Annulus Intervention, an entirely different animal

The first technology in the world to allow direct access to a pressurised well annuli

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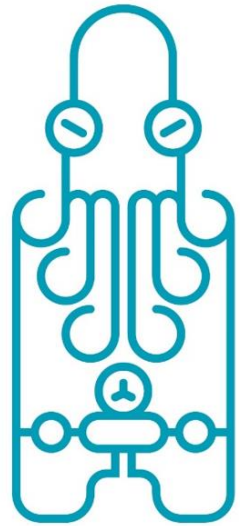
Agenda

Annulus Intervention

- About the technology
- Applications
- Equipment layout
- What the system can pump
- Fluid swap animation
- Case studies
- Any questions



Annulus Intervention

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About the technology

Well Intervention technologies can be broadly split into three categories

Deployment

Evaluation

Enhance / Remediate

	Evaluation			Enhance / Remediate		
Deployment	Reservoir Characterisation	Well Performance	Asset Integrity Evaluation	Reservoir optimisation	Well performance enhancement	Asset Integrity remediation
Annulus Intervention System			●			●
Coiled Tubing	●	●	●	●	●	●
Dyform Cable		●	●		●	●
E-Line	●	●	●	●	●	●
Fibre Optic Enabled Slickline (DFOS)		●	●			
Light Well Circulation System (CoilHose)		●	●		●	●
Mechanical Slickline	●	●	●	●	●	●
Slick-E-Line / Digital Slickline	●	●	●	●	●	●
Tractors	●	●	●	●	●	●
Tubing / Completion / Drill Pipe	●	●	●	●	●	●

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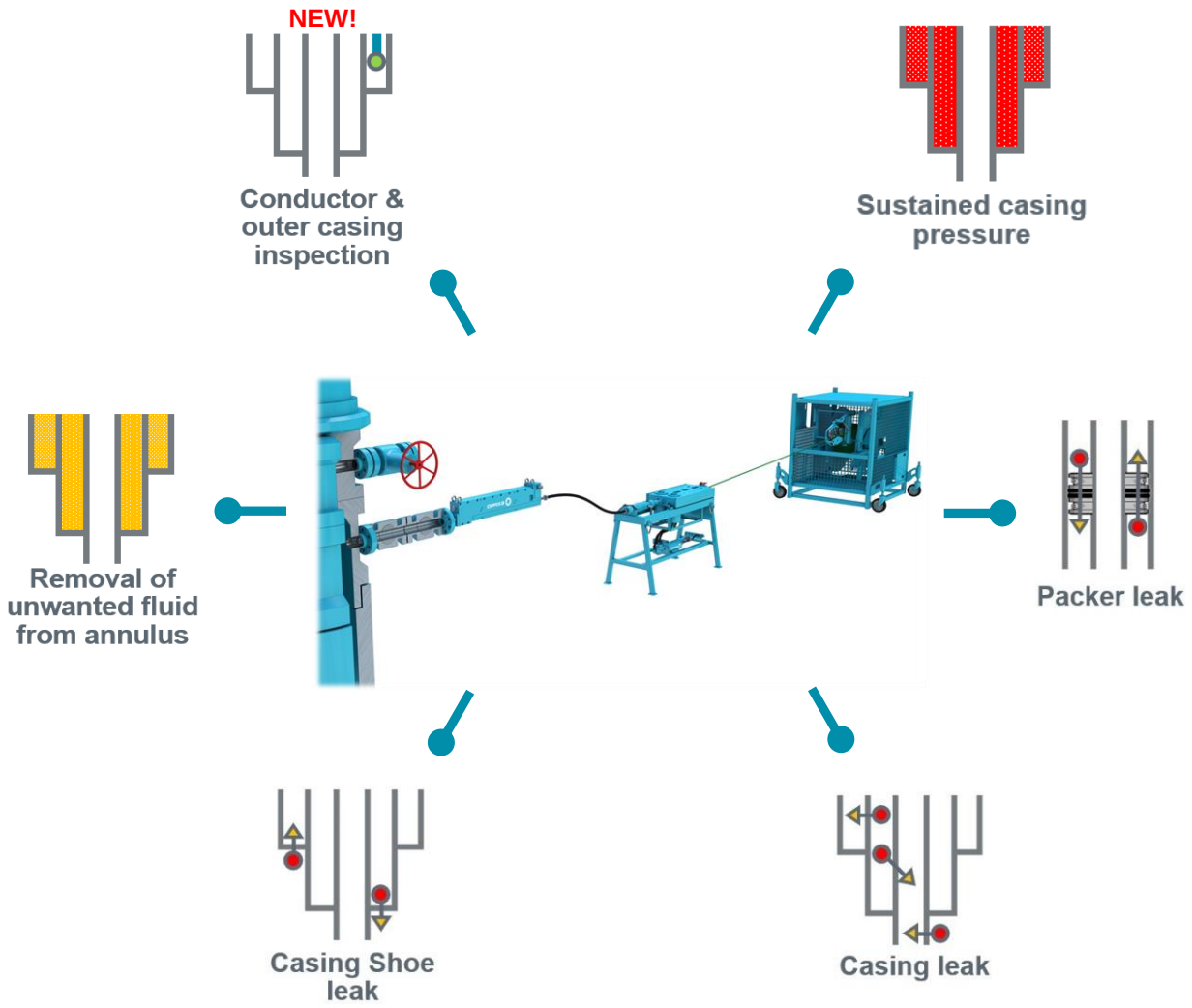
About the technology

Many wells develop integrity issues in the annuli and casing strings over time, however, remediation of these challenges is usually in the domain of lengthy lubricate and bleed operations or heavy duty well work

Entry into a pressured annulus using the Expro Annulus Intervention system enables the remediation of a range of integrity issues, from sustained casing pressure to packer leaks

The Annulus Intervention system can be easily mobilised to the well location, with its compact footprint enabling quick rig-up and efficient commencement of operations



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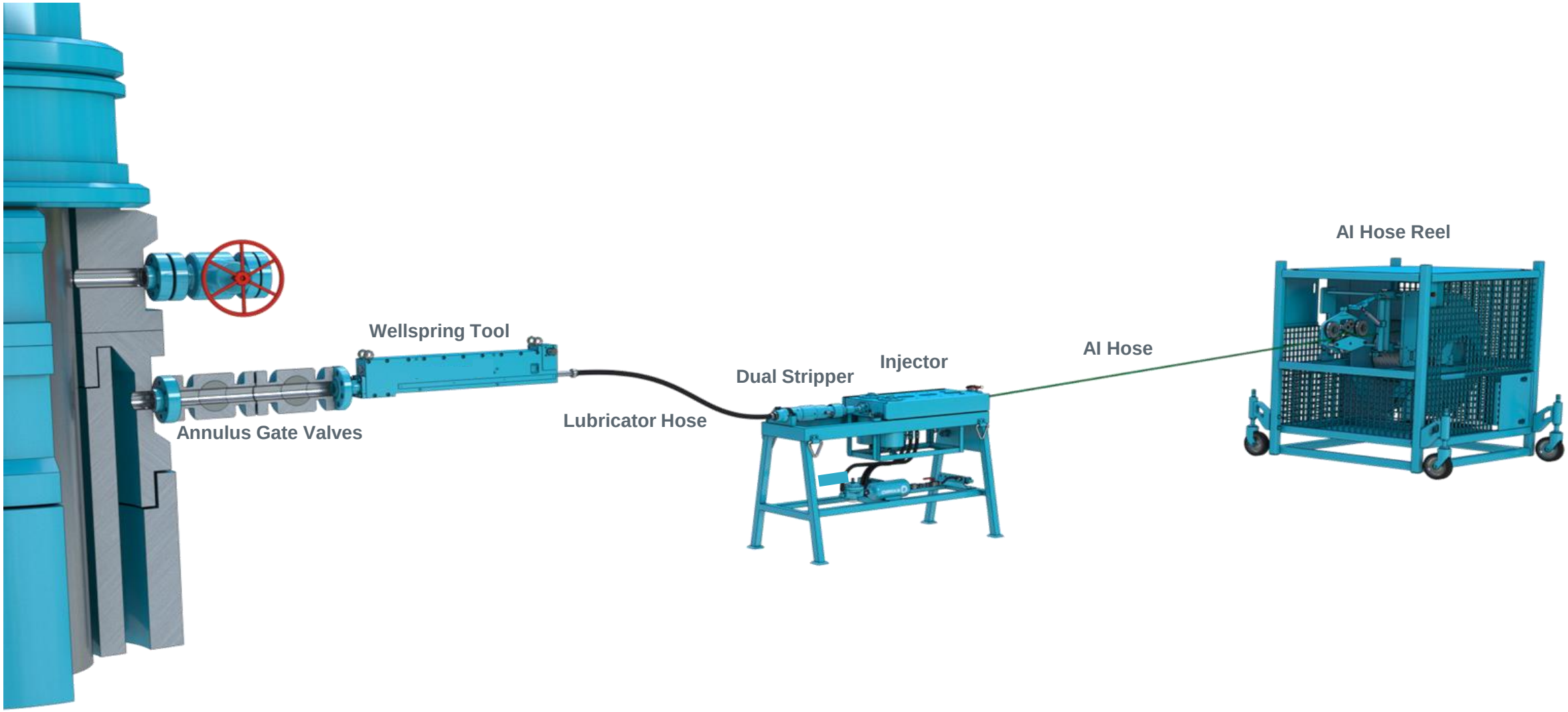
Equipment layout



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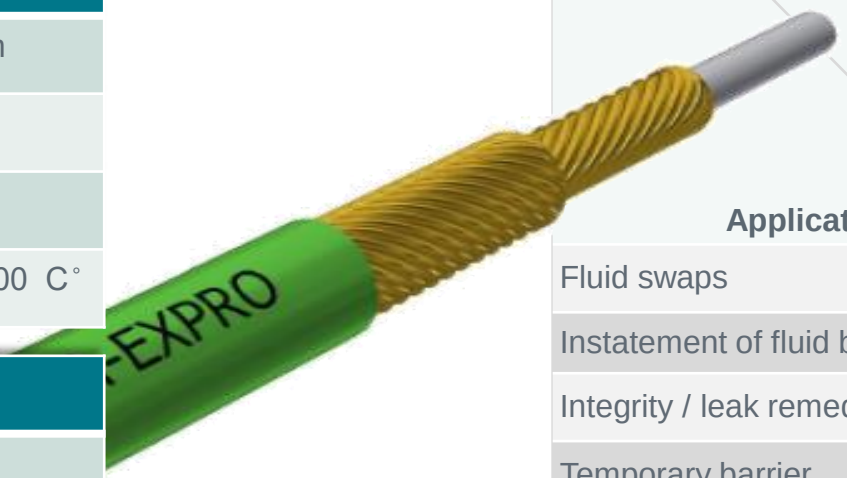
AI Hose and Fluid pumping table

Large AI Hose	
OD	11.5 mm
ID	6.3 mm
Working pressure	600 Bar
Temprature rating	-30 to 100 C˚

Small AI Hose	
OD	6.9 mm
ID	3.4 mm
Working pressure	690 Bar
Temprature rating	-30 to 100 C˚



Application \ Product	Brine, 1.0 to 1.8 SG	Heavy Brine, 1.6 to 2.2 SG	Epoxy resin	Polymer resin	Barite resin	Dissolvable gel	Nitrogen	Electromagnetic cement
Fluid swaps	●							
Instatement of fluid barrier	●	●						
Integrity / leak remediation			●	●	●			●
Temporary barrier						●		
P&A barrier			●	●				●
Expansion cushion							●	

● Electromagnetic cement is currently being evaluated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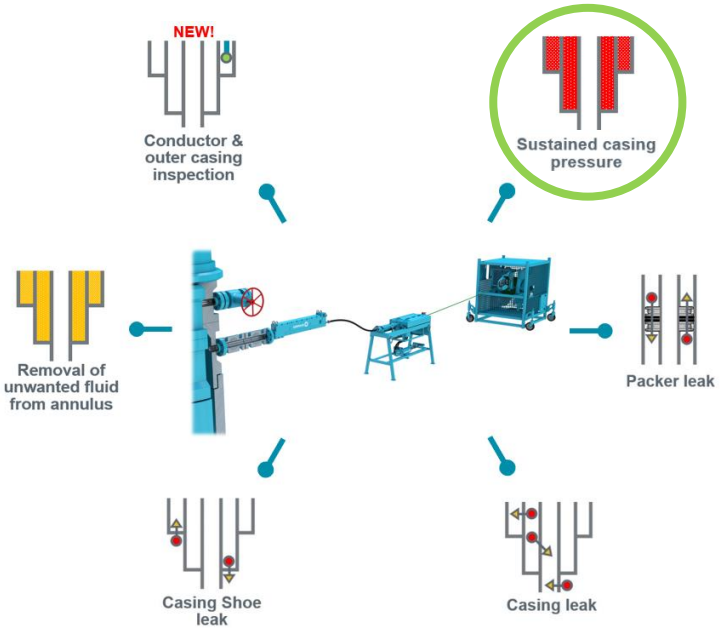
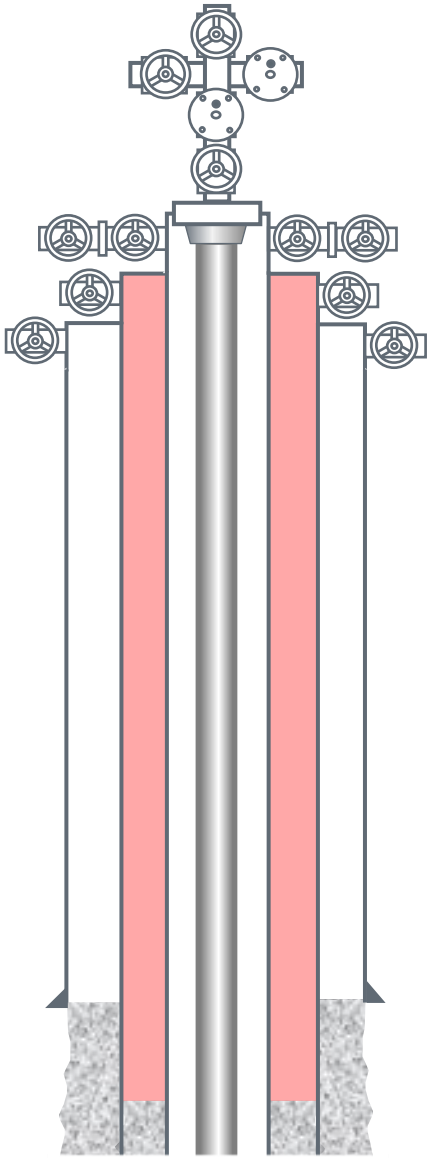
Fluid swap sequence

Customer challenge
Sustained casing pressure in the B annulus

Job objective
To replace the B Annulus contents with 1.5 SG Brine





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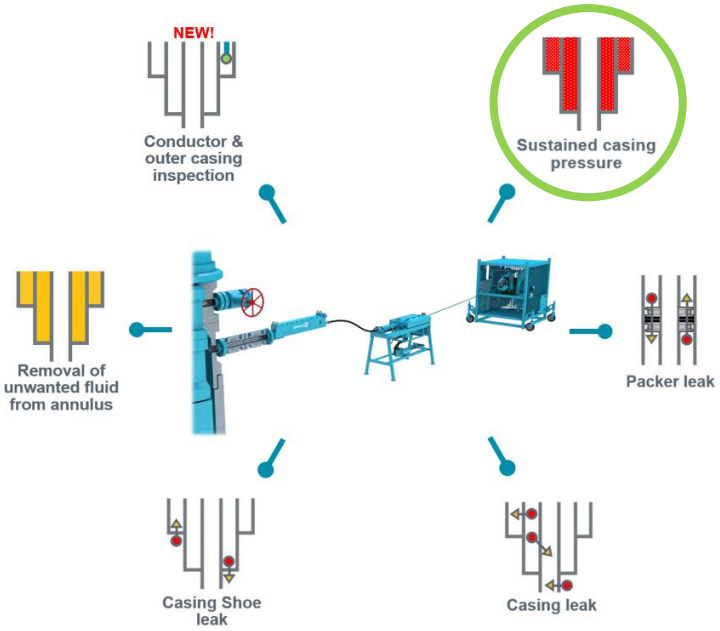
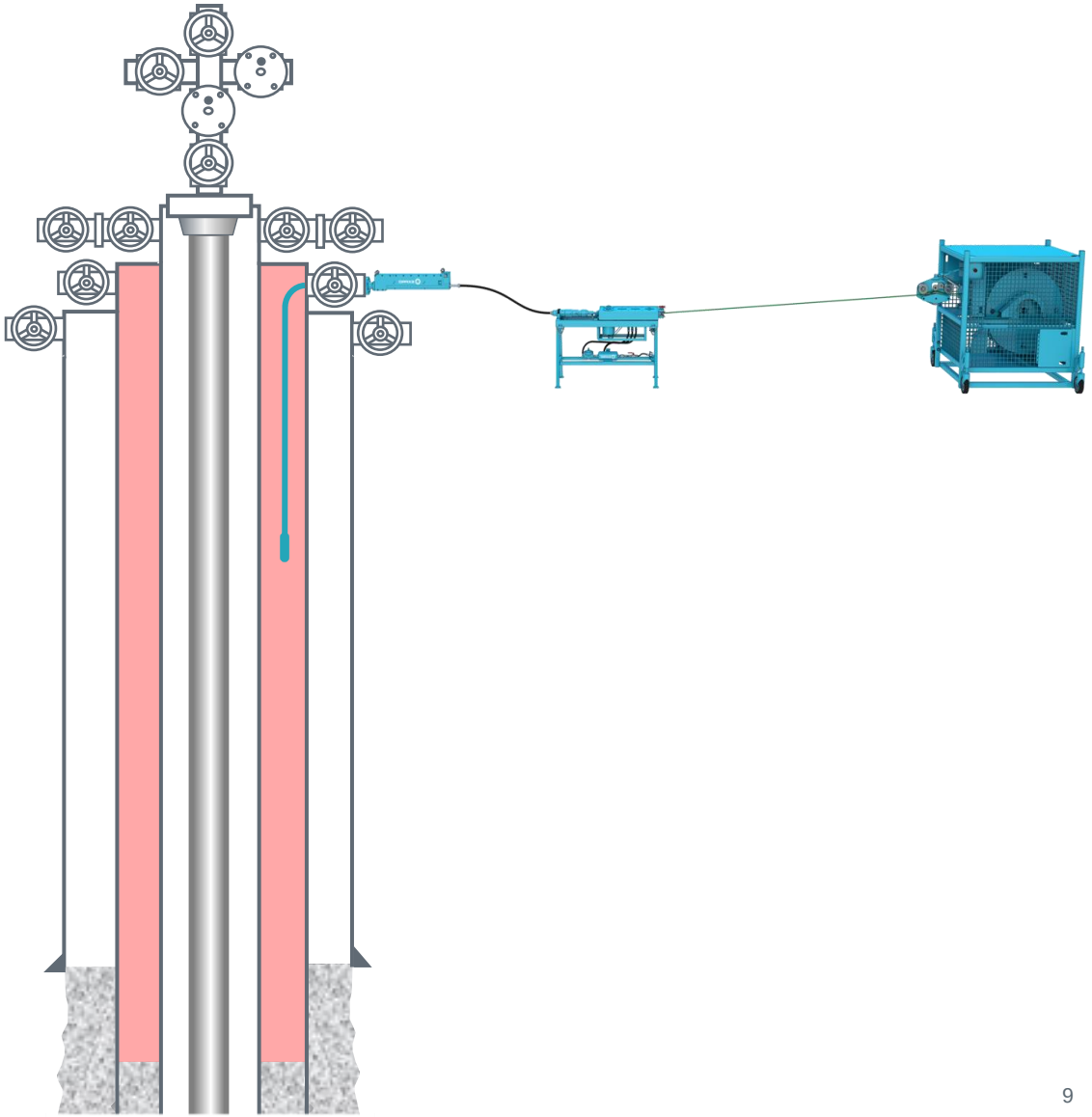
Fluid swap sequence

Rig up AI system and run into the B Annulus.

AI Hose BHA depth reached is influenced by a combination of factors such as well design, well integrity issue to be remediated, hose type, fluid to be pumped and desired fluid pump rates





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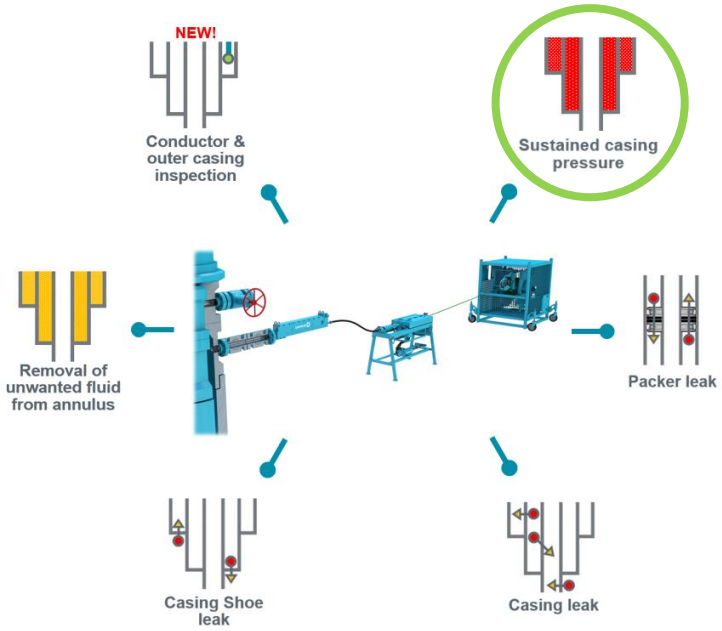
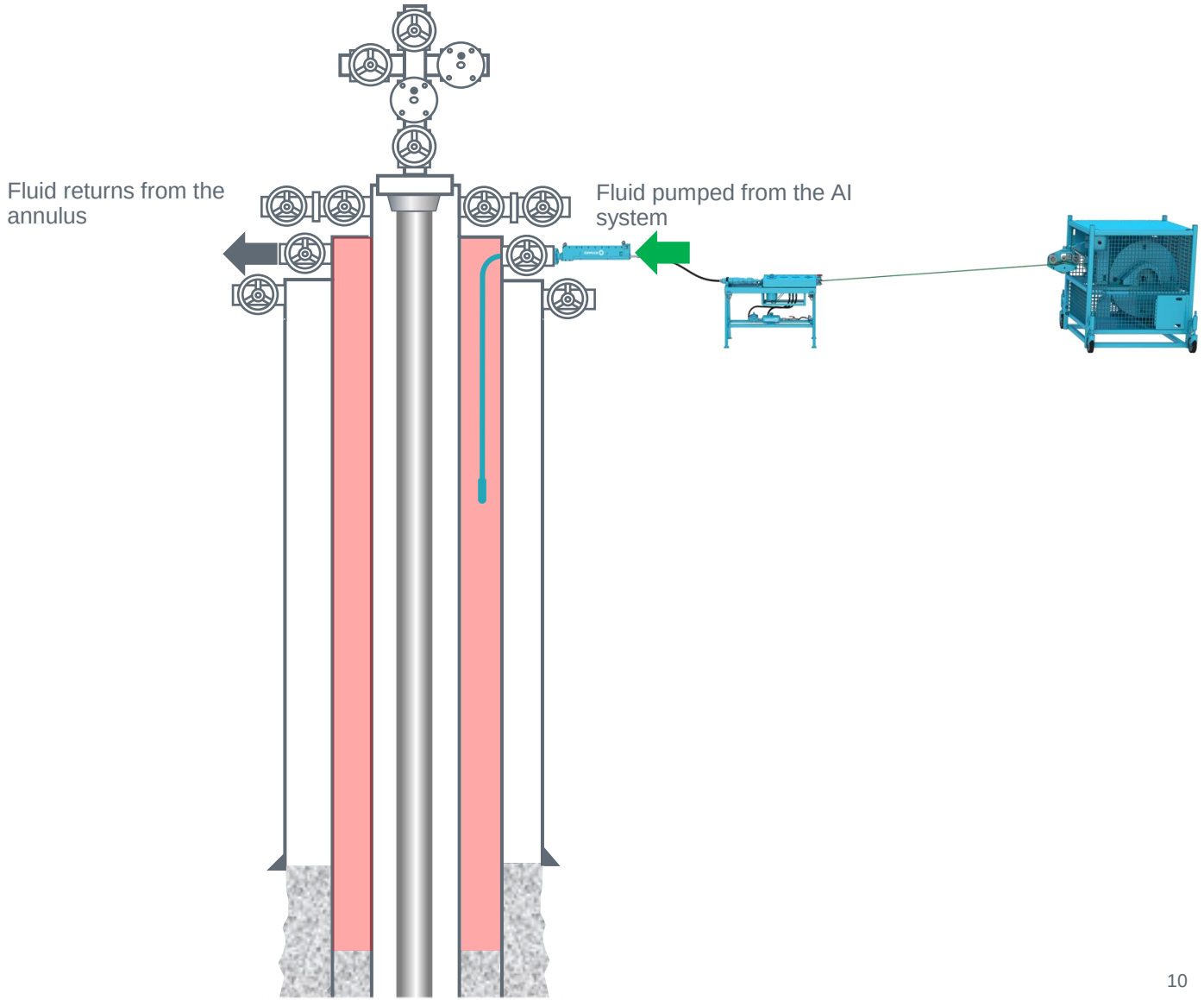
Fluid swap sequence

Commence fluid pumping with returns being taken on the opposite side of the wellhead (returns can also be taken back the same side as the Annulus Intervention system).





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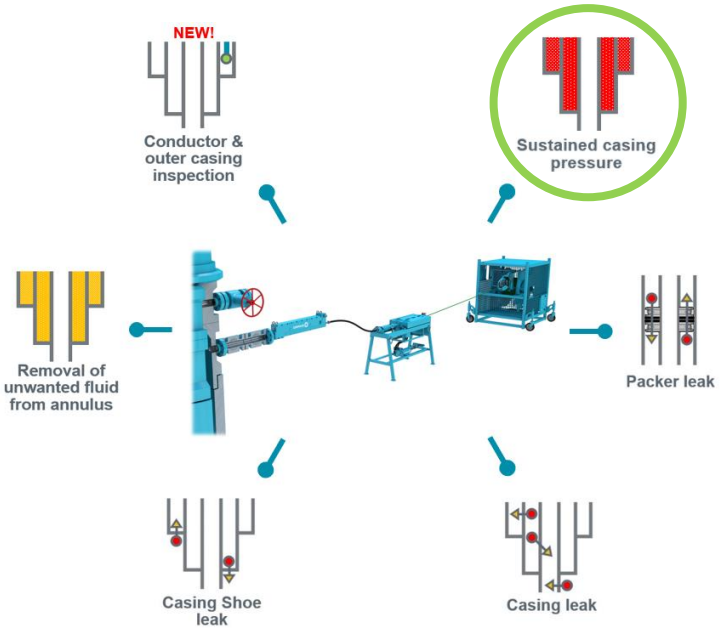
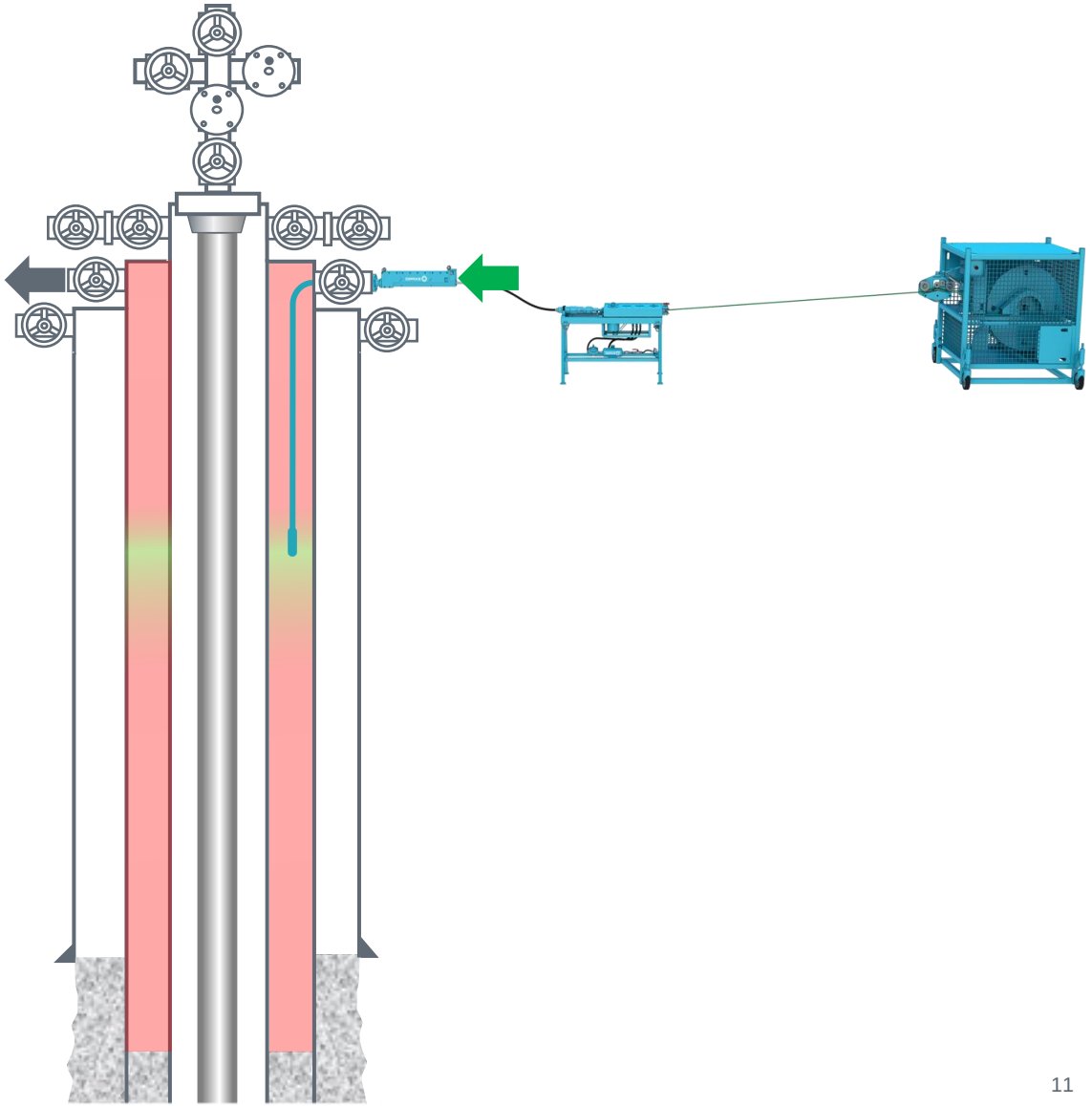
Fluid swap sequence

Depending on the **miscible / immiscible** and **SG** relationship between fluids in addition to the hose depth, the fluid swap process could take anything from a few days to a few weeks. This is modelled pre-job





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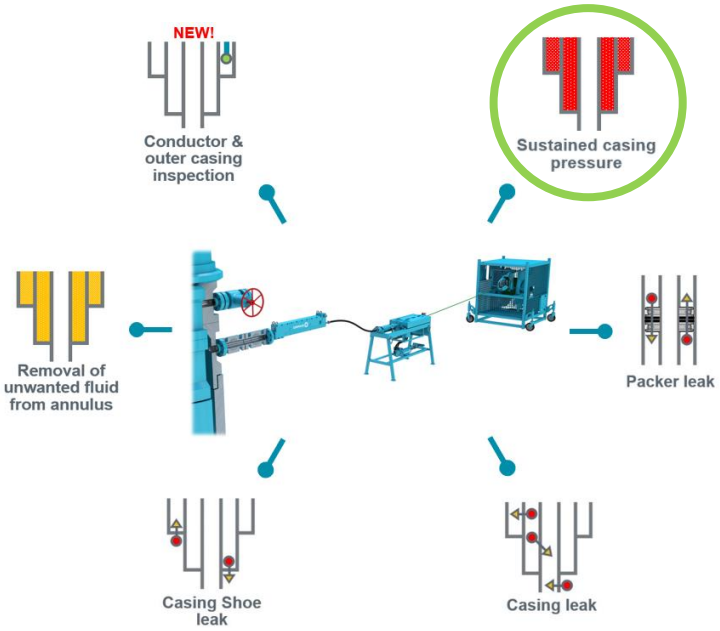
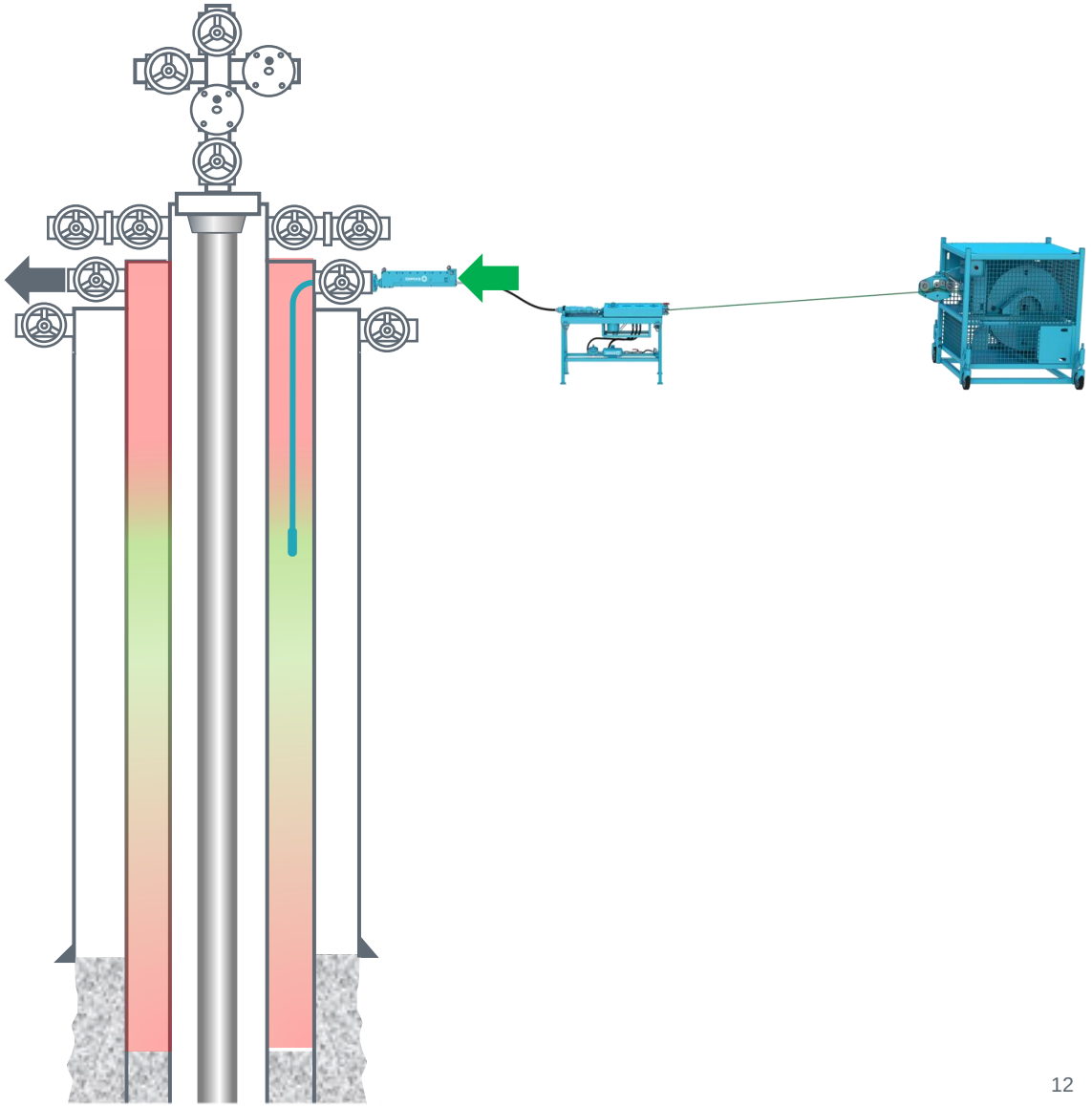
Fluid swap sequence

Throughout the entire pumping and circulation process, fluids pumped and returned are continually monitored





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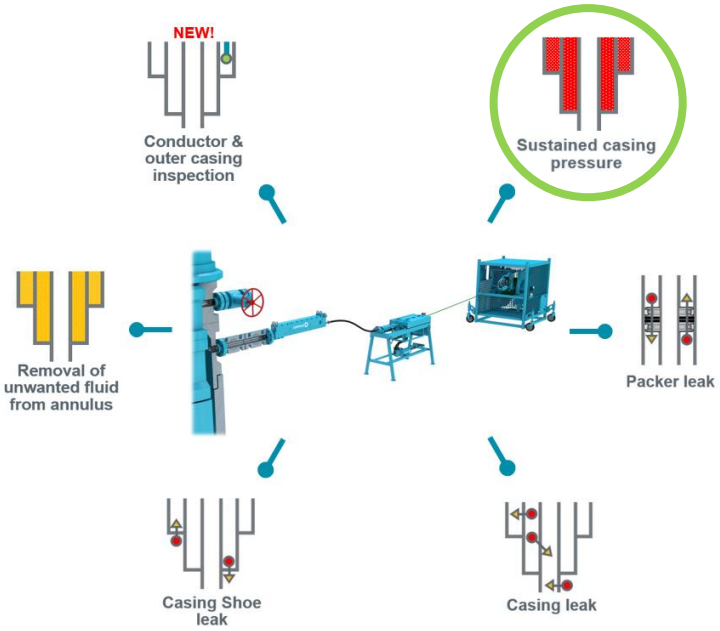

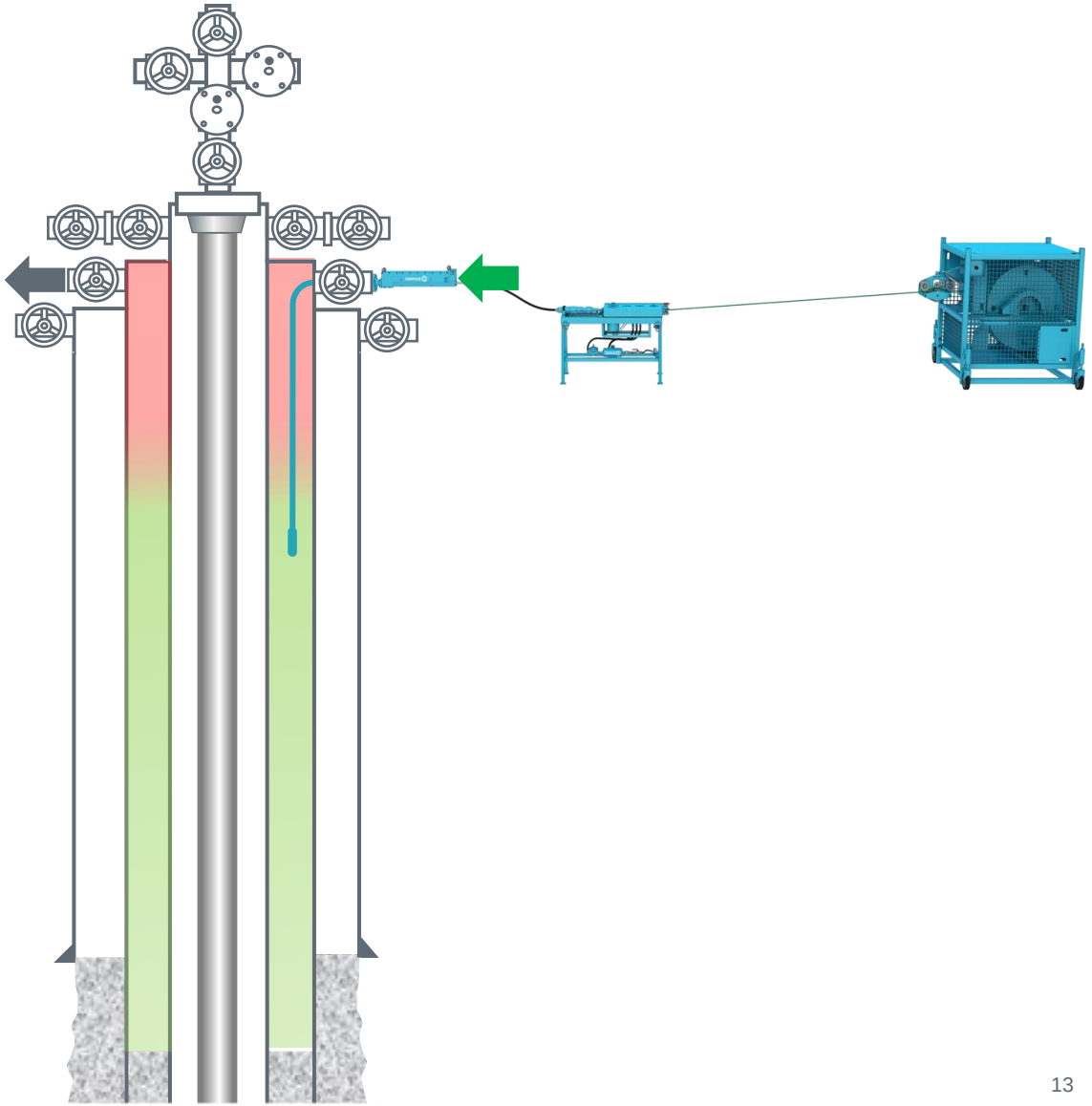

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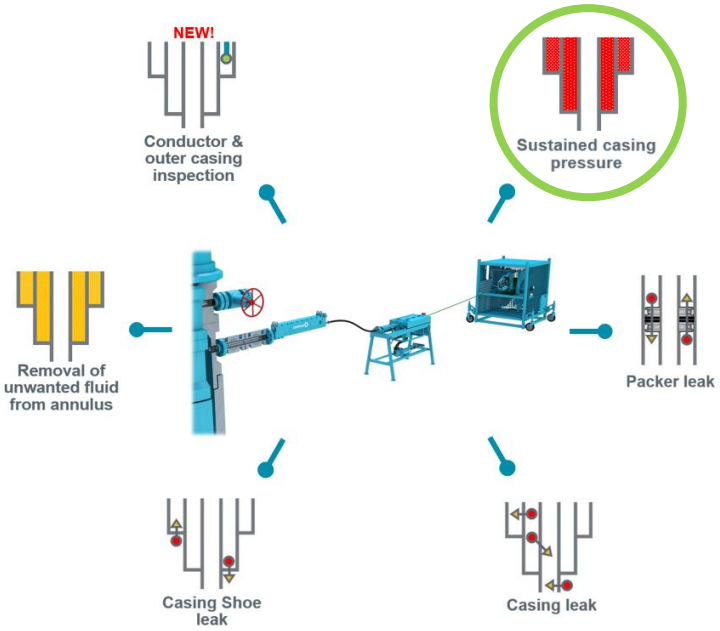

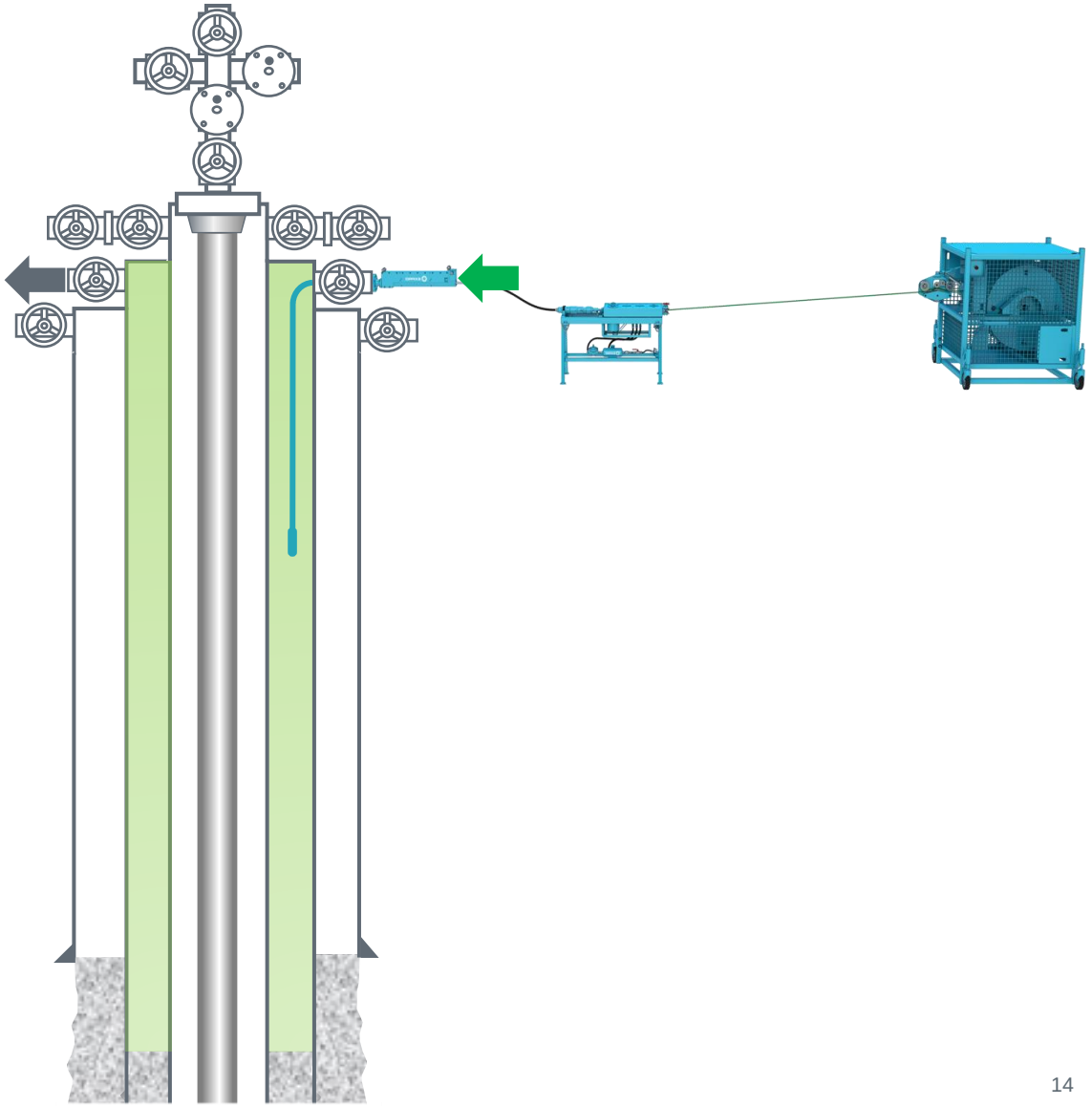

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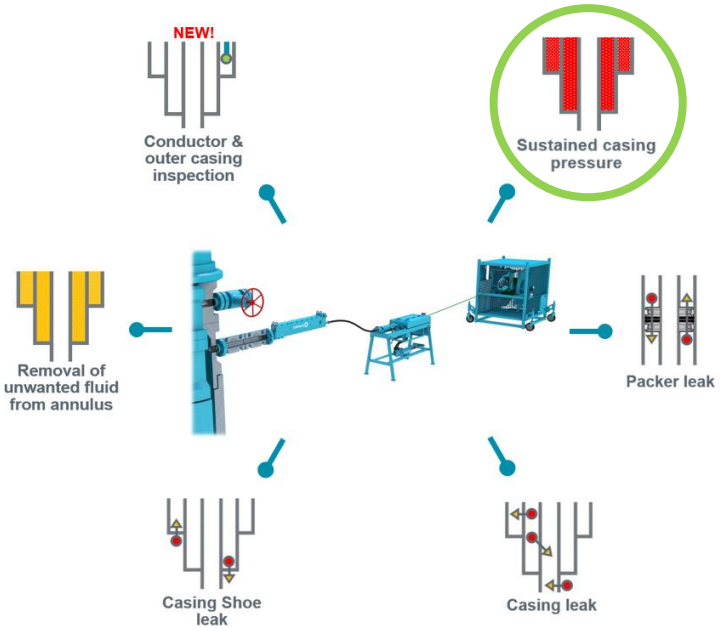
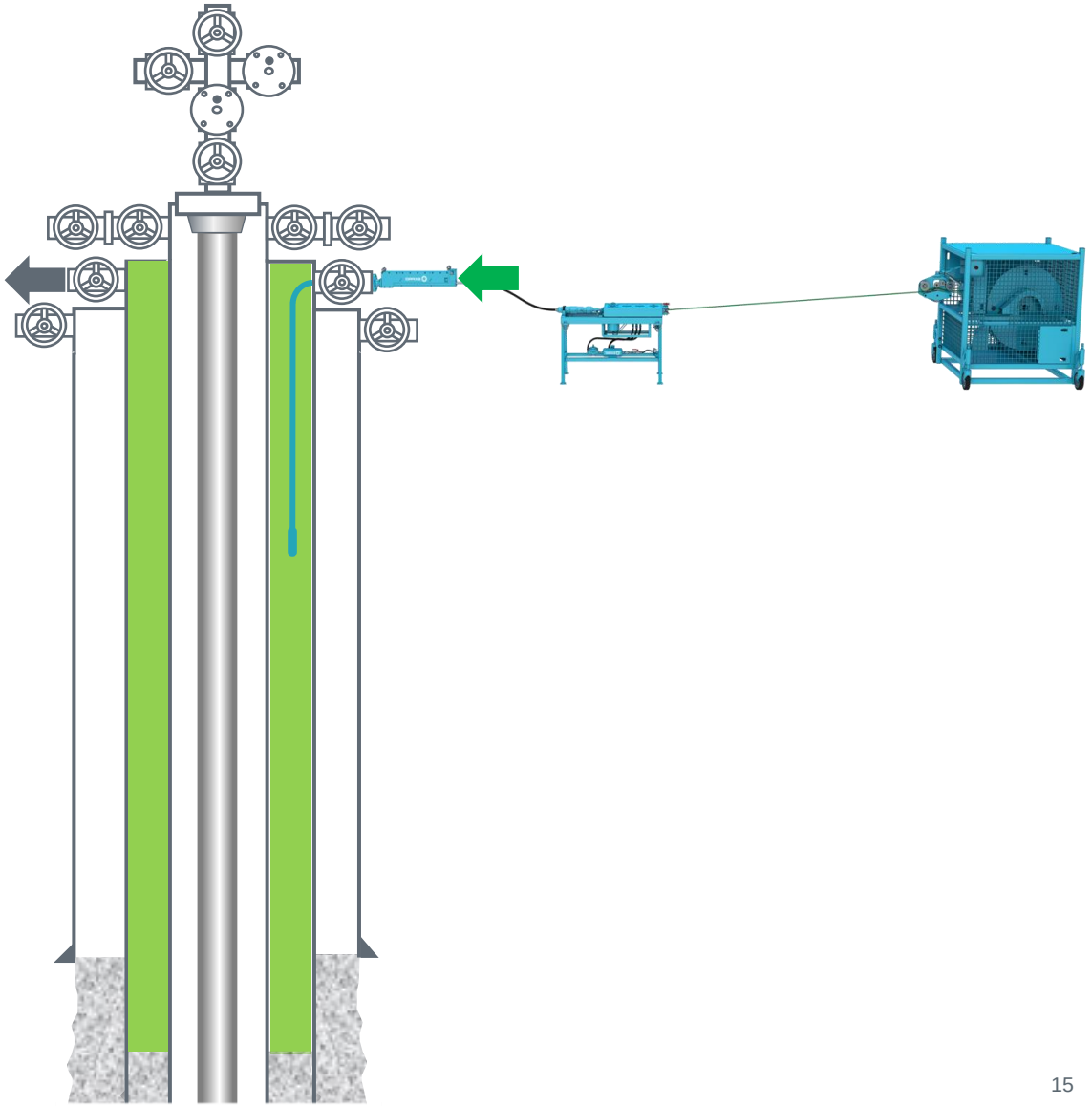
Fluid swap sequence

Generally more than one annular volume is pumped to assure the annulus contents are homogenous





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Fluid swap sequence

Objective achieved, B Annulus contents replaced with 1.5 SG Brine and SCP remediated

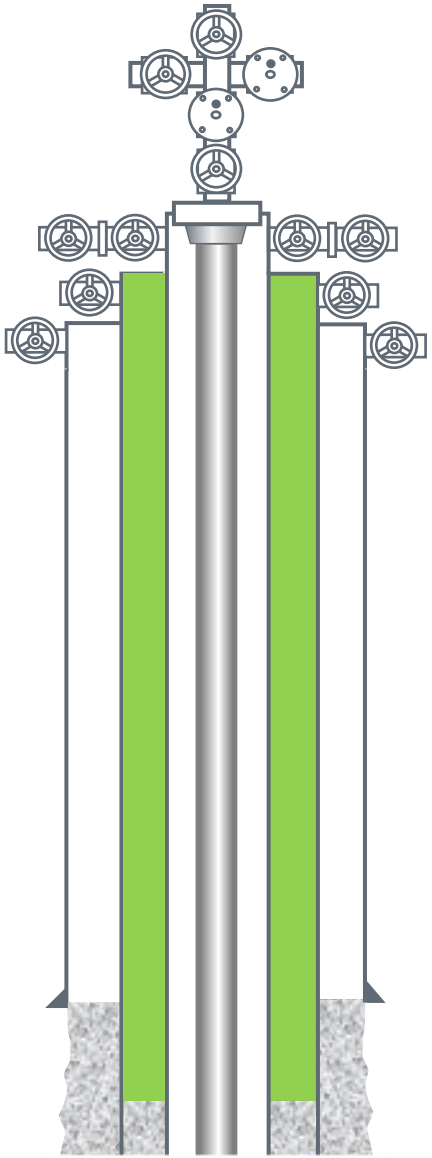
Rig down Annulus Intervention System and hand well back to production.

Bespoke solution

Well Integrity Remediation

Reduces operating costs

Increases asset value



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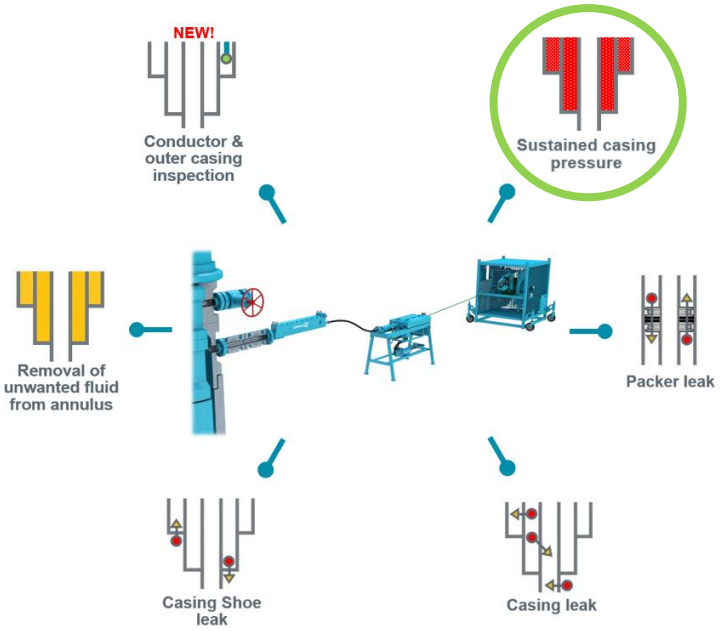
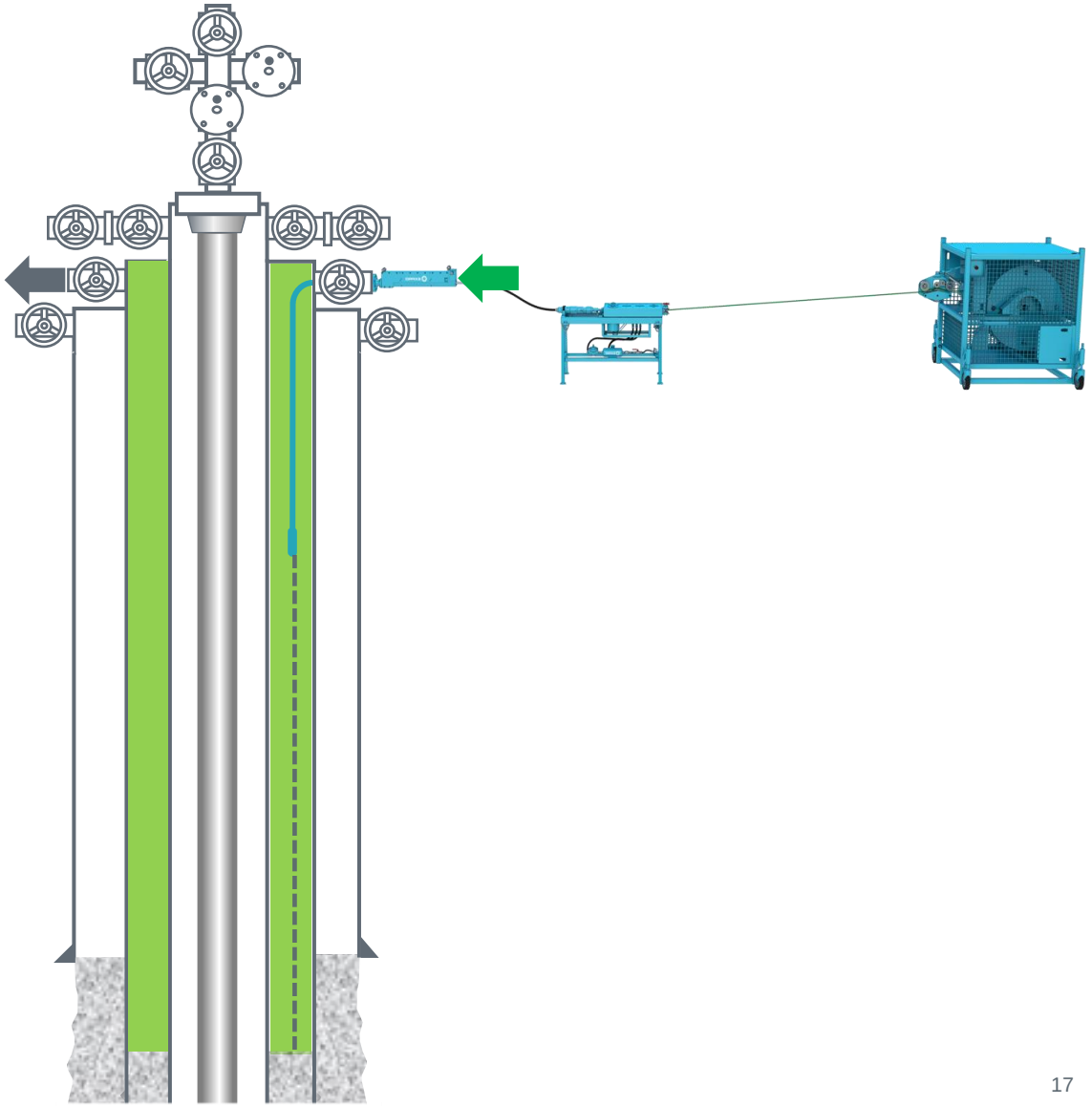
Resin drop sequence

For resin jobs, after the annulus has been conditioned the resin can then be mixed at surface and pumped into the well via the AI hose.
The recipe ensures the resin stays in its liquid state whilst pumping.





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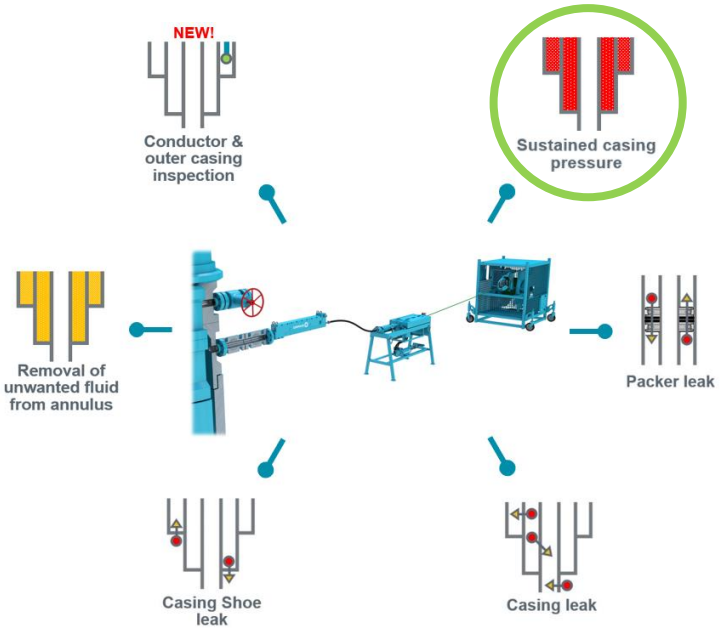

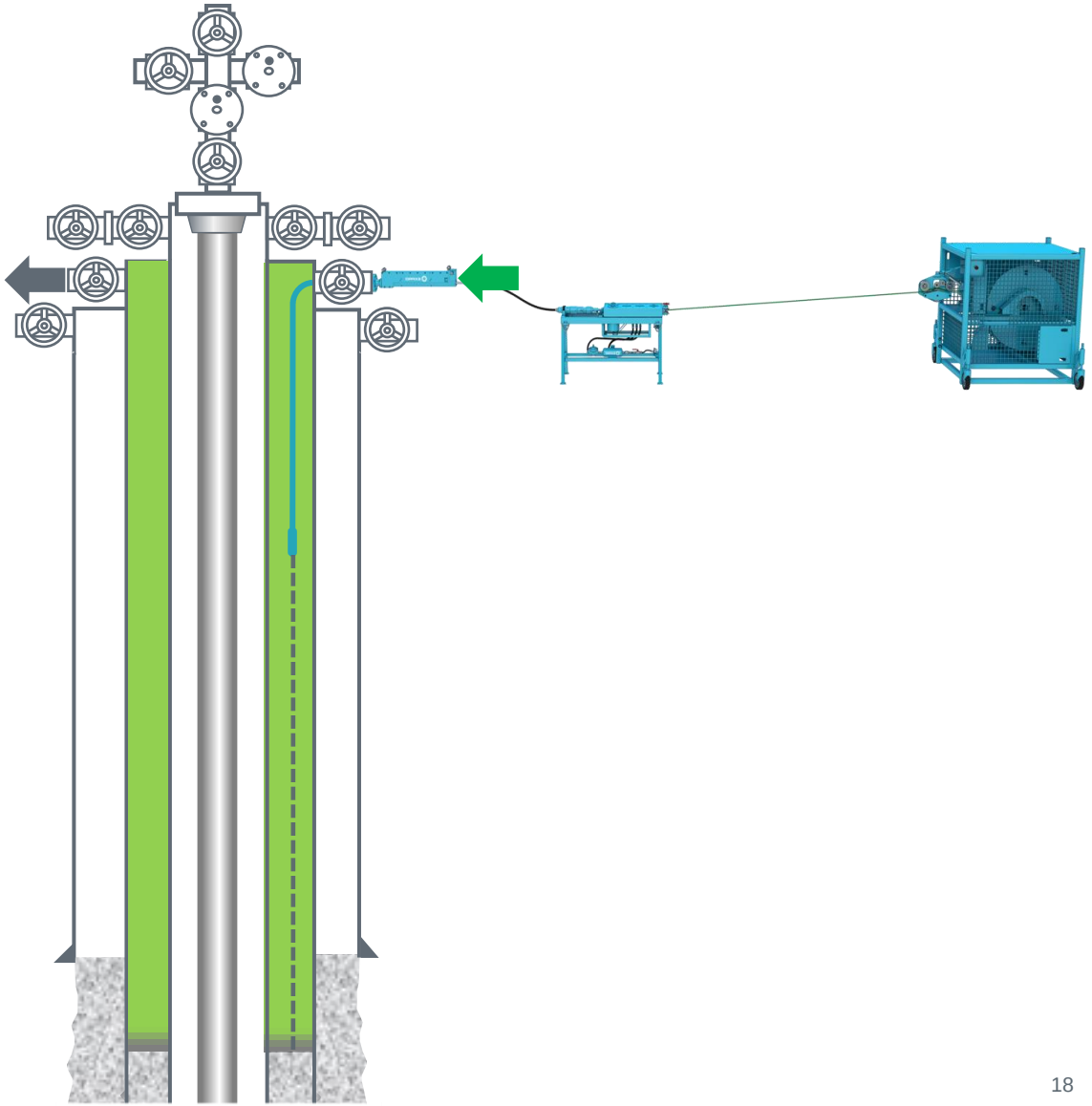

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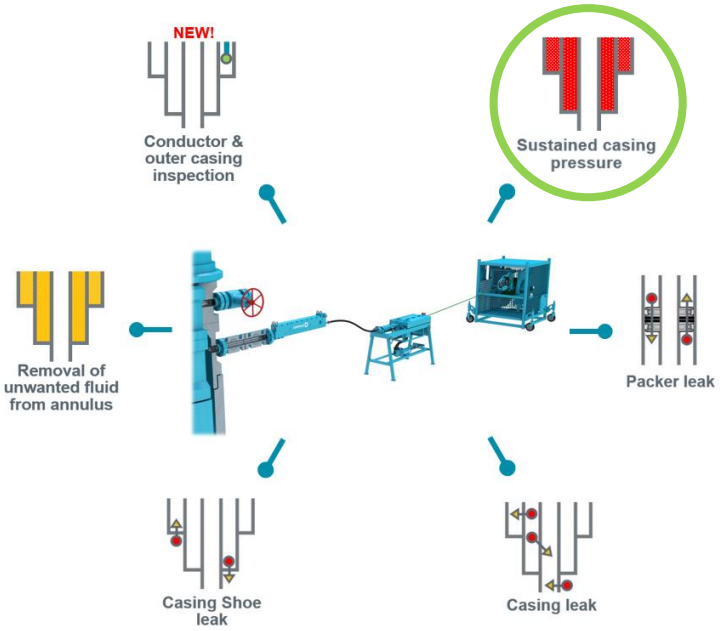

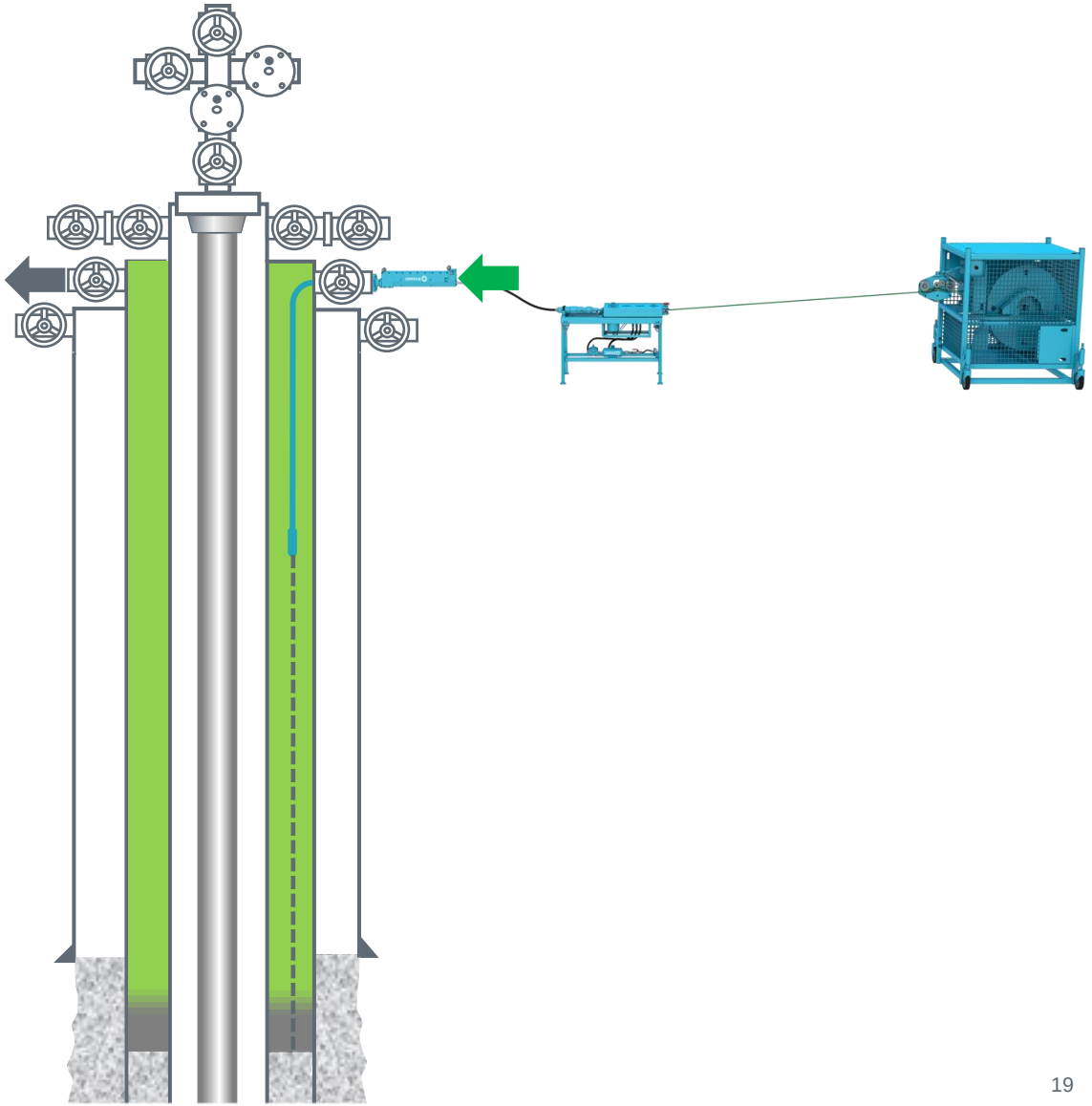

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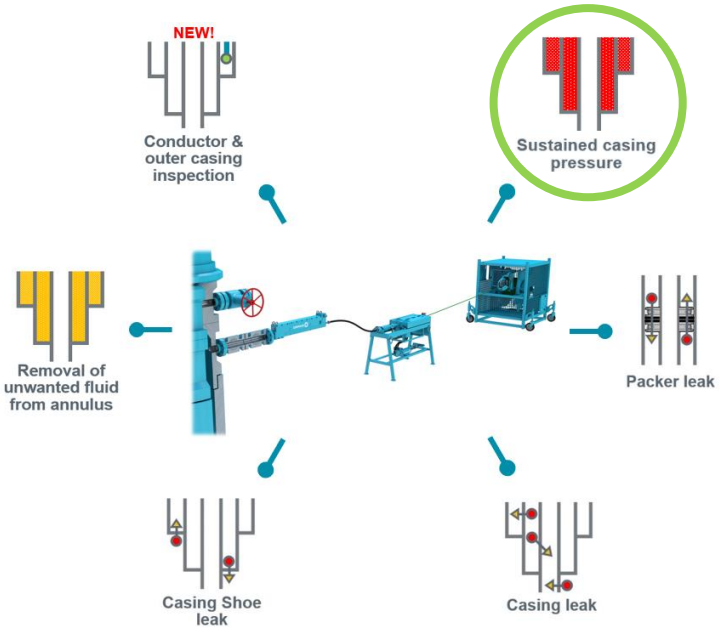
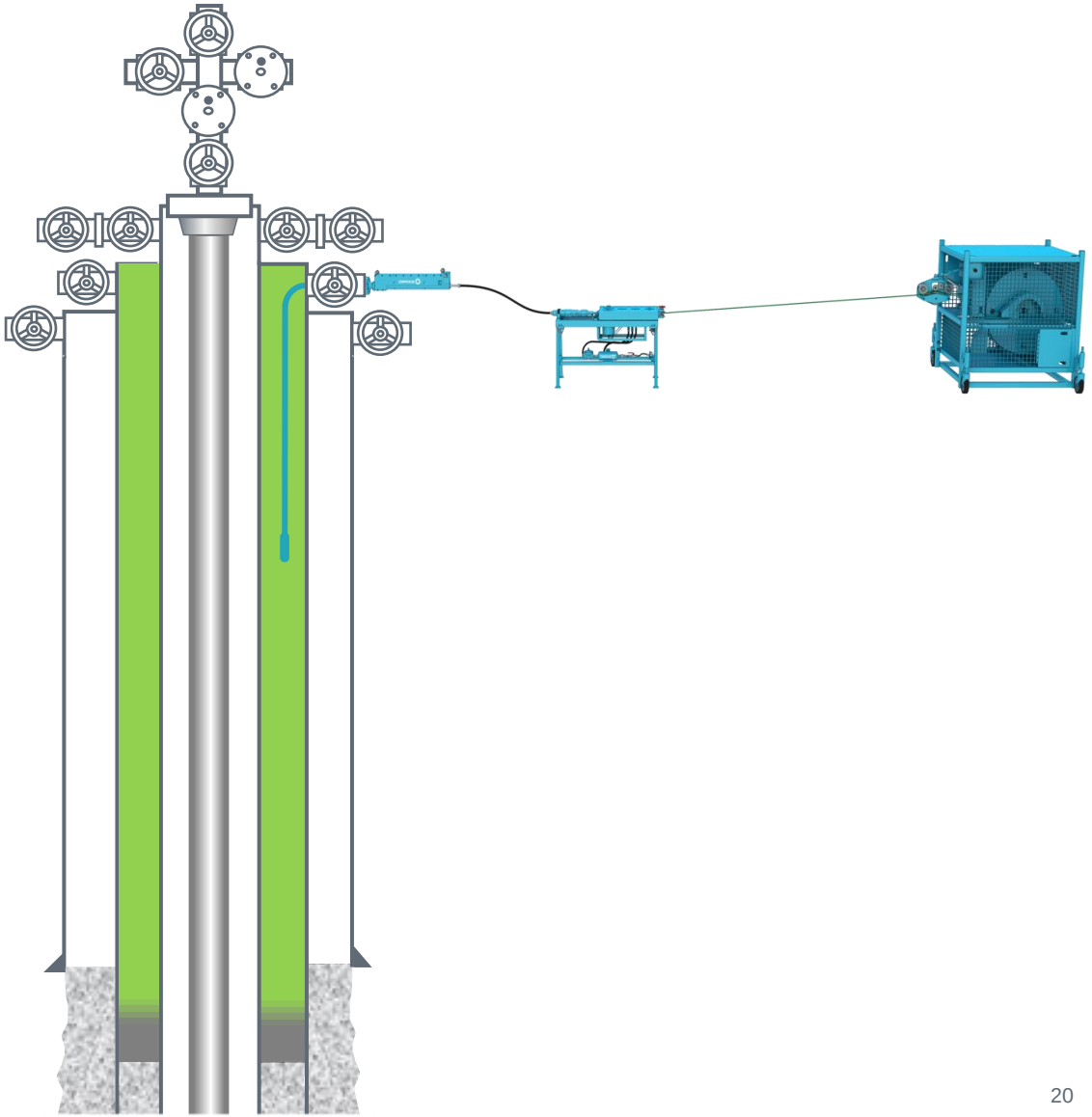
Resin drop sequence

Following the resin pumping a “**squeeze**” operation then takes place. After which the Resin is allowed to cure and is then **in-flow tested**.





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Resin drop sequence

Objective achieved, resin barrier installed and in-flow tested.

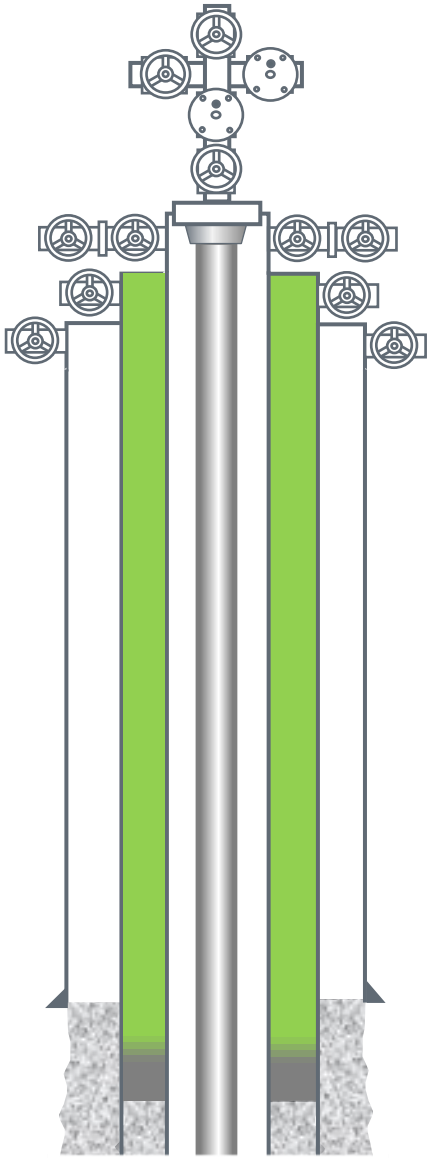
Rig down AI system and hand well back to production.

Bespoke solution

Well Integrity Remediation

Reduces operating costs

Increases asset value



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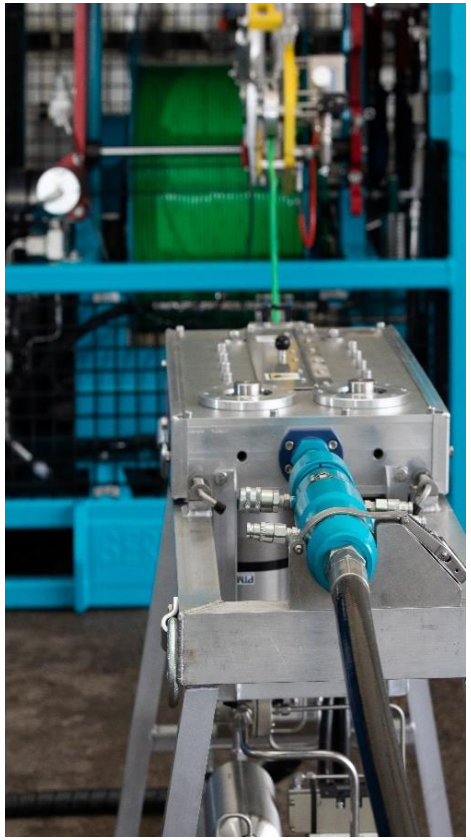
Case study - AI system deployed for sustained casing pressure remediation

Customer challenge

- A major operator had issues with plugged bleed-off lines due to a high viscosity mud in the B-annulus
- A subsequent influx of gas into the B-annulus then caused the well to be shut in
- A traditional “lubricate and bleed” operation was estimated to take 12 months to complete



Expro Excellence

- Expro designed a tailor-made solution featuring a 6mm Hose and Wellspring deployment tool
- An onshore design of service estimated that by deploying the Annulus Intervention system, the operation would be completed within 21 days
- To remove the shut-in casing pressure, the annulus fluid was replaced with 1.5 SG brine

Value to the client

- No spills or incidents occurred during the operation
- The Annulus Intervention system was deployed to 49m depth below the B-annulus gate valve
- The total volume of 252 BBLS of 1.5 SG brine was pumped
- The operation was completed in 25 days
- Production from the well was successfully reinstated

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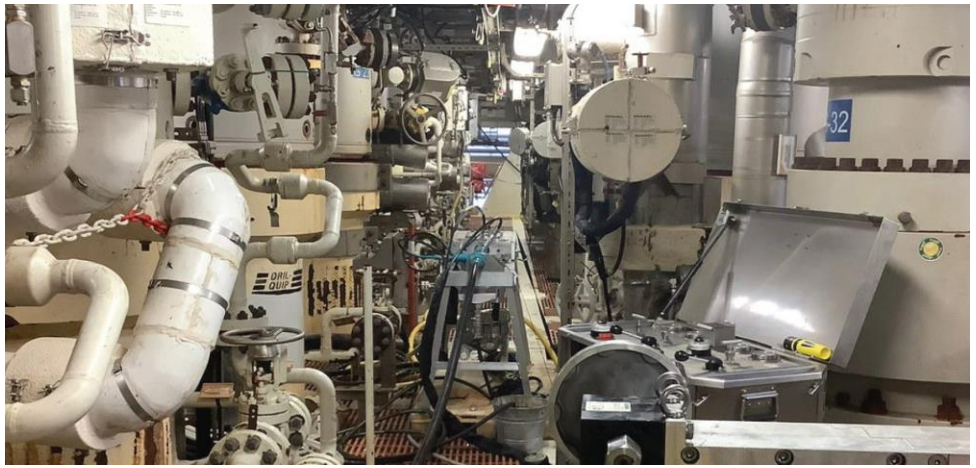
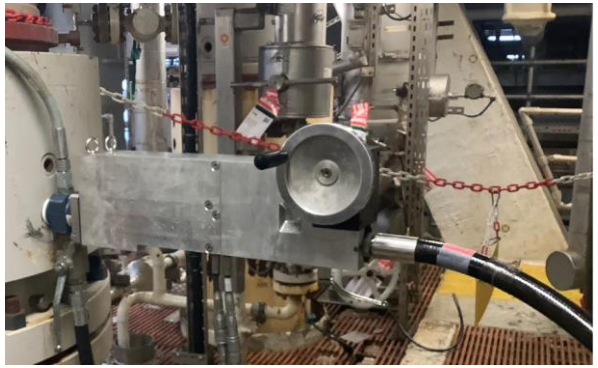
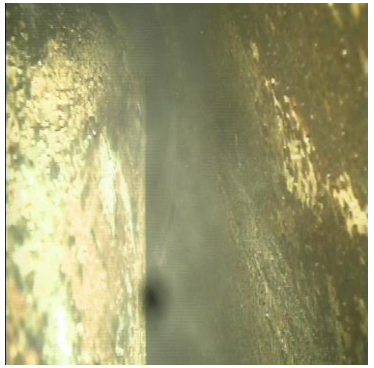
Case study - AI system deployed for slot recovery inspection

Customer challenge

- Expro were approached to provide Annulus Intervention services to inspect the D-Annulus in five wells. The overall objectives of the project were as follows:
  - Determine fluid levels
  - Confirm TOC
  - Fluid swap annulus contents
  - Camera inspection
  - Log the casing wall thickness







Expro Excellence

- The customer had explored several different solutions to inspect the annular
- Expro are the only company globally that can provide annular intervention services using our patented Annulus Intervention technology. We were selected to provide a complete integrated service delivery model for this project

Value to the client

- The customer was able to determine the fluid level and successfully confirm the TOC this allowed the customer validate the well condition
- World first for Annulus Intervention with this specific type of application has proven to be successful in providing more decision-making data for our customer which will now be applied to further wells in the field

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Thank you

Any questions?