Addressing Reliance Upon and the Reliability of Downhole Safety Valves: Goals, Challenges, and Progress of a Cross Industry Initiative

RWOT DHSV System Working Group

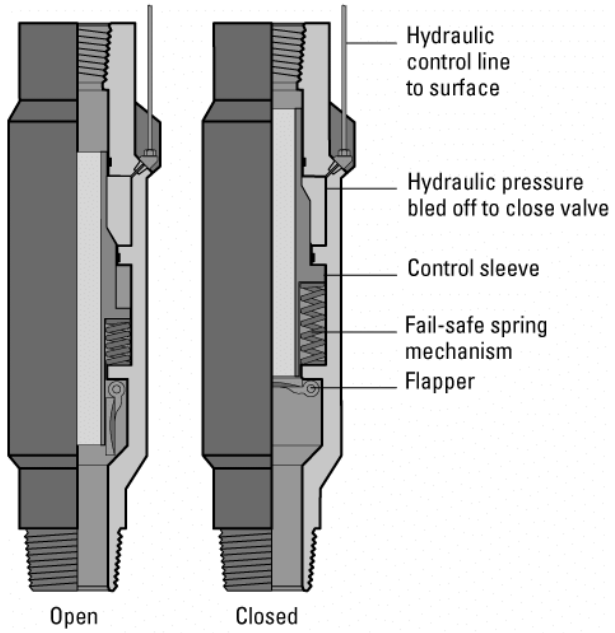
Presented By Christian Shields (RWOT Chair)

Reservoir & Wells Optimisation Team / Wells Taskforce

WELLS
TASK
FORCE

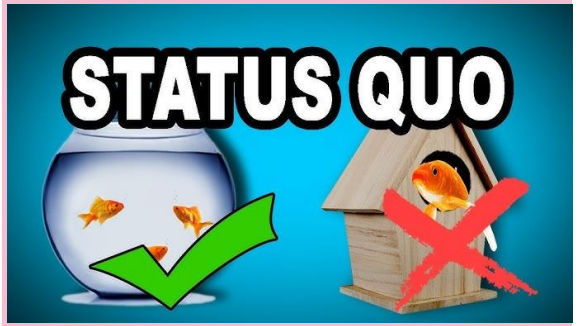
Presentation Outline

WELLS TASK FORCE



DHSV issues impact

History



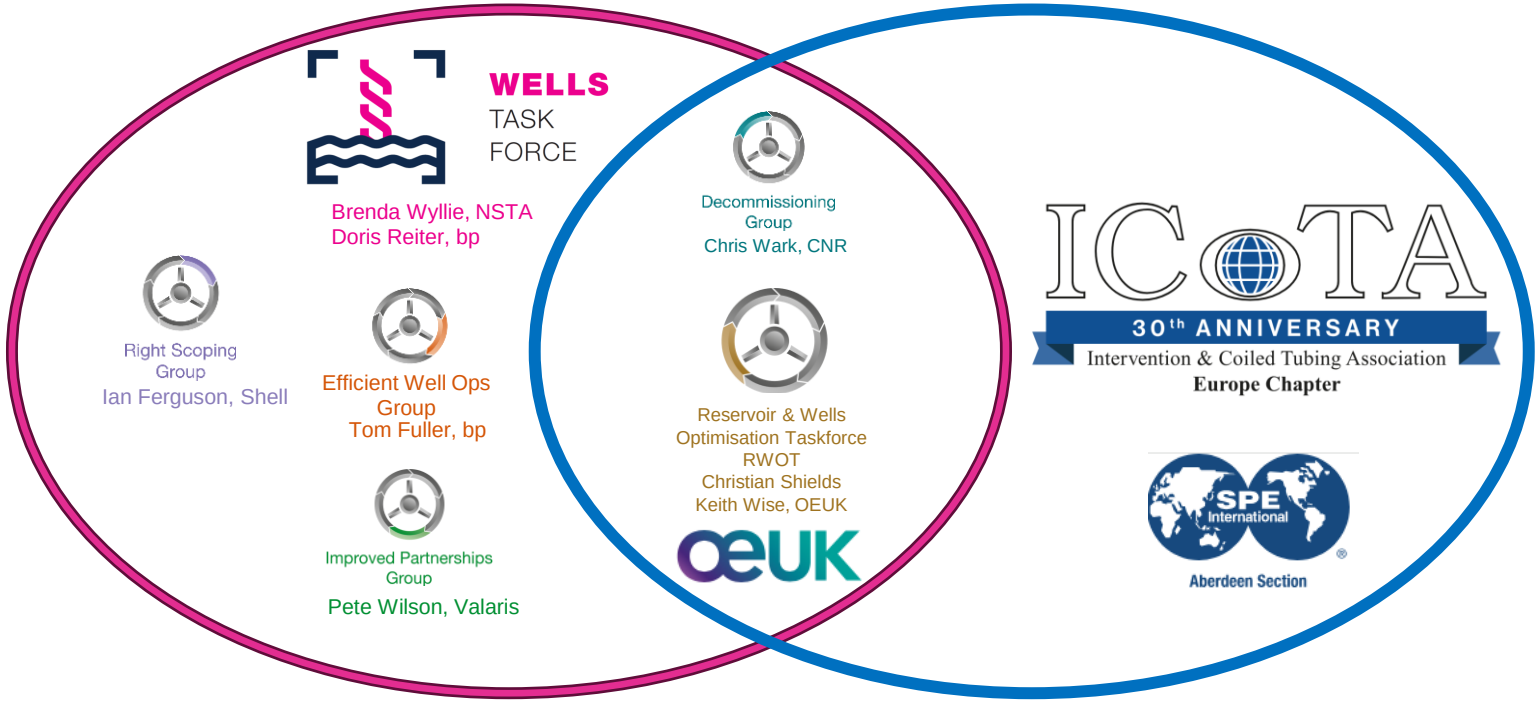
Maintaining the Status Quo

Improving System Reliability

Existing Well Integrity Practice

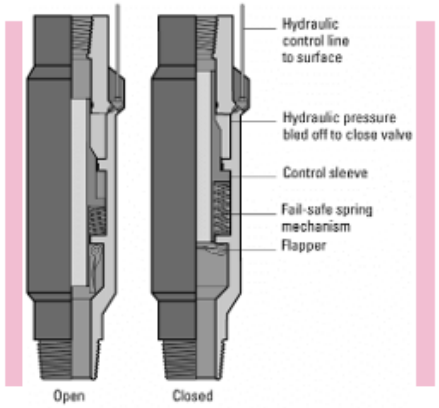
Collaboration

Wells Task Force, RWOT/OEUK & ICoTA



Wells with DHSV Issues / Shut in Wells

WELLS TASK FORCE



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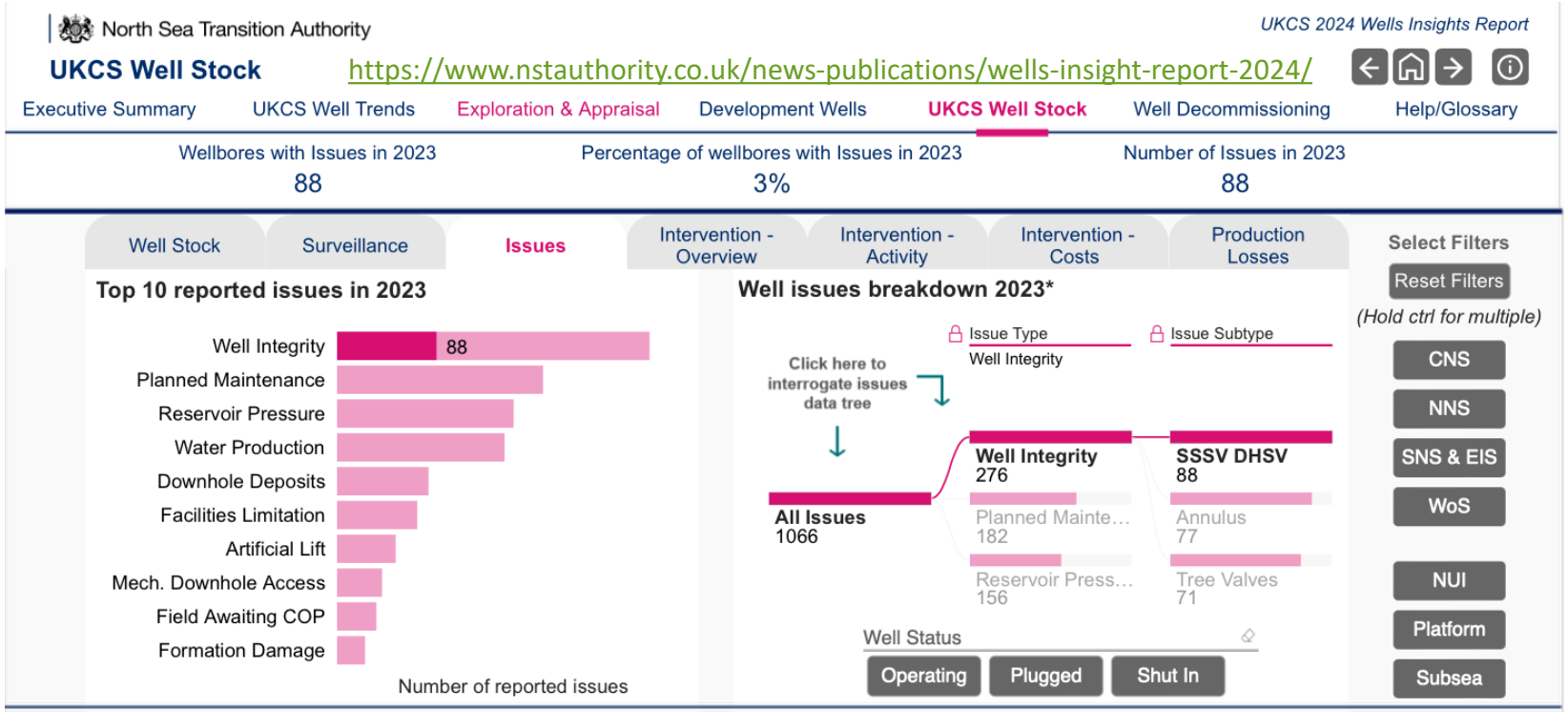
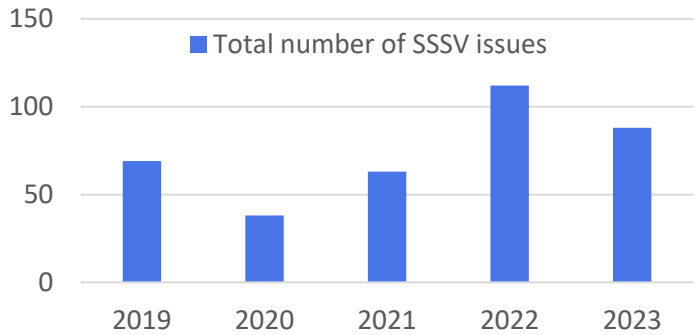


2023 Wells Issues 88 wells have/had DHSV issues (**29 operating**, 7 Plugged, **52 shut in**)

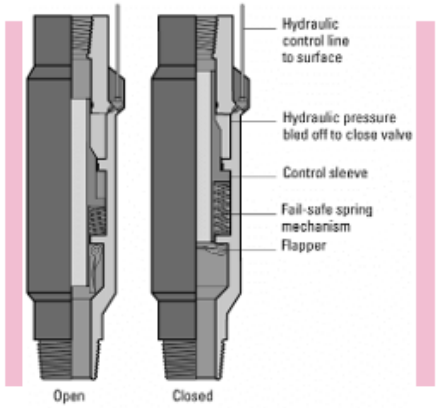
Currently 9 UKCS wells long term shut for 7 operators under the cause ‘DHSV issues’



Shut in well re-opening prize?
What are the technical challenges? Losses?
Can the collaboration help?

Where is the Pain? Interventions

WELLS TASK FORCE



DHSV issues impact

History

North Sea Transition Authority

UKCS 2024 Wells Insights Report

UKCS Well Stock

https://www.nstauthority.co.uk/news-publications/wells-insight-report-2024/

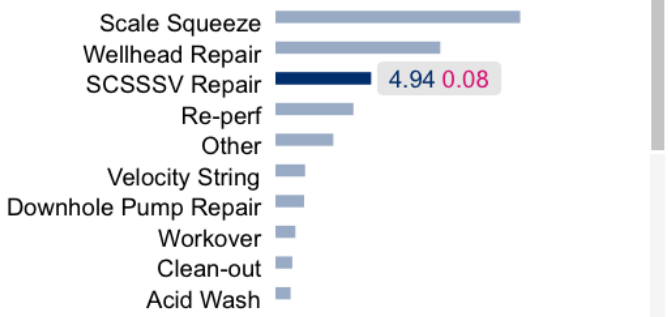
Executive Summary | UKCS Well Trends | Exploration & Appraisal | Development Wells | **UKCS Well Stock** | Well Decommissioning | Help/Glossary

Total Production Added (MMboe) in 2023	Average Production Added per Job (boe) in 2023	Total Success Rate in 2023
4.9	82.3K	63.3%

Well Stock | Surveillance | Issues | Intervention - Overview | **Intervention - Activity** | Intervention - Costs | Production Losses

Total added and average production per job

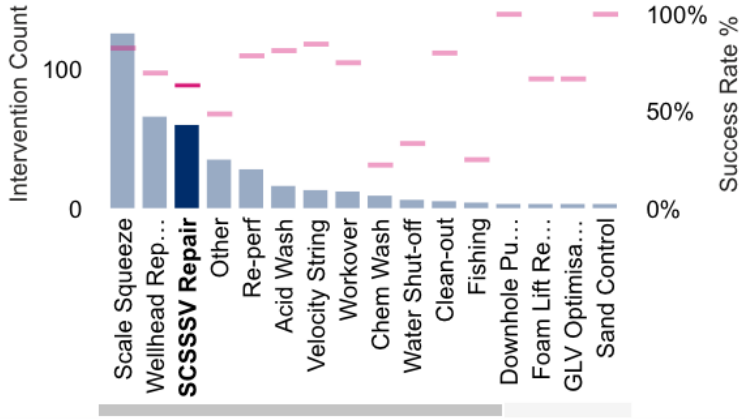
● Total Production Added (MMboe) ● Avg Production Per Job (MMboe)



Optimisation | Restoration | Safeguarding

Activity and technical success rate

● Intervention Count — Success Rate %



Select Filters

Reset Filters

(Hold ctrl for multiple)

CNS | NNS | SNS & EIS | WoS

NUI | Platform | Subsea

Interventions 60 jobs = 4.9 Mmboe for £35M

Cost Metric £7/bbl at £0.576M/job. Success Rate 63.3%

How to improve intervention success / type?
Can we reduce interventions / costs and losses?

Where is the Pain? Interventions

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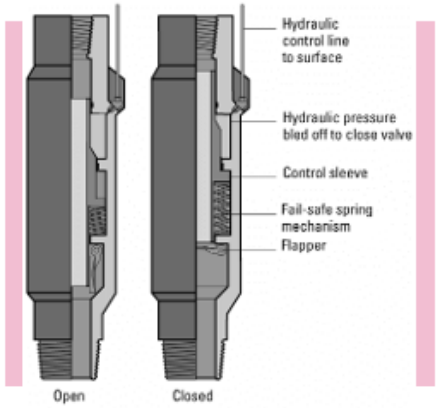

DHSV issues impact

History

	Year	2021	2022	2023	3 year figures	Comments
NUI	Job Count	8	7	9	24	steady level of jobs
	£/boe	£11.80	£11.81	£12.49	£12.06	
	Success Rate (%)	75%	71%	33%	58%	Poor success rate in 2023 - why?
	Average Job Cost	£707,788	£337,485	£275,579	£437,704	£100k more than platform equivalent
	Total Cost	£5,662,300	£2,362,392	£2,480,215	£10,504,907	
Platform	Job Count	27	42	50	119	Sharp Rise in Platform Jobs
	£/boe	£2.83	£1.90	£2.57	£2.39	Very compelling economics to fix
	Success Rate (%)	67%	76%	70%	71%	30% of jobs fail
	Average Job Cost	£255,411	£281,544	£410,650	£329,861	Costs are high and are increasing
	Total Cost	£6,896,088	£11,824,855	£20,532,520	£39,253,464	Biggest spend, because of most wells
Subsea	Job Count	1	1	2	4	relatively few jobs
	£/boe	£20.00	£250.78	£0.00	£79.50	economics for 12m don't look good
	Success Rate (%)	100%	100%	0%	50%	Poor success rate
	Average Job Cost	£4,952,000	£7,523,466	£5,789,341	£6,013,537	Expensive job cost - LWIV / rig / DSV
	Total Cost	£4,952,000	£7,523,466	£11,578,681	£24,054,147	

2023 Interventions 60 jobs = 4.9 Mmboe for £35M, Cost Metric £7/bbl at £0.576M/job. Success Rate 63.3%

How to improve intervention success / type?
Can we reduce interventions / costs and losses?

Timeline of Collaborative DHSV Focus

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NSTA/OEUK RWOT Benchmarking	Benchmarking Category set up in 2010	Consistently in the most frequent DH intervention types	Trends are getting worse but need more data	Action required
RWOT Workshops	**Brenda's era** DHSV workshop 3 OEMS highlighted operating care Good discussions – but no shared documents	**Doris/Marie's era** ongoing conversations around DHSV issues	**Christian's era** Storm choke / DHSV operating envelope (Sept '23) Further DHSV problem framing (June '24)	**Christian's Era** DHSV working group initiative (ongoing)
OGTC / NZTC - DHSV Project	lead by Sara De Boer with Colin Black and …	DHSV opening RCA A range of innovative technologies to help common faults	Springboard for new technology e.g. Pulse 8 (Tendeka/TAQA)	Currently looking at DHSV suitability for CCS

Previous RWOT Co-Chairs – Stathis Kitsios, Brenda Wyllie, Katy Heidenreich, Doris Reiter, Marie Morkved, Keith Wise, Christian Shields

A North Sea Operator – The Ambient Valve (Storm Choke) Losses – Sept 2023

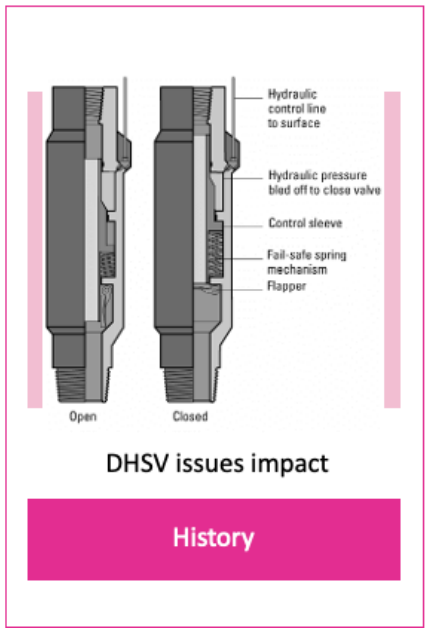
>1,000,000 bbls lost production in 3 years

Losses Incurred to Maintain Operating Window of Ambient Valves (Slugging and Testing Capability)

832 kbbls lost production from storm choke wells

In Sept '23 burning 1157 bopd of 'losses' from 5 wells

2 workovers planned on the larger economic wells



– but got better

Adapting Guidelines post RWOT workshop

Operating window changed – below flowline pressure

Set up via a flattened test separator

Re-tested by shutting off gas lift and tripping

Loss are perhaps the biggest economic driver but are not captured in Stewardship

… yet they had

Justified not installing Storm Choke Subsea

Non economic workover / intervention

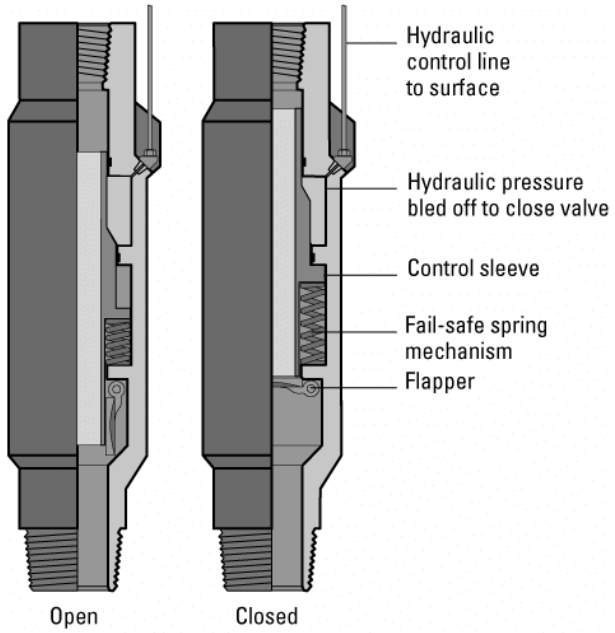
Well was sub–hydrostatic and gas lifted to flow

Protected Tree

Risk Assessment & ORA underpinned by yearly intervention / surveillance and reservoir modelling obligations

Presentation Outline

WELLS TASK FORCE



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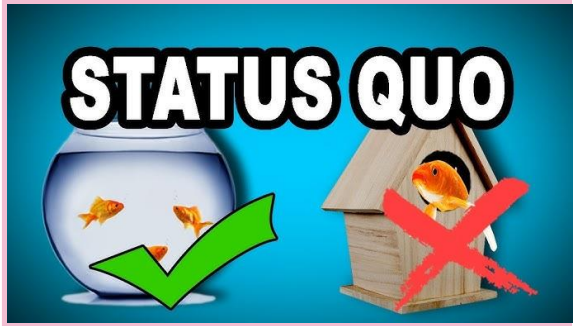

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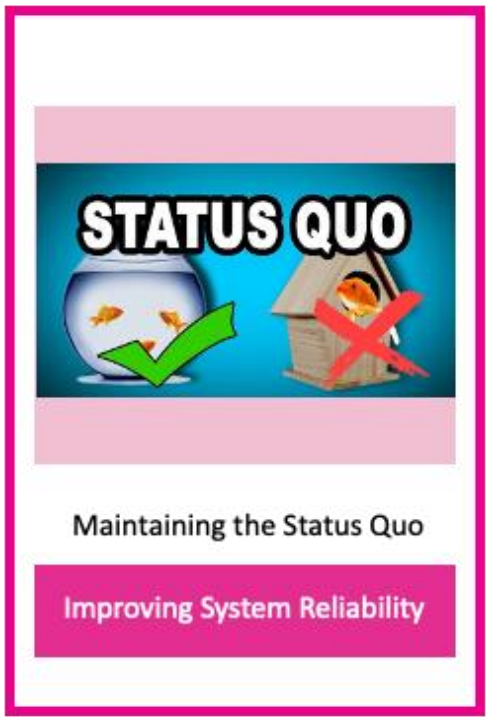
OGTC / NZTC Study – Key Faults

WELLS TASK FORCE



Key Fault Findings

The Oil & Gas Technology Centre
Your Innovation Partner

Common Faults

- Communicating with the tool
- Operating the valve mechanism
- Damage/deposits in flapper/seal
- Fixing failed hydraulic system challenging

Technology Areas

- Hydraulic Communication Alternative
- Electric Valve (Comms and Operation)
- Alternative to Flapper Valve (e.g. Iris)
- Position Sensing
- Nano Cleaners
- Self Cleaning
- Control Line Keyhole Surgery

Key Fault Findings & Solutions – Adapted and Expanded

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Ranked Faults

?

?

Communicating with the tool

?

Operating the valve mechanism

?

?

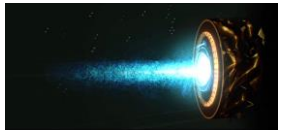
Damage/deposits in flapper/seal

Fixing failed hydraulic system challenging

New & Existing Technology Areas

Hydraulic Communication Alternative

Electric Valve (Comms and Operation)



Alternative to Flapper Valve (e.g. Iris)

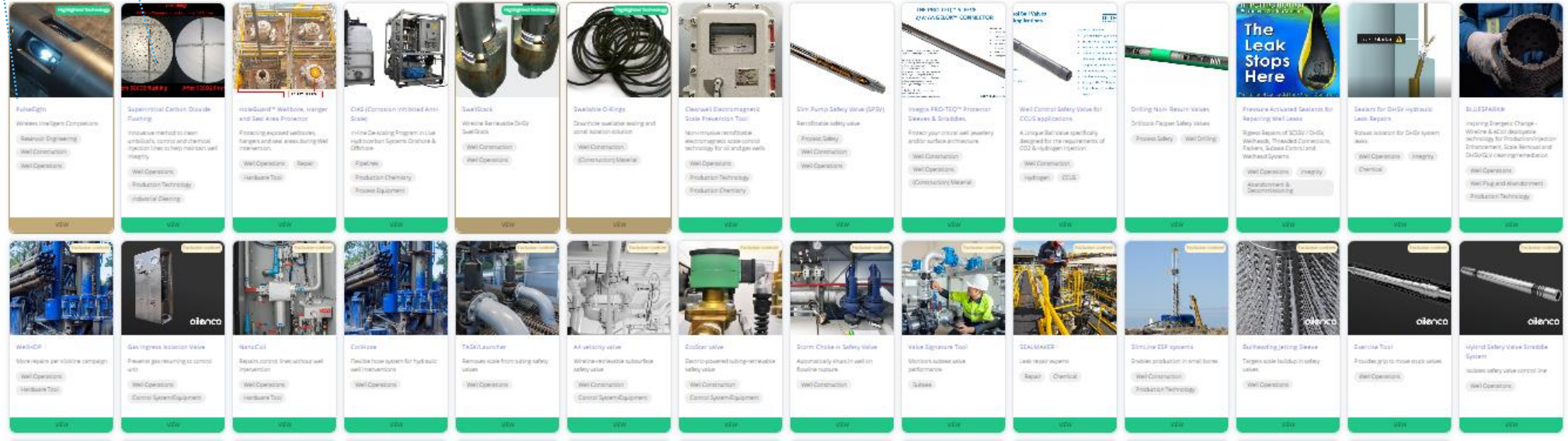
Position Sensing

Nano Cleaners

Self Cleaning

Control Line Keyhole Surgery

Expanded & Existing Solutions



Filling the Toolbox - Digitally

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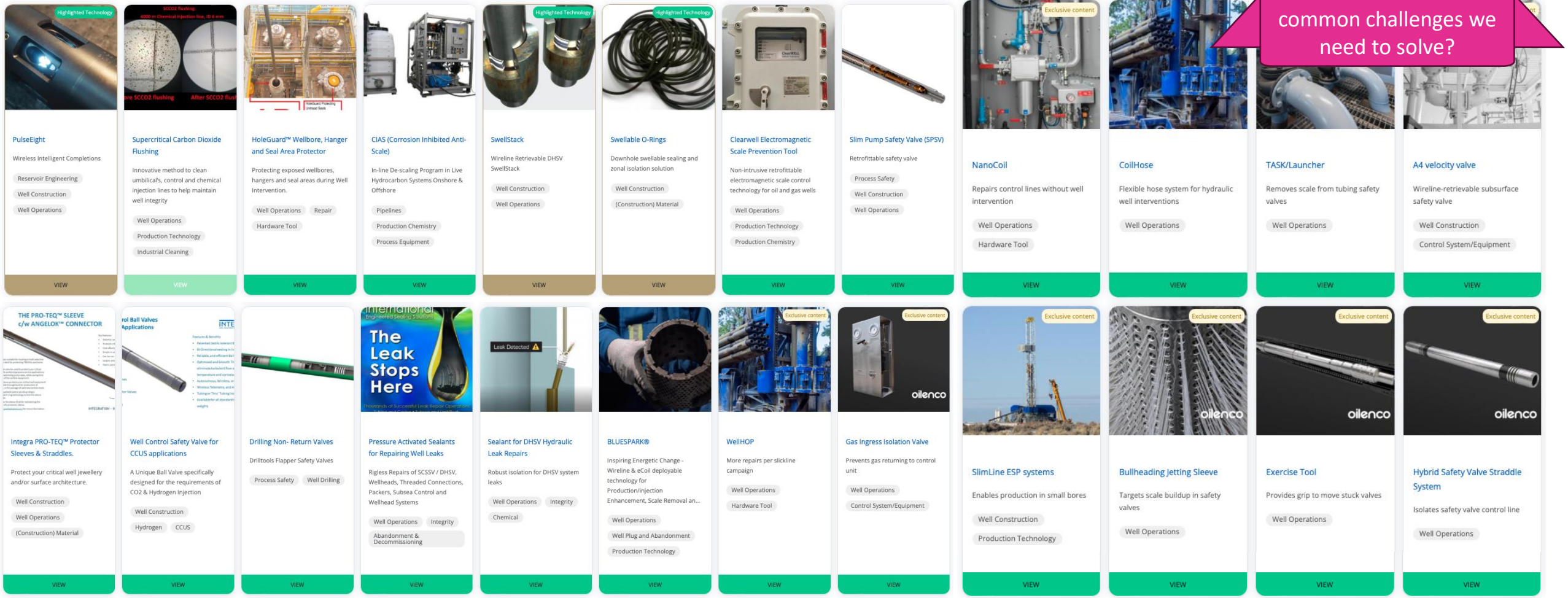
A DHSV system troubleshooting call for solutions and techniques was posted on the NSTA / OEUK supported UK Energy Technology Platform

41 associated solutions/tools/technologies were gathered Solutions to address Downhole Safety Valve Challenges | UKETP (energytechnologyplatform.com Has your company entered a solution yet?

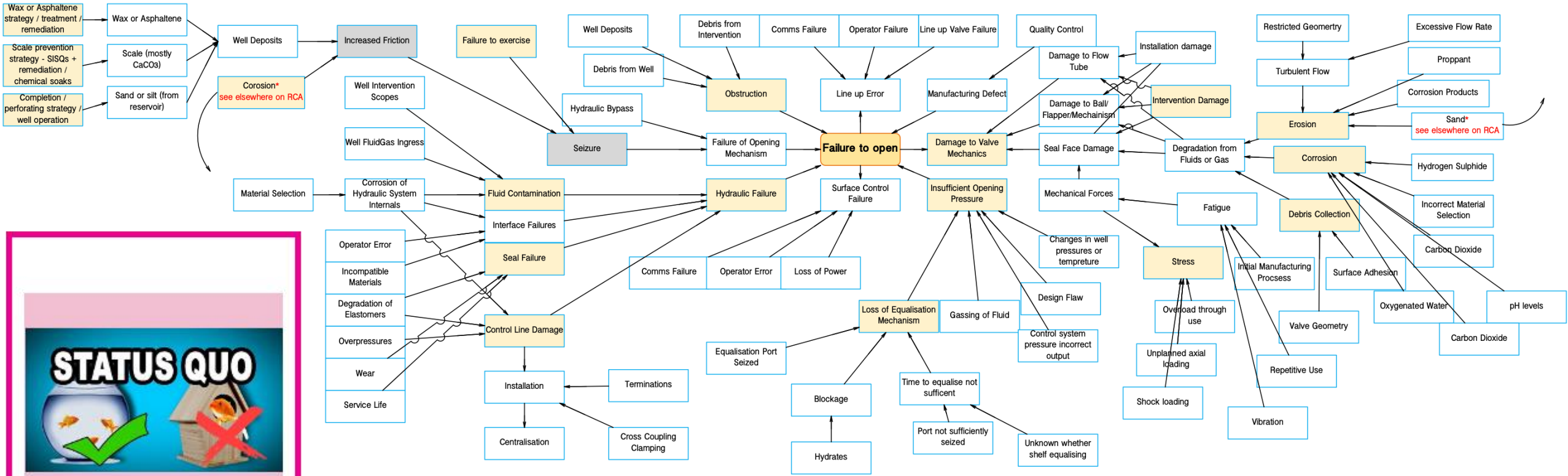
WHAT IS THE PROBLEM? common challenges we need to solve?

Solutions to address Downhole Safety Valve Challenges



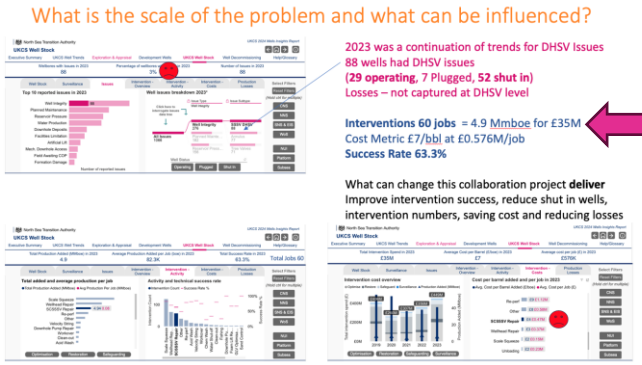
OGTC / NZTC Study – Root Causes

WELLS TASK FORCE



Quest for Further Data – Frame the Problem

WELLS TASK FORCE



- Just limited to 2023 data – online tool does not allow any multi year analyses
- What do we already know

- Compile all text replies from well issues
- Anonymise operators
- Look at shut in well data

Current Wells Insight Report

Compile data from last 5 years of stewardship

Send FMECA questionnaire to operators

engage the OEMs SLB / Halliburton / Weatherford individually

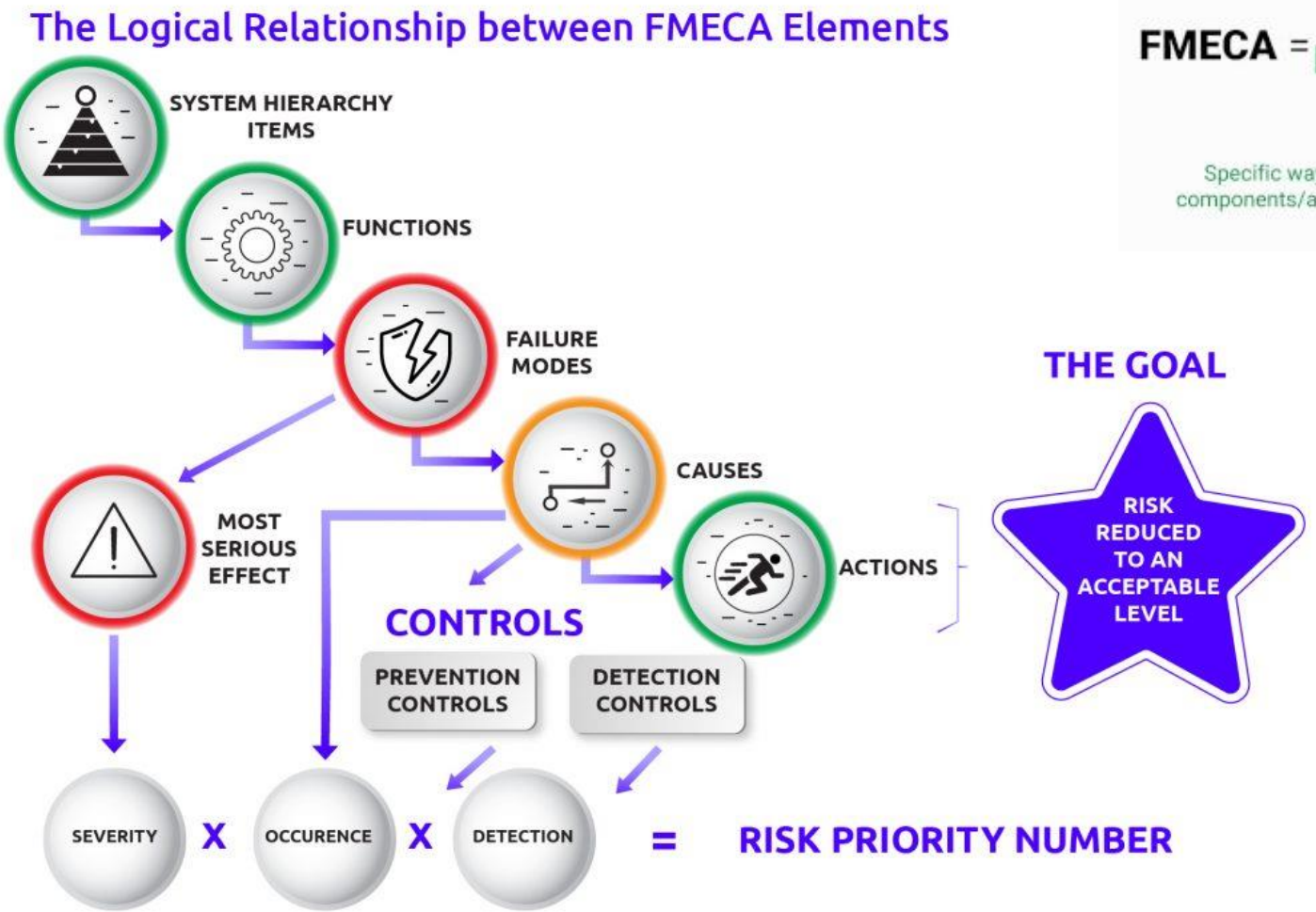
- Provides the fullest picture of what the system trends are
- This will take the longest time to turn around

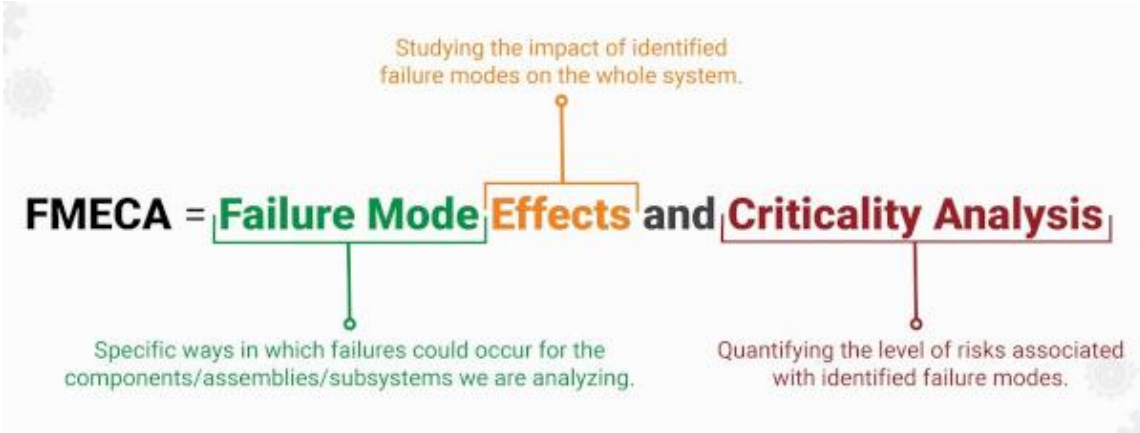
- Anonymise company & compile failure trends
- This may just give valve failures and not the full picture of the total system
- May not have operator cause insights

Company	Valve type TRRSSV WLRSSV storm choke	Well type Platform subsea NUI	Well function Oil /gas/ WINJ	Component that failed Control line / seal bore / flapper valve etc	Failure mode	Failure Cause	Systemic Cause (underlying cause)	Remedial action

FMECA and other Reliability Techniques

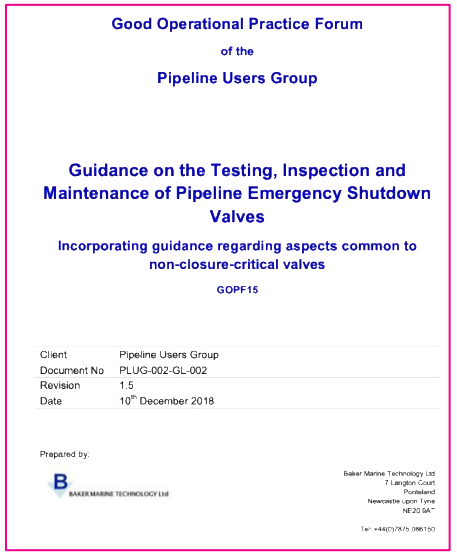
WELLS TASK FORCE





What Could the Project Achieve? **Guidance**

WELLS TASK FORCE



Good Operational Practice Forum

of the

Pipeline Users Group

Guidance on the Testing, Inspection and Maintenance of Pipeline Emergency Shutdown Valves

Incorporating guidance regarding aspects common to non-closure-critical valves

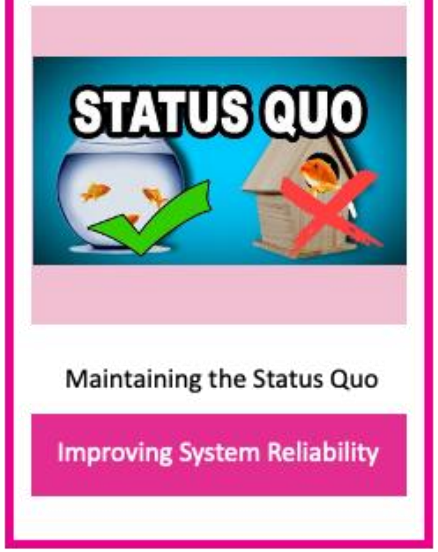
GOPF15

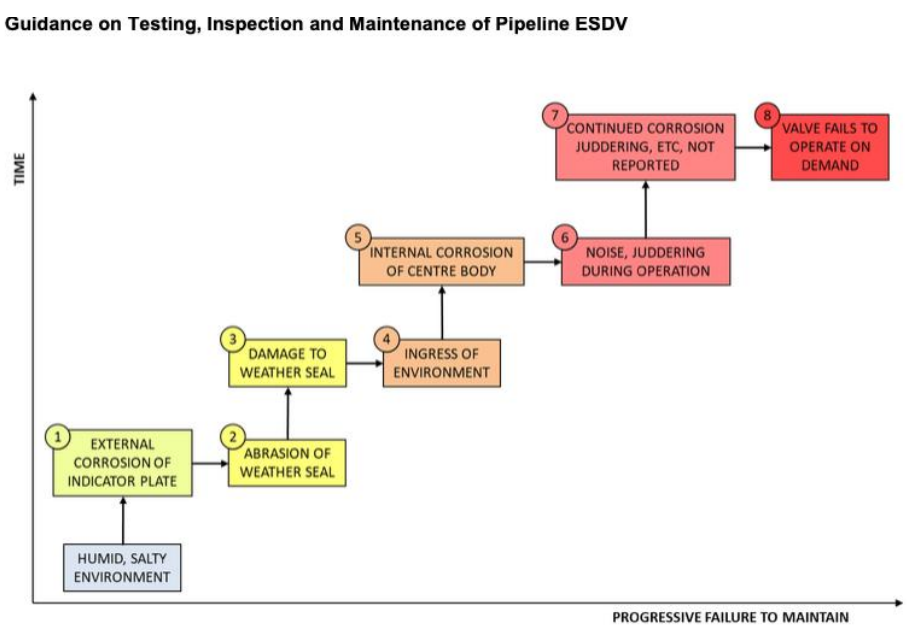
Client	Pipeline Users Group
Document No	PLUG-002-GL-002
Revision	1.5
Date	10th December 2018

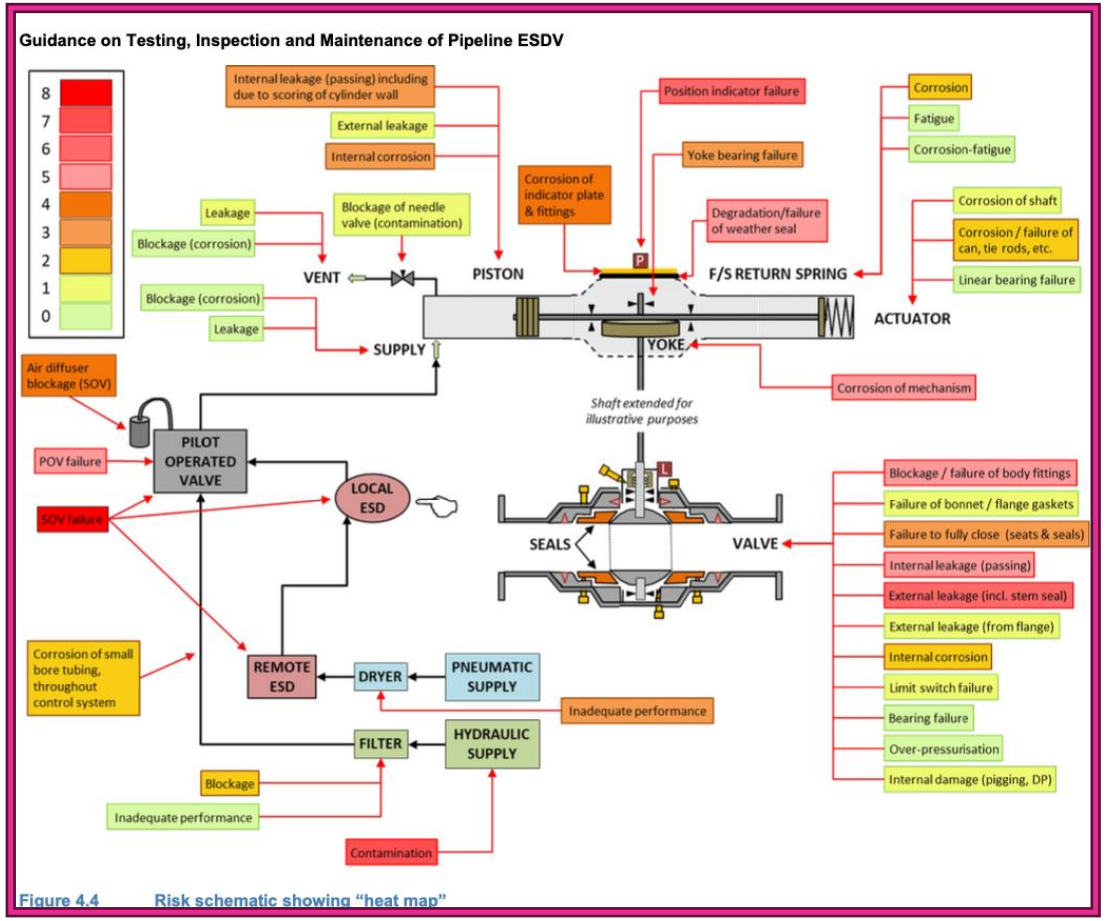
Prepared by:

Baker Marine Technology Ltd
7 Langton Court
Ponteland
Newcastle upon Tyne
NE20 9AT

- Mirroring for the DHSV system what has been done for Pipeline ESDV system
- Kudos to Brett Cowan Harbour Energy
- A guidance document can incorporate the main themes from this collaboration initiative (OEUK)







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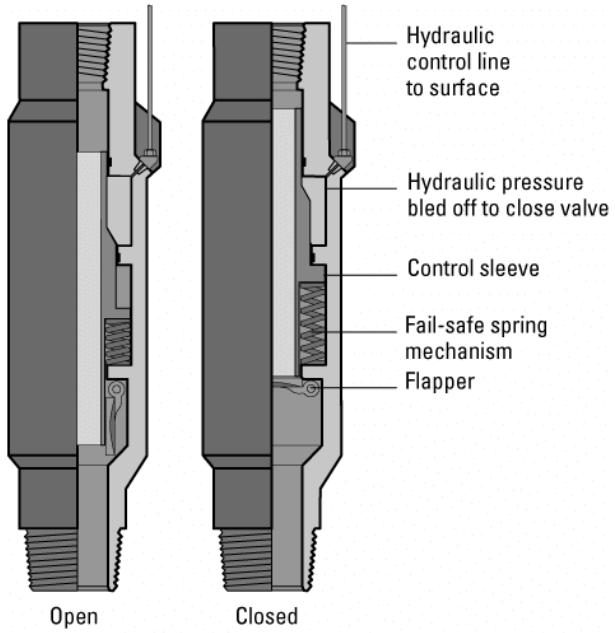

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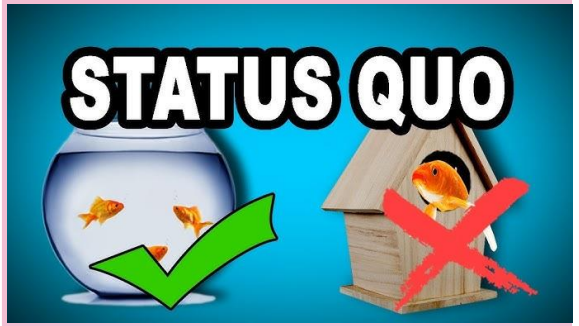

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Understand What Can be Done

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- The RWOT DHSV workshops highlighted sharing operational rationales for DHSV use
- Sharing ORAs or approaches could be done anonymously via OEUK
  - Or options explained in a guidance document
- To date 3 different North Sea operators have taken this approach

Well Considerations	Wells with low pressure or sub-hydrostatic – artificial lift – late life wells Wells would be operated under risk assessment and ORA - re-assessed periodically The status could change over time due to deterioration of other tree valves or manifold valves Safety case / company policy guidance may need updating
Priority / Prize	Subsea > NUI > Platform wells – justification of each operator Potential to reinstate wells shut in due to workover economics being unattractive Reduce addressing DHSV system issues losses / interventions by adapting testing criteria
Stakeholders	OPRED – considerations for an increased environmental risk – is it similar to ASVs vs MSAS? HSE – don't ask the HSE for anything less than Current Practice NSTA / OEUK Company / JV Partners
Collaboration	Not changing norms, as these were accepted before, rather sharing existing practice and ensuring consistency. Build a comprehensive list of things to consider in a good risk assessment for the various categories of wells that, if mitigated, would demonstrate the ALARP position References - ISO 16530 & latterly NOPSEMA, API 14B, OEUK well integrity guidelines, consequence analysis

DHSV System Working Group – Join Us

email Christian Christian@welloptimsation.com or Keith kwise@oeuk.org.uk

WELLS TASK FORCE

Problem: North Sea operators are incurring potentially avoidable effort, costs, and losses to maintain DHSV functionality, especially in late-life and subsea wells

Goal: The North Sea can collaborate to change the DHSV story

How:

1. Reliability, integrity and maintenance FMECA
2. Sharing / framing of DHSV and storm choke company guidelines, testing, ORAs & strategies
3. Improved intervention & remediation
4. Emerging & Field Proven technology or improved well design.

Core Working Group Members

Uchenna Makoni, Brett Cowan, Ben Orrell – Harbour

Stuart Connon - Total

Greg Jackson - Apache

Elisabeth Tweedie - NZTC

Scott Glendinning - Taqa

Rob Loov, Sundaresh Sundaralingam – slb

Mike Hartley - Ithaca

Paul Savelli, David Brands, Angus Macleod – bp

Keith Wise, Anthony Lo, Zara Jeffrey – OEUK

Ross Cygan-Taylor - NSTA

Marcos Berredo, Gavin Leslie, Keith Houghton - Shell

Ewan Abel – Repsol Resources UK

Christian Shields

Colin Black – Carjon-nrg

Hamish Mackenzie - Baker

Halliburton, Baker Hughes, slb, Weatherford

Wellvene, Oilenco, ...