven Concept (Basic R&D, paper concept)	Basic scientific/engineering principles observed and reported; paper concept; no analysis or testing completed no design history.	1
Proof-of-concept	Concept	1	Proven Concept (As a paper study or R&D experiments)	a) Technology concept and/or application formulated b) Concept and functionality proven by analysis or reference to features common with/to existing technology c) No design history; essentially a paper study not involving physical models but may include R&D experimentation	2
	Proof-of-concept	2	Validated Concept (experimental proof of concept using physical model tests)	Concept design or novel features of the design is validated by a physical model, a system mock-up or dummy and functionally tested in a laboratory environment; no design history; no environmental tests; materials testing and reliability testing is performed on key parts or components in a testing laboratory prior to prototype construction	3
Prototype	Integration	3	Prototype Tested (System function, performance and reliability tested	a) Item prototype is built and put through (generic) functional and performance tests; reliability tests are performed including reliability growth tests, accelerated life tests and robust design development test program in relevant laboratory testing environments; tests are carried out without integration into a broader system b) The extent to which application requirements are met are assessed and the potential benefits and risks are demonstrated	4
	Demonstration	4	Environment Tested (Pre-production system environment tested)	Meets all Requirements of TRL 3; designed and built as production unit (or full scale prototype) and put through its qualification program in simulated environment (e.g. hyperbaric chamber to simulate pressure) or actual intended environment (e.g. subsea environment) but not installed or operating; reliability testing limited to demonstrating that prototype function and performance criteria can be met in the intended operating condition and external environment	5
	commissioning	5	System Tested (Production system interface tested	Meets all the requirements of TRL 4; designed and built as production unit (or full-scale prototype) and integrated into the intended operating system with a full interface and functional test but outside the intended field environment	6
Field qualified	Production	6	System Installed (Production system installed and tested)	Meets all the requirements of TRL 5; production unit (or full-scale prototype) built and integrated into the intended operating system; full interface and function test program performed in the intended (or closely simulated) environment and operated for less than three years; at TRL 6 new technology equipment might require additional support for the first 12 to 18 months	7
	Field proven	7	Field Proven (Production system has been field proven)	Production unit integrated into the intended operating system, installed and operating for more than three years with acceptable reliability, demonstrating a low risk of early life failures in the field	8 & 9

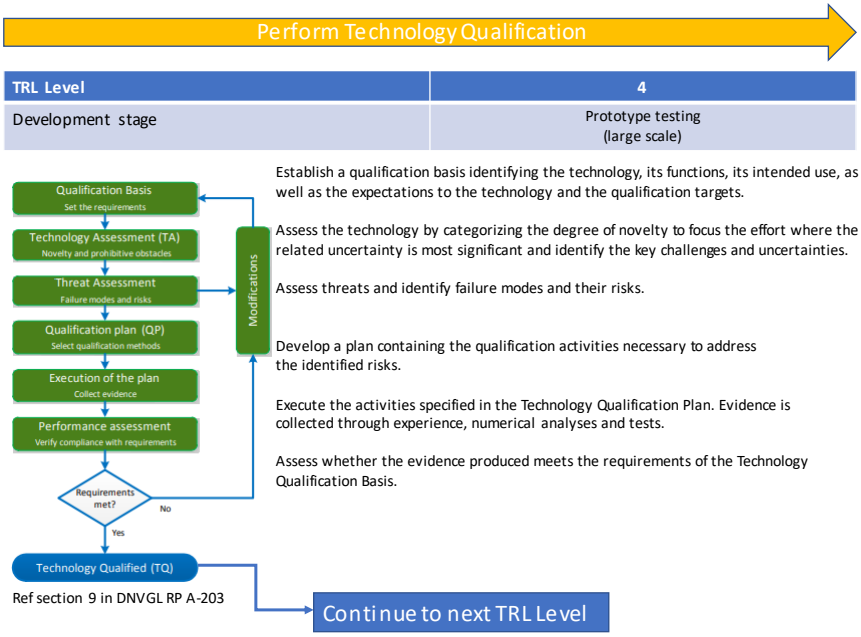
Roadmap for Technology Qualification based on TRL Level



Useful standards & guidelines that could be used during the development stages;
- DNVGL standards
- NORSOK standards
- UK Oil & Gas
- ISO standards
- API standards
- IEC standards
- NOROG Guidelines

Identify Technology need
Technology categorization in accordance with DNVGL-RP-A203 is useful as part of Technology Need Identification.

Roadmap for Technology Qualification based on TRL Level



Check-in with PSA about the technology development to ensure compliance with any regulatory requirements that could be valuable for the development

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Roadmap for Technology Qualification based on TRL Level

Implement New Technology

TRL Level	5	6	7
Development stage	Technology integration test	Technology installed	Proven technology
	Full scale prototype (or production unit) built and integrated into the environment where it is intended to operate, with full interface and functionality tests.	Full scale prototype (or production unit) built and integrated into the environment where it is intended to operate, with full interface and functionality tests. The technology has operated in accordance with the predefined performance criteria over a limited period of time.	The technology has operated in accordance with predefined performance and reliability criteria, over a period of time sufficient to reveal time-related effects. Required duration of operation is one of the pre-defined criteria. **The technology is now proven for use within specified operating conditions/limits.**

Provided the steps are followed and documented throughout the development, including an end of project qualification report, the technology is considered proven for field deployment.

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