Innovative scale removal system enables safe and efficient restoration of TRSSSV integrity - A case study from the Nelson field

Presnted by
Date

Archer
The well company

Agenda

1. The scale of the issue
2. Introduction to Nelson
3. Case study of N21

The scale of the issue
The impact to well performance

The effects of scale

“Precipitation of mineral scales causes many problems in oil and gas production operations: formation damage, production losses, increased workovers in both producers and injectors, poor injection water quality, and equipment failures due to under-deposit corrosion.”

I.R. Collins, BP Exploration; M.M. Jordan, Nalco/Exxon Energy Chemicals

***SPE: 68317**, ISBN 978-1-55563-915-0*

“Field pressure is sustained by water injection, which contributes to the formation of scale in downhole tubulars. This scaling can cause both safety and production problems, for example, by blocking a subsurface safety valve or chocking flow at downhole nipples.”

J. Al-Ashhab, Zadco, and D. Petrone and S. Mokhtar, Schlumberger

***SPE: 97863**, ISBN: 978-1-55563-239-7*

“Inorganic precipitates (scales) are one of the major flow assurance concerns in offshore oil and gas production, and lead to significant reductions in productivity and cosily workovers if allowed to form uncontrolled.”

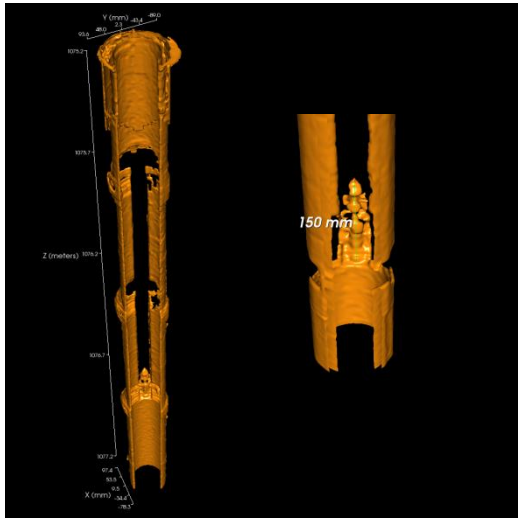
Gordon M. Graham, Eric James Mackay and Sarah J. Dyer, Heriot-Watt University; H.M. Bourne, TR Oil Services Ltd.

NACE: 02316

Scale and integrity

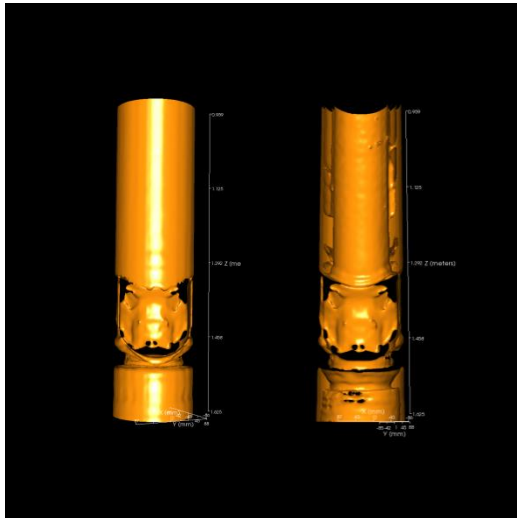
NORSOK D-010 states:

“Downhole safety valves, production tree valves and annulus valves shall be regularly leak tested. Leak test acceptance criteria shall be established and be available.”



Oil & Gas UK Well Integrity Guidelines state:

“Testing standards should be defined by the well-operator and clearly defined. DHSV should be tested every six months, unless local or documented historical data indicate a different testing frequency (see BS EN ISO 10417).”



3D images from SPACE/20 surveys

Conventional techniques for remediation

Benefit	Limitation
Pumping of chemicals from surface	
– Simple operation requiring minimal operational setup – Reduced level of risk as no intervention within well	– Large volumes of fluid required – Imprecise placement and exposure of chemicals to large areas of completion – Chemicals carried back to surface with production
Mechanical milling	
– Eliminates chemical hazard – Targeted remediation	– Highly abrasive mechanical technique – Geometrical reach defined by shape of milling bit
Chemical / particle jetting	
– Reduced volumes of fluid required – Targeted remediation – Conforms to downhole geometry	– Requires coiled tubing unit on location

Introduction to Nelson

Introduction to the Nelson field

Facilities

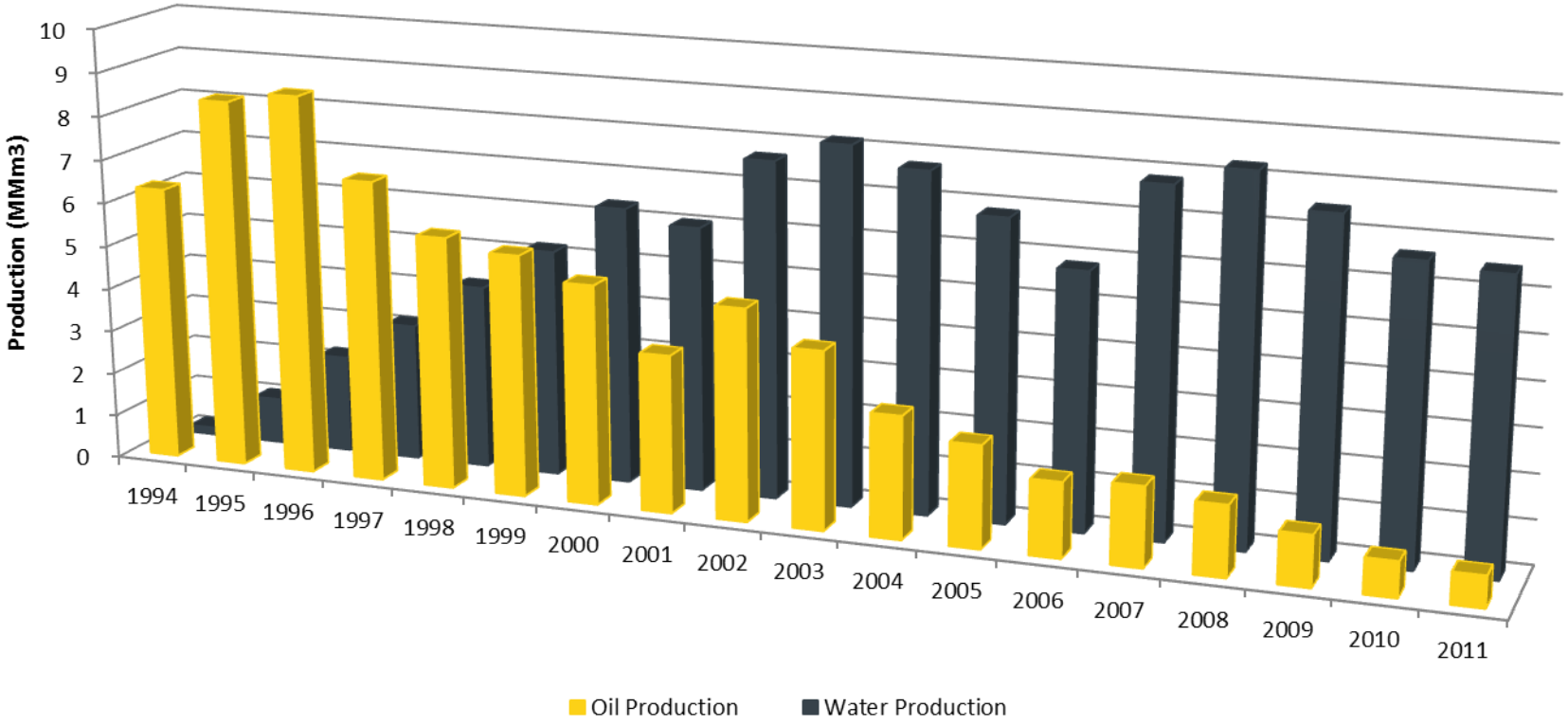
- Located 80km North East of Aberdeen in Quadrant 22, Block 11
- Discovered in March 1988
- Fixed platform installation in water depth of 288 ft

Production

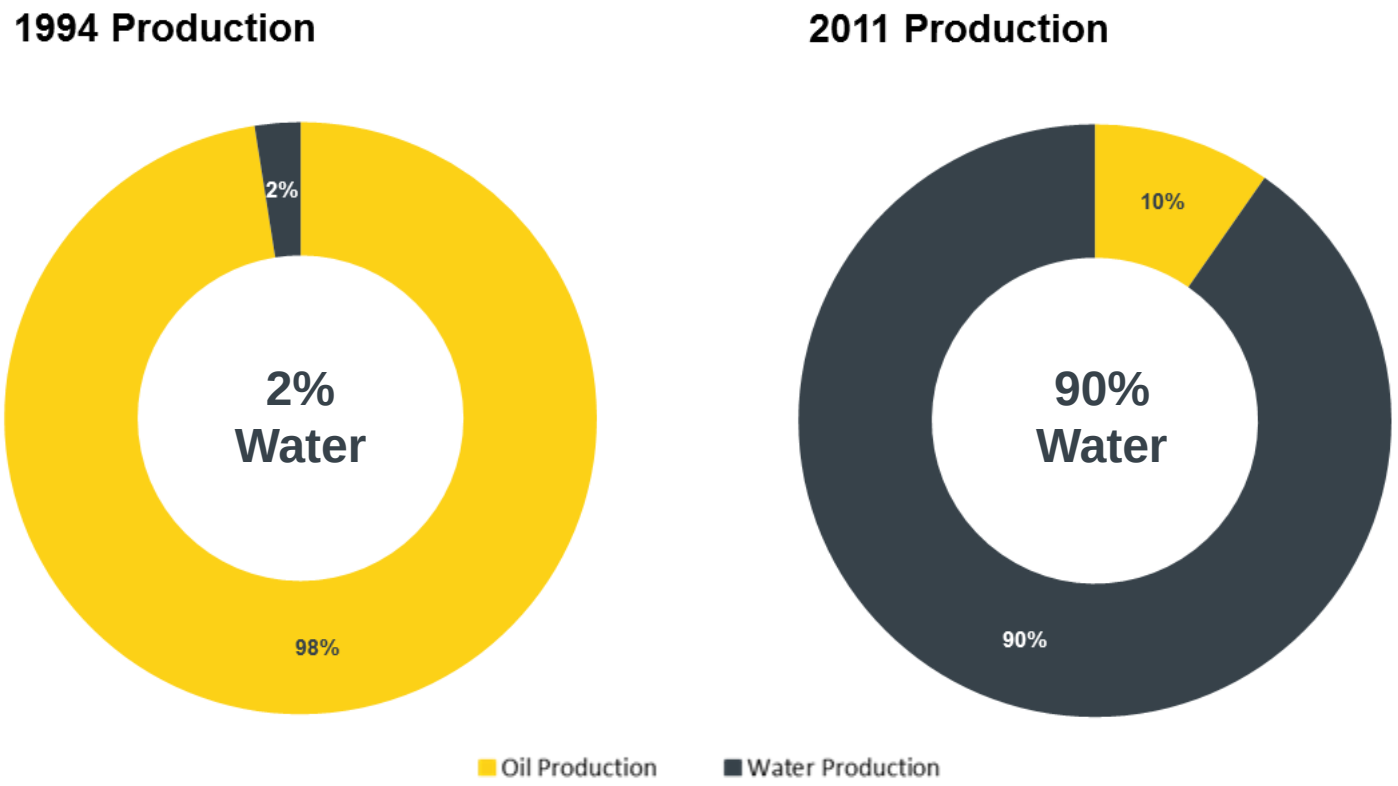
- Initial production commenced in February 1994 and has produced over 72 million m^3 of oil and 6.5 billion Sm^3 of gas to date
- The Nelson facilities process oil and associated gas from the Nelson, Howe and Bardolino fields
- Oil is exported via the Forties Pipeline System and associated gas via the Fulmar Gas Line.

Production information courtesy of DECC

Nelson production history



Nelson production history



A history of scale

Historically, Nelson wells form carbonate scale and there is an scale squeeze program in effect.

However scale-related issues are still evident:

- A TRSSSV insert valve retrieved in 2011 showed carbonate deposition
- Production log surveys in 2011 encountered rings of carbonate scale in the well.

Scale at the top of lock

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Flapper being held open by flotube

Case study of N21

Safe and efficient restoration of TRSSSV integrity

Background to N21

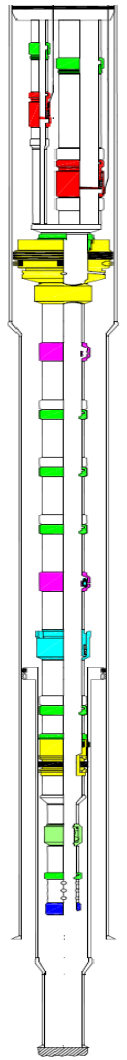
Productivity

- Gas lift producer with dual string upper section
- Producing at approximately 94% water cut

TRSSSV failed well integrity leak rate test.

- Pressure increased from 0 -100 bars in 30 minutes
- Operating under dispensation: WIMS Action Code 6 (repair within 2 months)

Owing to the high water cut and history of scale related issues within the field It is suspected that the PSSSV failed its integrity test due to $CaCO_3$ scale deposition resulting in failure of the flapper valve in the open position.

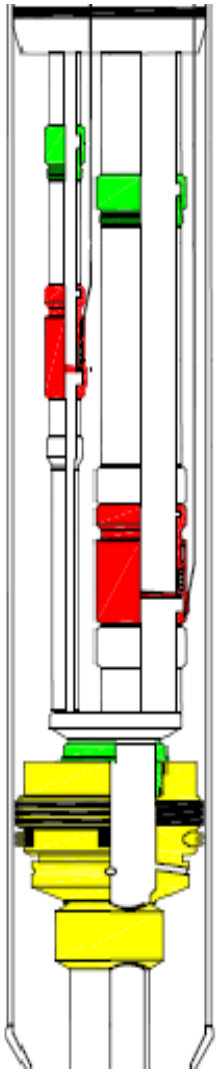


Program for remediation

Primary objective is to reinstate existing valve in preference to locking open the TRSSSV and setting an insert valve

- An insert would severely reduce the internal diameter for future interventions
- Reduction in internal diameter may have a detrimental effect on the flow rate
- Lead time to obtain required insert valve greater than current dispensation would allow

Based on the results of this intervention, this well will be placed on future scale squeeze programs to prevent a recurrence of scale deposition.



Program for remediation

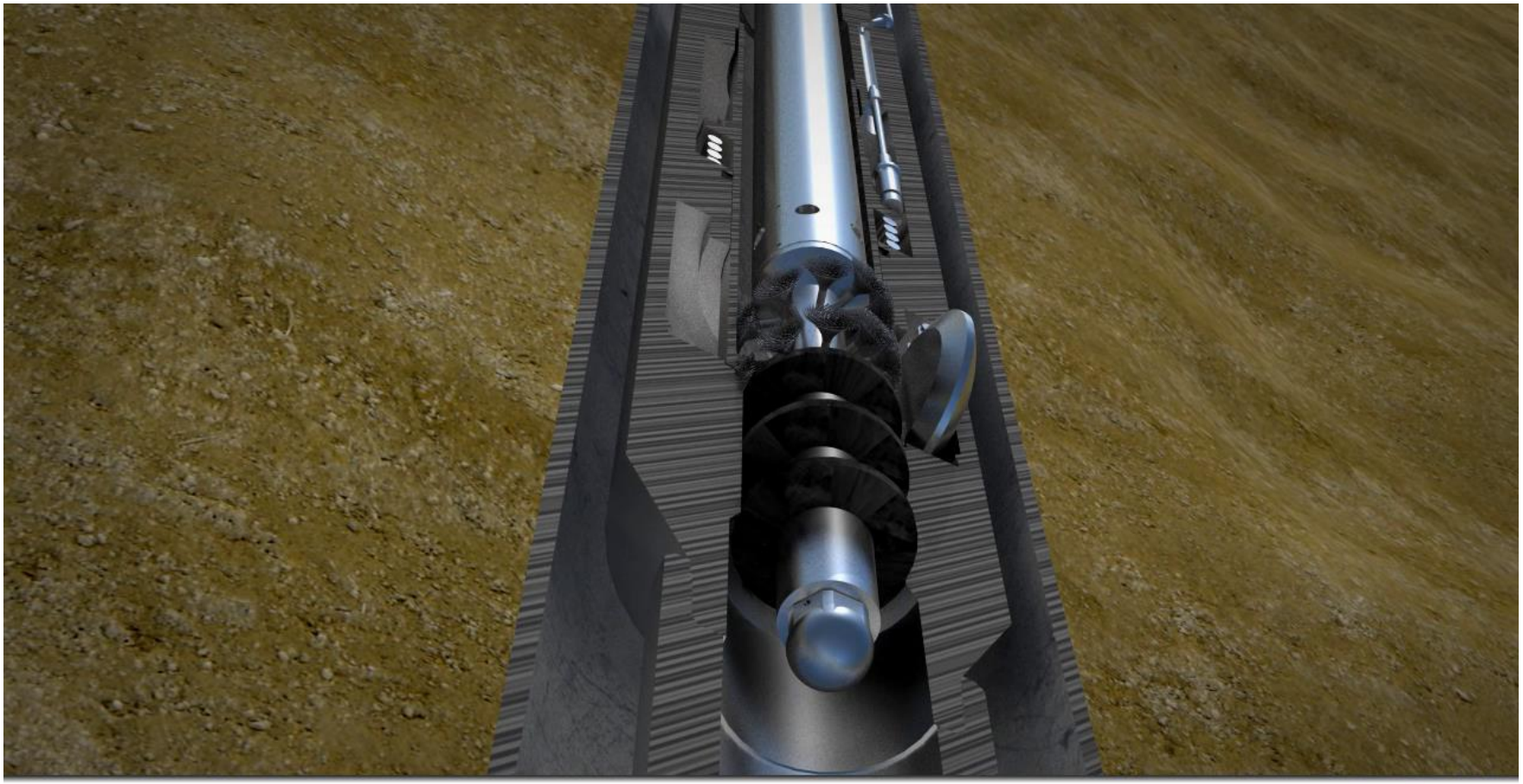
Archer TASK system selected as remedial technique

- Targeted chemical treatment of TRSSSV deployed with slickline
- Precision circulation system to wash affected area with zero abrasion risk
- Use of low hazard chemicals with closed-loop safe filling system.

Two choices of compound available:

- TASK/1: Optimized for Calcium, Barium and Strontium sulphate scale
- TASK/2: Optimized for Calcium Carbonate scale

Operational sequence



TASK

Launcher deployed to no-go

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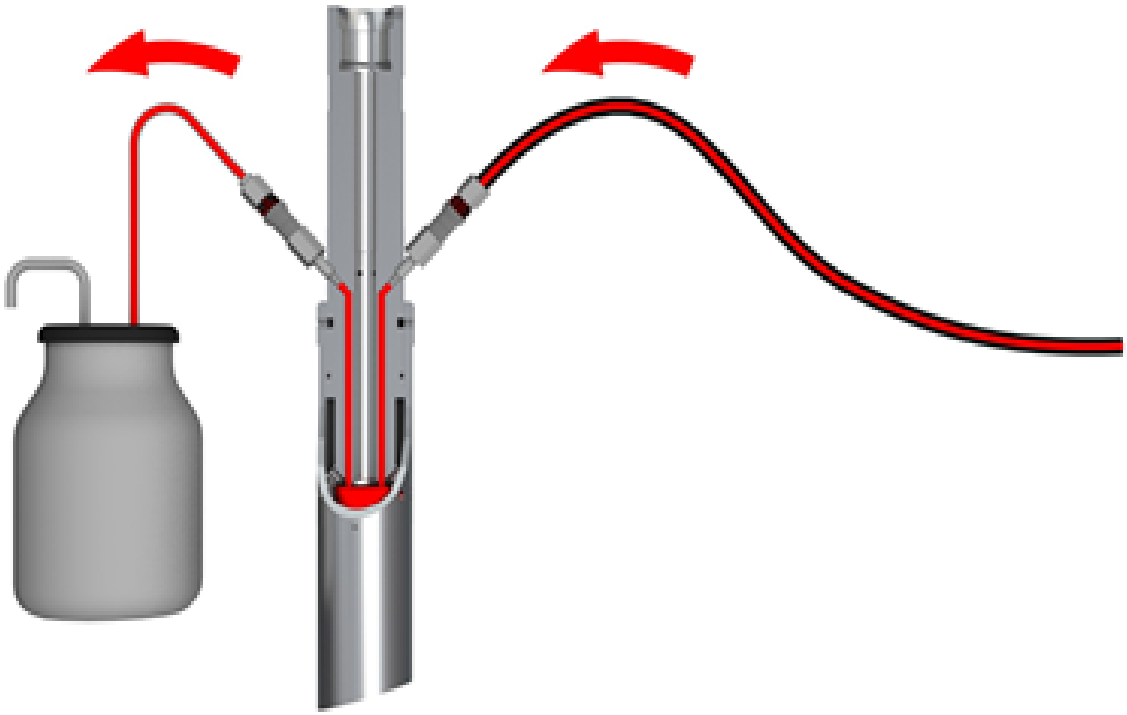
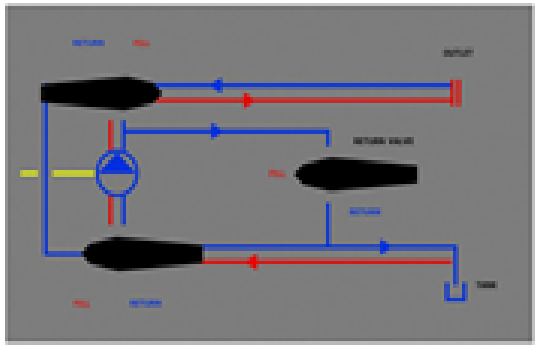
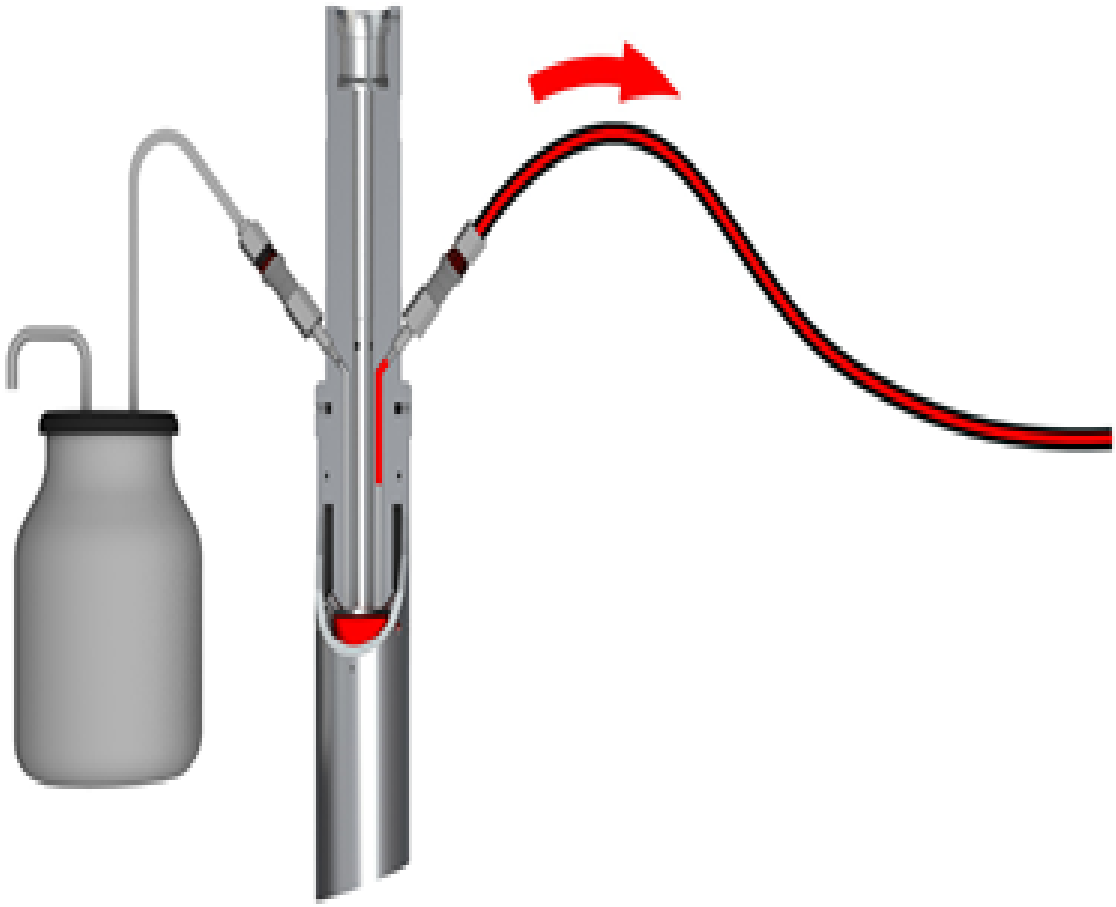
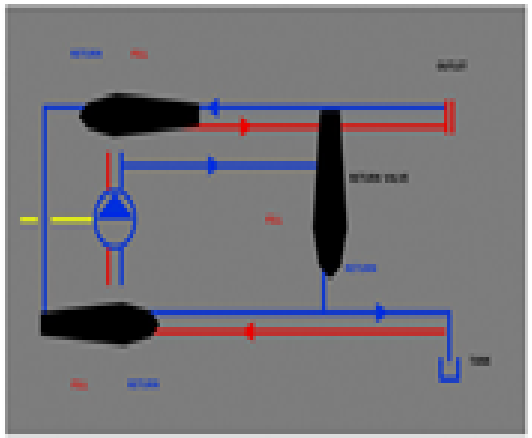
closed-loop safe filling system





Reverse pumping chemical back to tank to avoid spill





Operational outcome – Nelson N21

Well handed back to production after approximately 17.5 hours total operating time

- Drift run and tag TRSSSV nipple (5 ½ hours approx.)
- Two treatments with of TASK system (12 hours approx.)

Successful test of TRSSSV on first attempt

- 0.1bar pressure build up after 30min inflow test
- Integrity restored and dispensation closed

N21 has been added to the scale squeeze treatment program and has remained on continuous production post intervention

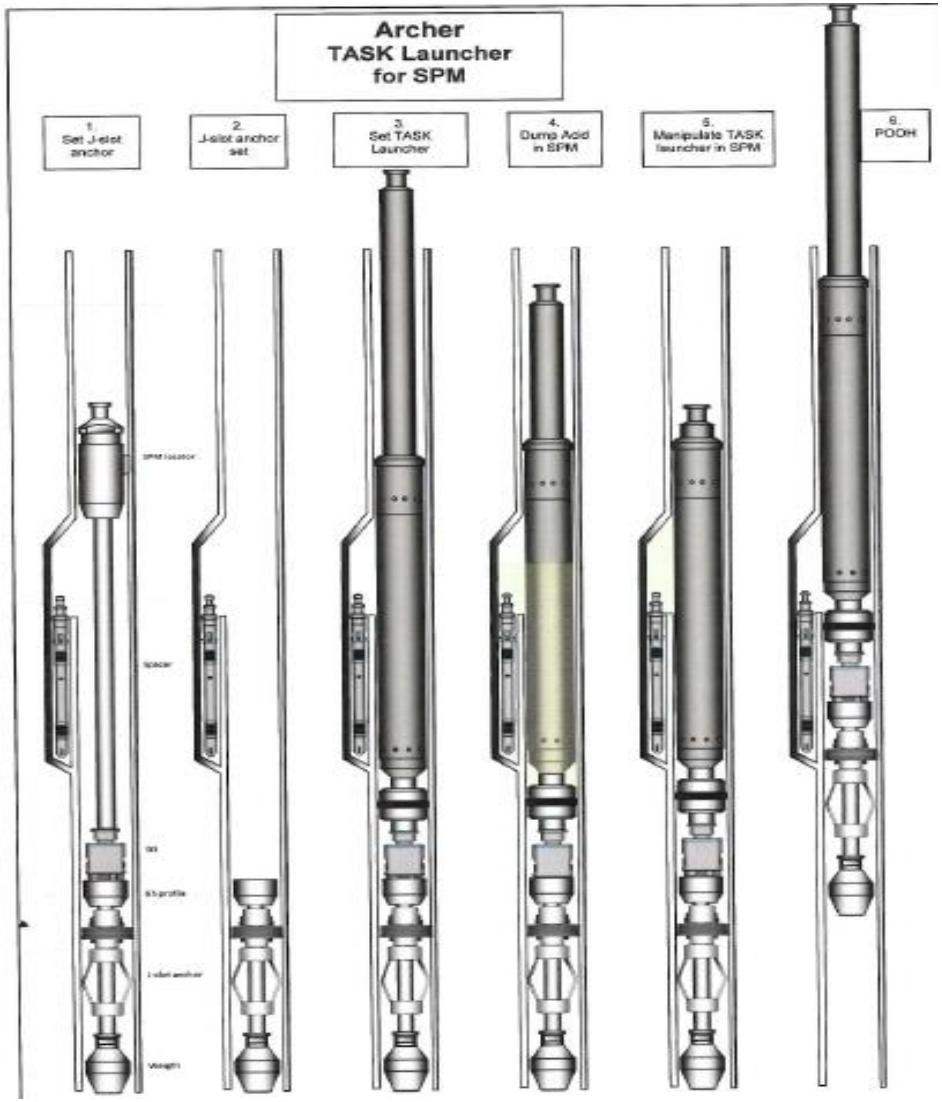
TASK effectively enabled the safe and efficient restoration of TRSSSV integrity for the Nelson well N21.

"Owing to the success on N21 TASK will be first choice for this application in future."

"We are also actively looking at this as a solution for retrieving problematic GLV's."

— Gary Farquhar, Shell UK

TASK for treatment of SPM - Overview



Acknowledgements

On behalf of Archer I would like to thank the following:

ICoTA for inviting me to present to you here today

Shell for allowing this case study to be shared

My co-authors

- Gary Farquhar, Shell
- Oluyinka Jimoh, Shell

The audience for your attention and participation in this event

Thank you

Archer

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