



# Technology Qualification



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## Aker Clean Carbon CO<sub>2</sub> capture technology

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- Technology qualification – what and why?
- DNV's recommended practice - a new guideline specific for CO<sub>2</sub> capture
- Qualification process of CO<sub>2</sub> capture technology for Aker Clean Carbon

**CO<sub>2</sub>** Catch & Contain

Go clean.

*DNV's definition of Technology Qualification:*

*The process of providing the evidence  
that the technology will function reliably  
within specific limits*



# DNV Qualification Process



MANAGING RISK

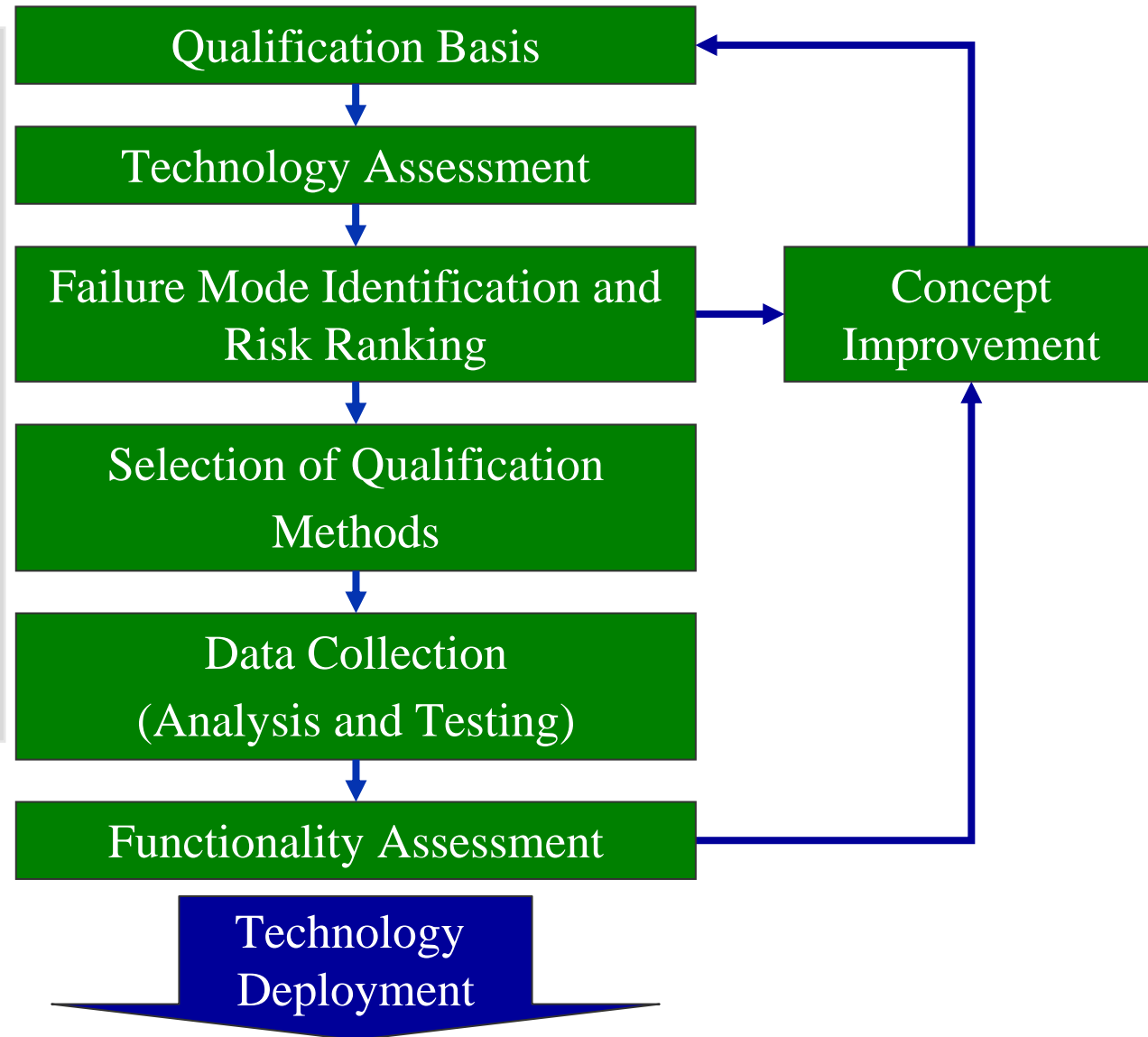


RECOMMENDED PRACTICE  
DNV-RP-A203

QUALIFICATION PROCEDURES FOR  
NEW TECHNOLOGY

SEPTEMBER 2001

DET NORSKE VERITAS



# Guideline for Qualification of CO<sub>2</sub> capture technology

MANAGING RISK

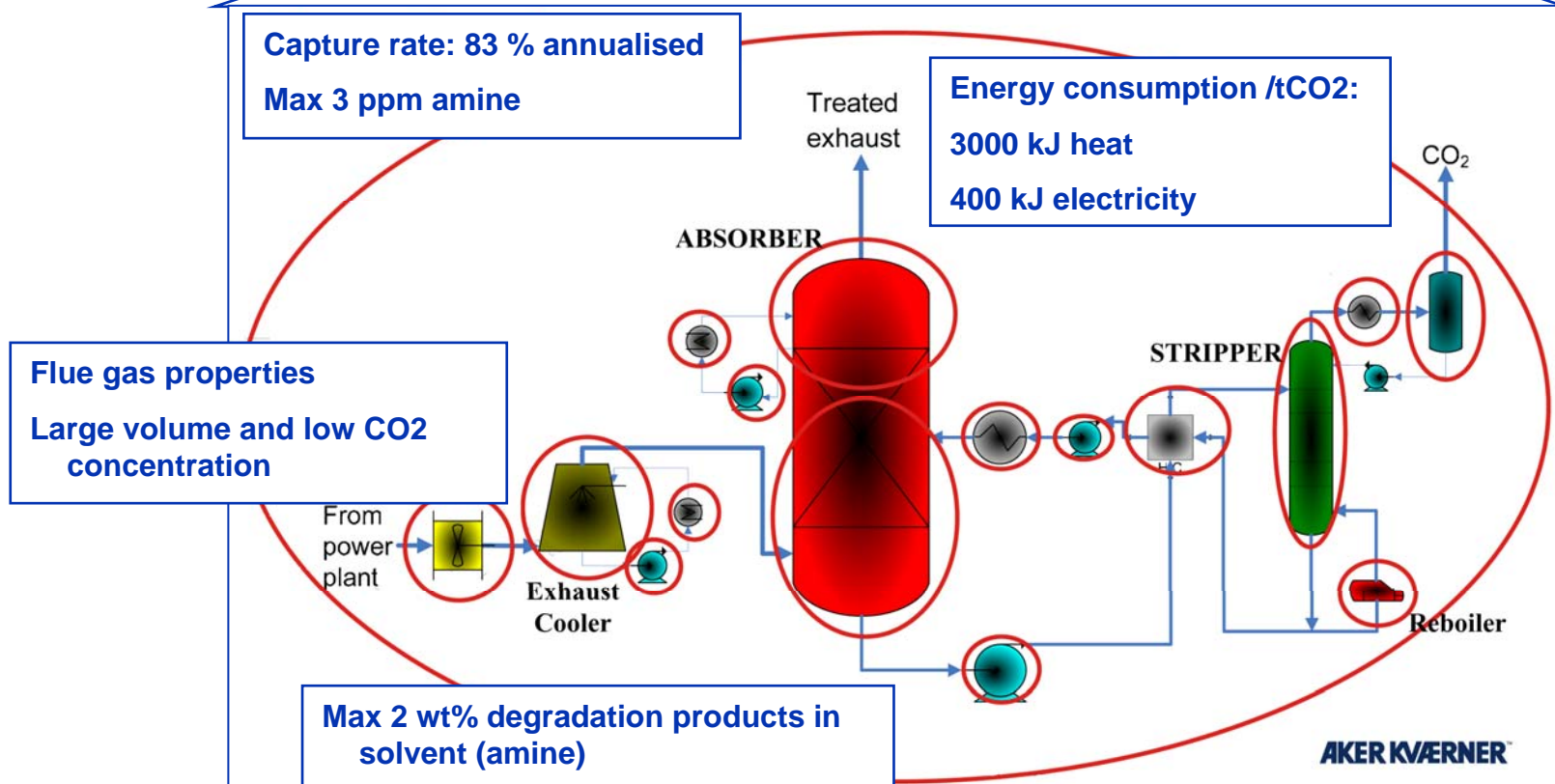


- Draft guideline was issued 15 May 2007
  - Process and CO<sub>2</sub> capture specific
- The procedure is tested on 3 selected CO<sub>2</sub> capture technologies (case studies)
- *A final updated guideline will be delivered autumn 2008*



## Qualification Basis

### Frame conditions



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## Technology Assessment

### *Technology Assessment according to DNV RP-A203*

Application Area	Technology status		
	1 Proven	2 Limited field history	3 New or unproven
1. Known	1	2	3
2. New	2	3	4

**1: Proven technology**     **2 - 4: New Technology**

#### Elements of new technology:

- Amine
- Interface to existing industrial site
- Heat exchangers
- Pumps

## Failure Mode Identification and Risk Ranking

		Consequence severity →				
		1 VERY LOW	2 LOW	3 MEDIUM	4 HIGH	5 VERY HIGH
Probability ↑	5 VERY HIGH				<b>HIGH</b>	
	4 HIGH				<b>HIGH</b>	
	3 MEDIUM			<b>MEDIUM</b>		
	2 LOW		<b>LOW</b>			
	1 VERY LOW					

### Key uncertainties

Up-scaling - fluid flow in absorber and stripper

Amine efficiency – energy usage and degrading

Materials properties – failure modes and resistance under influence of solvent

Innovative solution for heat efficiency – reducing energy need

Consequences might be economical, environmental, safety-related, brand impact etc

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## Selection of Qualification Methods

No	Qualification method	Component	Failure Mode	Failure Mechanism	Type of activity
1	Validate CFD Modelling	Liquid distributor in absorber	Uneven distribution in column	Modelling uncertainty	Pilot scale distributor test
2	Verify solvent Properties	Solvent	Reduced CO2 capture rate	Too high degradation of solvent	Long term (min. 3000 h) test of solvent properties
3	Lab testing of materials suitability	Piping	Leakage	Corrosion	Long term (min. 3000 h) test with corrosion probes

- All the Qualification Methods were evaluated in respect to the Probability of Success.

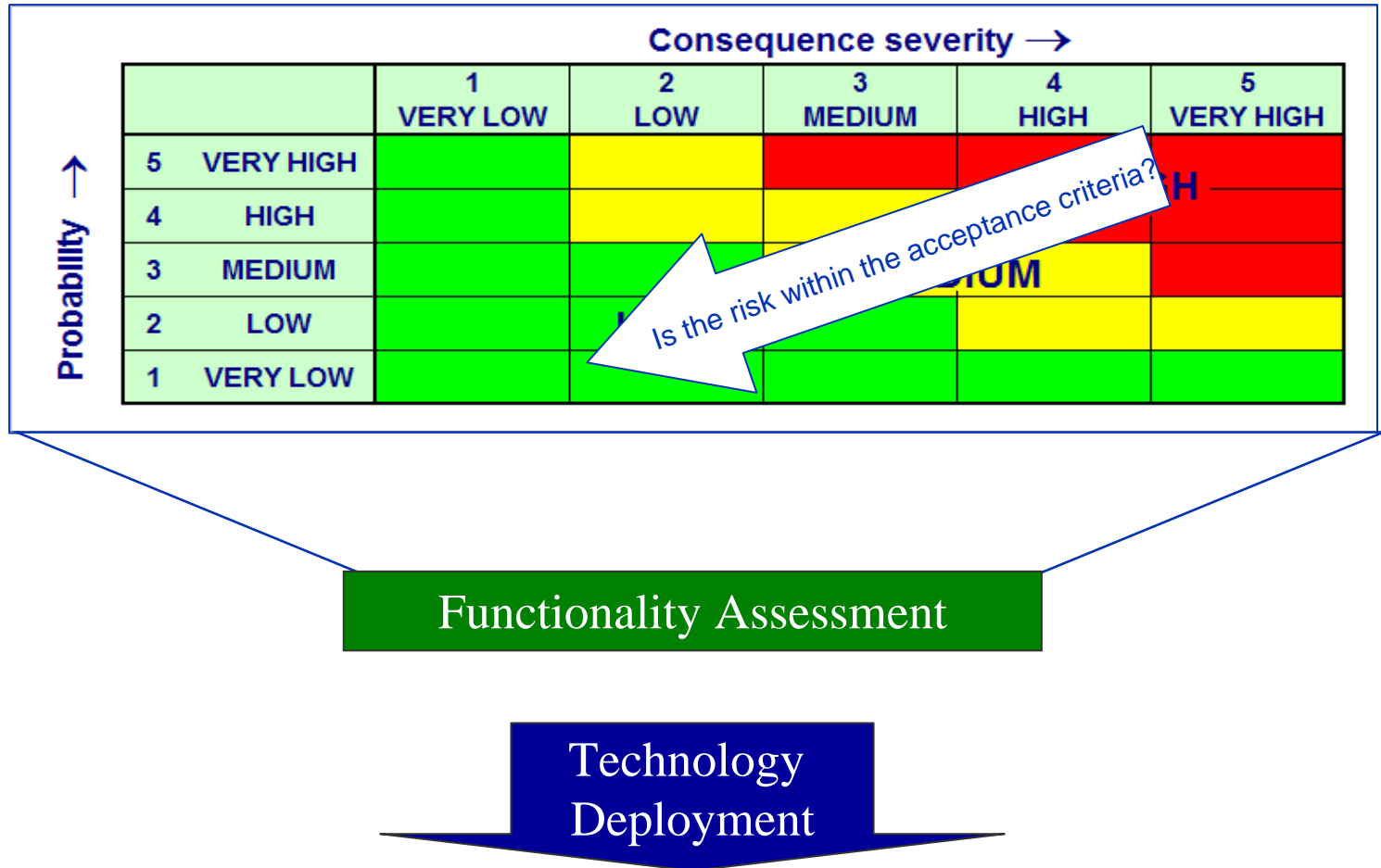
**Example: PoS Matrix – likelihood to complete an activity due to the technical challenge**

<b>Technical Challenge</b>		<b>PoS</b>
Project design and testing	1	High
Technical improvement	2	Medium
Technical Development	3	Low

- The overall Probability of Success for the Aker Clean Carbon CO<sub>2</sub> capture technology has been regarded as satisfactory and a “Statement of Endorsement” has been issued.

<p>Collect qualification data (Work the plan)</p>	<p>A risk reducing measure (Qualification Method) was given to every failure mode with Medium or High risk.</p>
<p>Qualification methods:</p> <ul style="list-style-type: none"><li>Lab scale / long term pilot scale test</li><li>CFD modelling</li><li>Dispersion analysis</li><li>Acquire documentation</li></ul>	<p>Risavika testing address uncertainties in:</p> <ul style="list-style-type: none"><li>amine efficiency / properties,</li><li>materials properties</li><li>heat efficiency</li></ul>

**Data Collection  
(Analysis and Testing)**



# Aker Clean Carbon Technology Qualification

MANAGING RISK

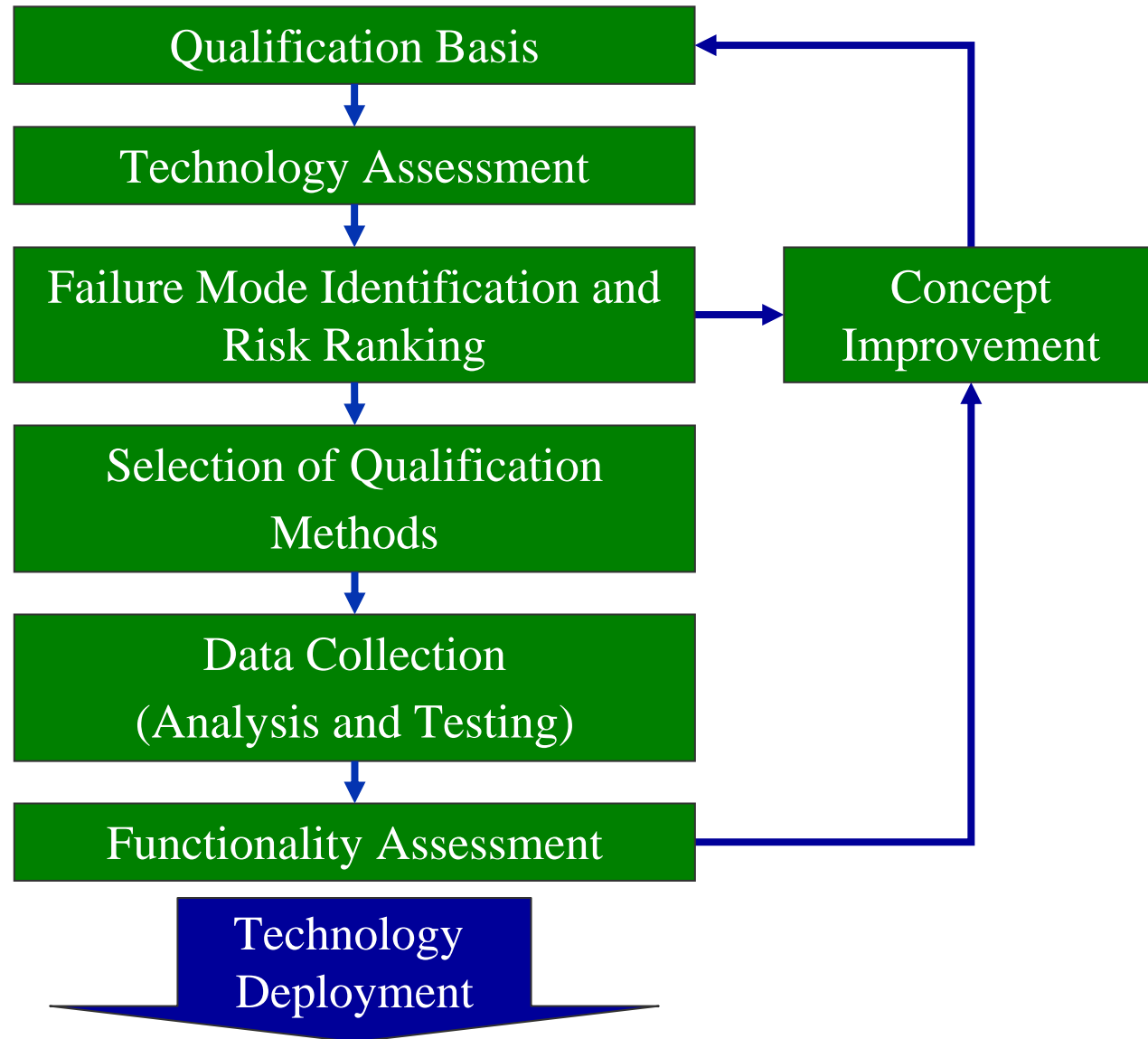


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GASSNOVA  
JOINT INDUSTRY PROJECT

GUIDELINE FOR QUALIFICATION OF  
CO<sub>2</sub> CAPTURE TECHNOLOGY

REPORT NO. 2007-0619  
DRAFT REVISION NO. 00



- The **risk** of introducing **unproven** technologies can be high
- DNV's procedure for qualification of new technology **builds confidence** in new technologies
  - A structural approach to identify potential modes of failure.
  - Ensuring that failure modes of high risk are adequately addressed.
  - Giving all stakeholders a transparent and structured documentation of the qualification, increasing their trust in the technology.
- Aker Clean Carbon capture technology is in the final stage of being qualified according to DNV procedure – and the probability of success is judged to be good!

Go clean.



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