Perforate and Wash for P&A

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The well company

Agenda

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1. Perforation Wash Run History
2. Perforation Wash Tool Introduction
3. Formation Integrity Test Tool
4. Casing Recovery Concept
5. Questions

Perforate and Wash Tool Run History

12 zones perforated and/or washed from January 2010 to June 2014

- 4 Statoil
- 3 Conoco Phillips
- 3 BP
- 1 Shell
- 1 Perenco

59 zones perforated and/or washed/tested from July 2014 to December 2015

- 35 Conoco Phillips
- 6 BP
- 8 Mærsk
- 2 Statoil
- 1 Canadian Natural Resources

Perforation Wash Tool Purpose

The main purpose of the Perforation Wash Tool is 2-fold:

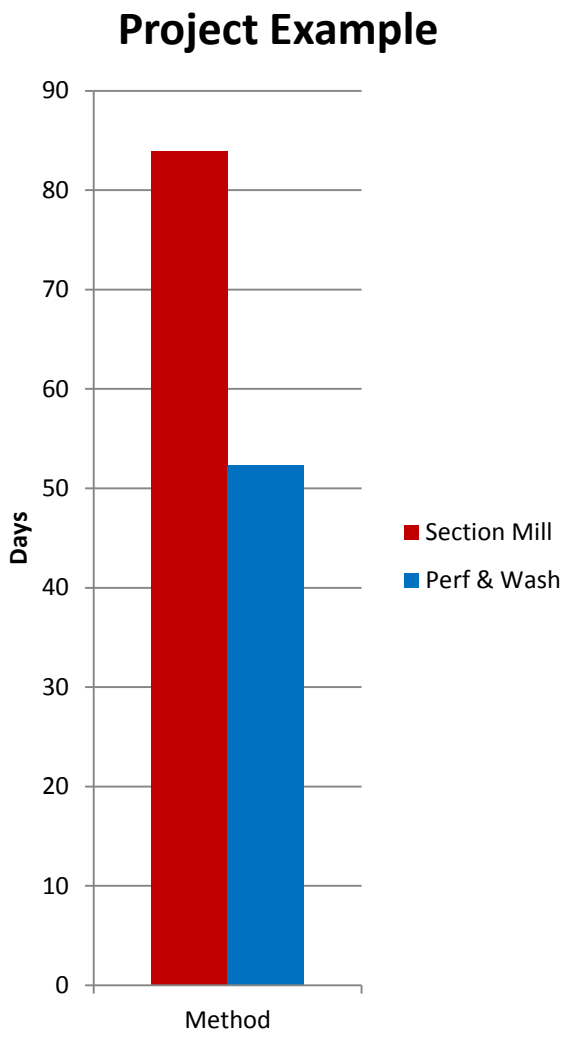
Firstly, to effectively and accurately wash the annulus of unconsolidated solids behind perforated casing (not **yet** a solution for cemented casing) and,

Secondly, to accurately place fresh, uncontaminated cement in the newly-washed annulus to form a barrier acceptable to P&A standards. The “rock to rock” solution.

The example here shows potential time saving for an 11 well campaign with 17 Perf & Wash sections.

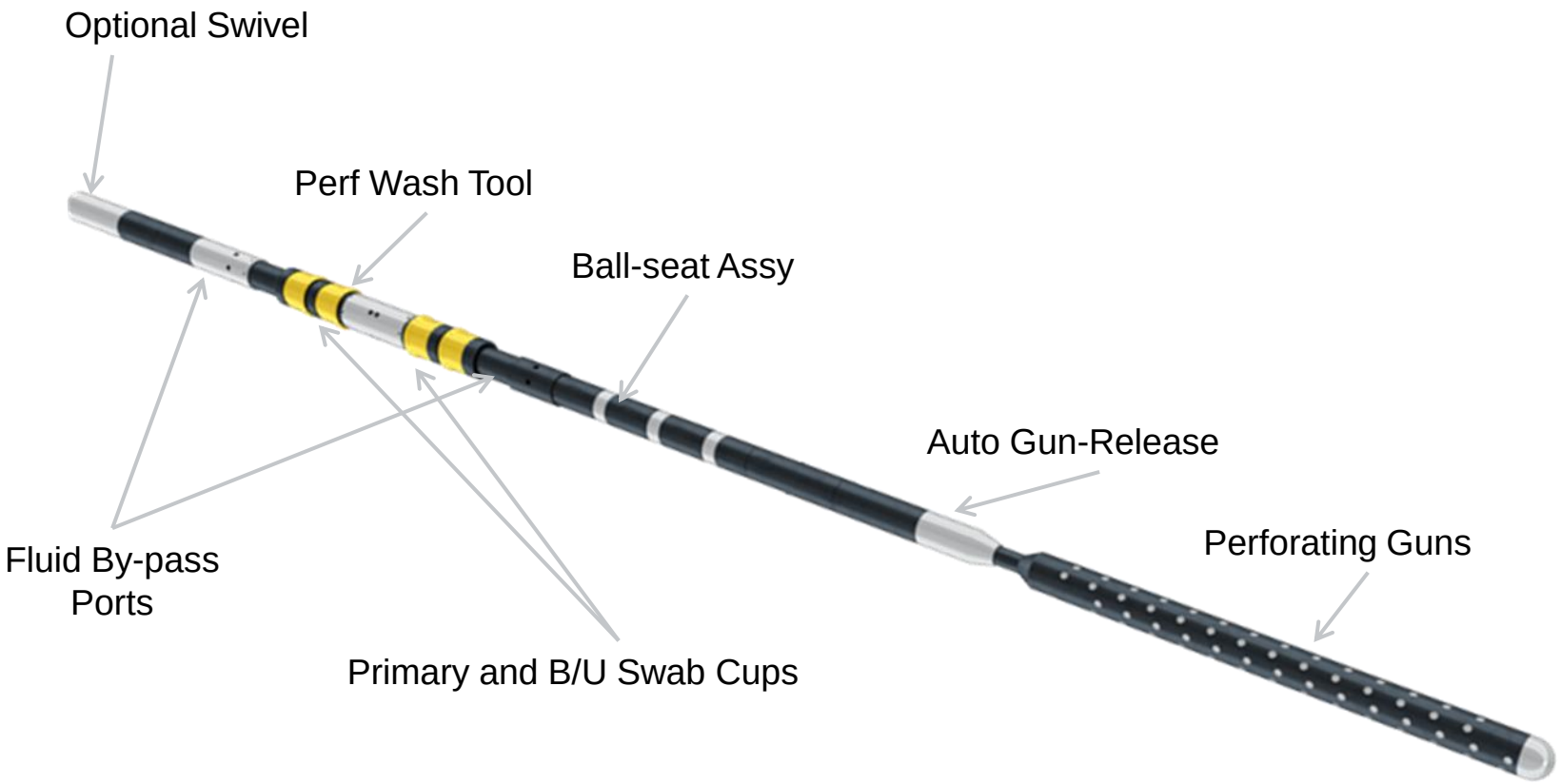
Additional benefits:

- Avoid the HSE issues of section milling swarf.
- Save at least 35% of rig time compared to milling. With less rig crew



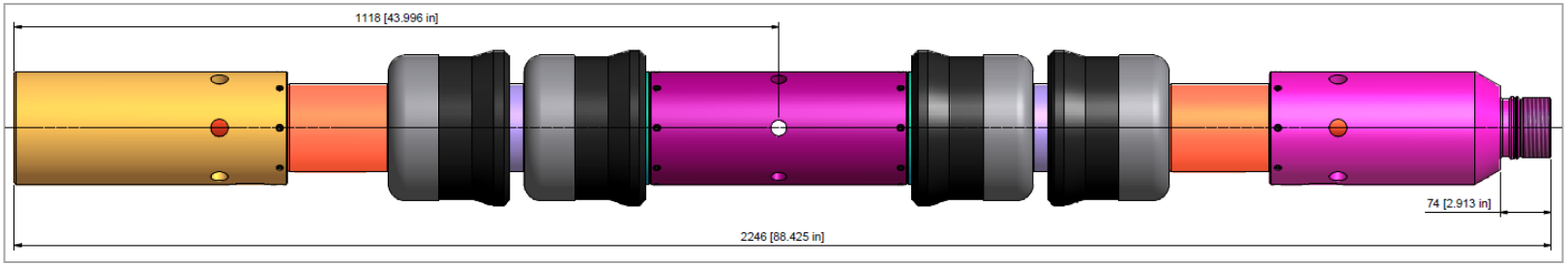
Perforate and Wash Tool

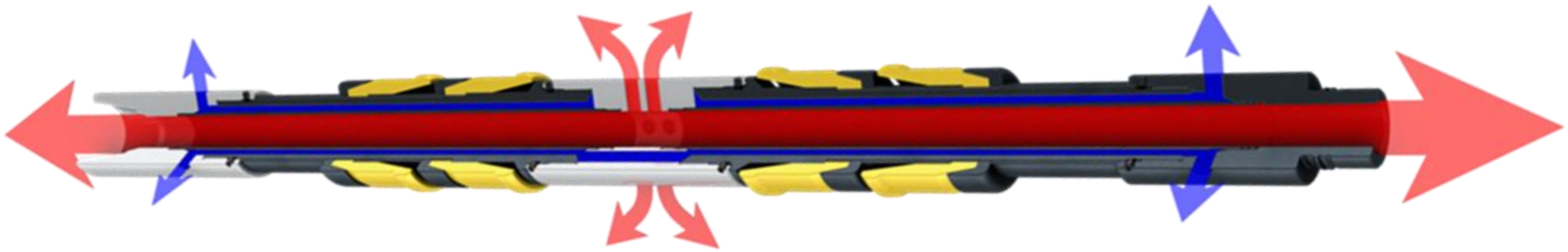
One Trip System



Features

- Dual swab cup design.
- Adjustable distance between the swab cups.
- Accurate control over the fluid/cement placement.
- Flow by-pass system.
- High circulation rates.
- High performance Swivel for wellbore cleaning.





Perforate and Wash Tool

Depending on customer or individual well requirements, the PWT can be run as a 1-trip or 2-trip system and can be configured to perforate only one casing (even inside another) or multiple casing and formation combinations.

2-trip system:

- One trip to perforate.
- One trip to wash the perforations and cement.

1-trip system:

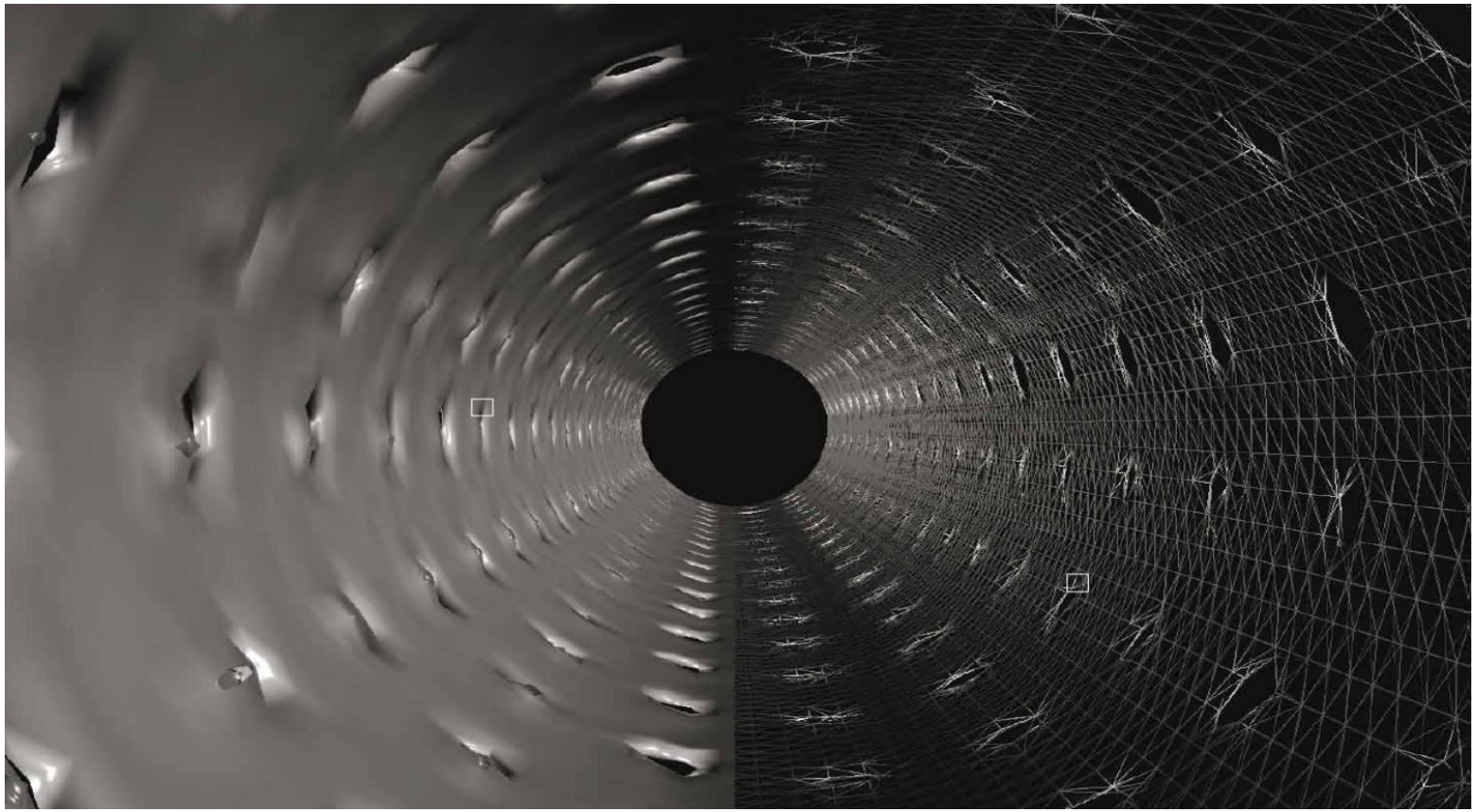
- One trip to perforate, wash and cement.

The perforating guns are normally dropped in the well after firing, if there is sufficient sump available to do so.

Ported subs above and below the tool and internal channels allow wellbore fluid to bypass the swab cups while tripping.

After isolating the PWT through bore, the washing fluid, spacer and cement is directed only through ports between the swab cups for accurate placement.

Perforation area geometry

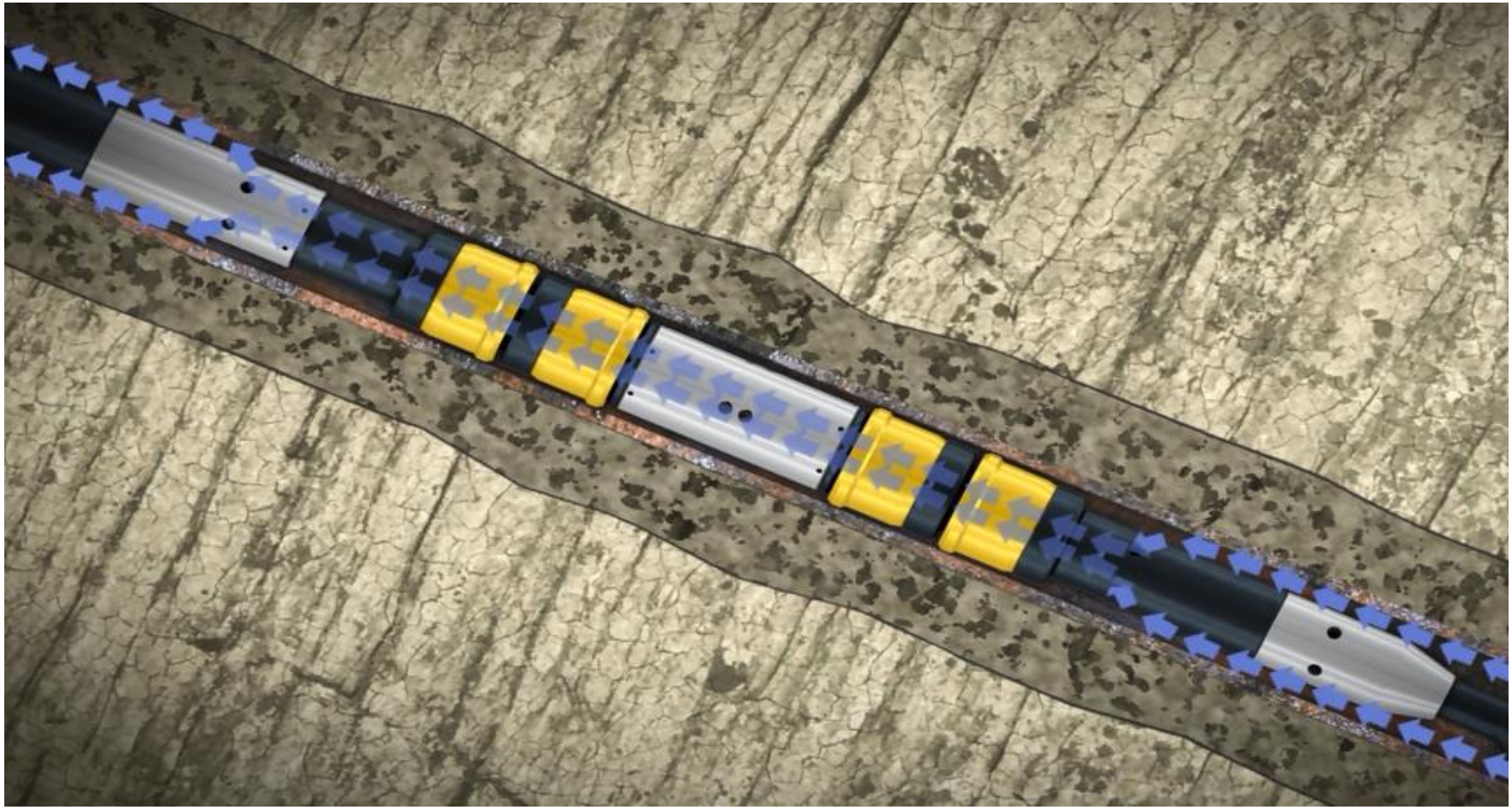


Perforation Wash Tool Operating Sequence

Operational sequence:

RIH with the PWT to the required depth.

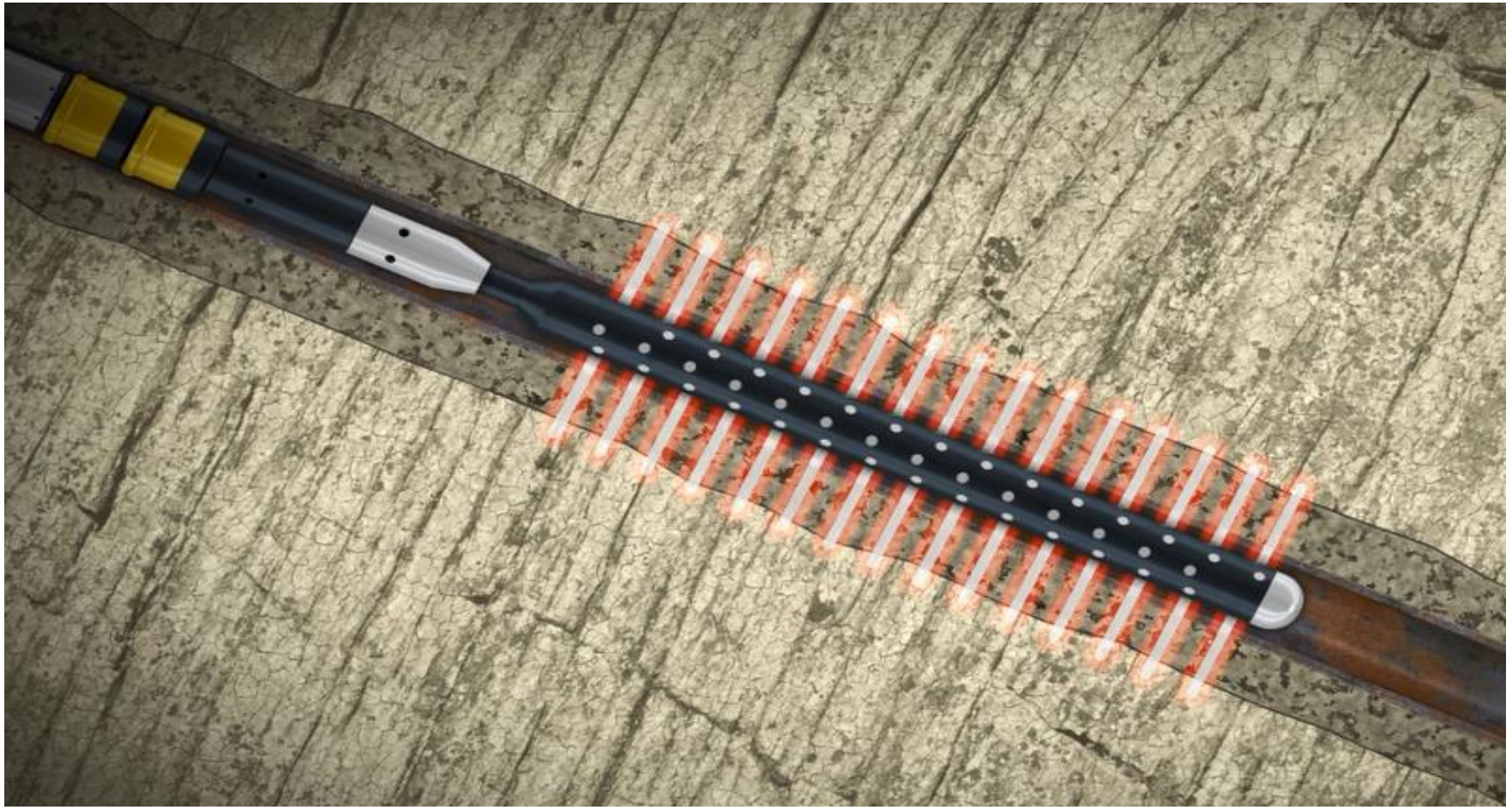
The by-pass system is active during tripping to eliminate swab and surge.



Operational sequence:

Perforate the desired interval and length according to the TCP procedure.

Correlate perforation depth according to wireline logs.



Operational sequence:

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After perforation, the guns will automatically release.

This is only applicable on single-run systems.

Operational sequence:

Start the washing sequence through the perforated interval with max circulation.

Establish circulation with 420 gpm and watch for returns on shakers

Stay below 75% of shear pressure for the ball seat.

Operational sequence:

Wash the entire interval with 420 gpm from top to bottom of the perforations.

Operational sequence:

Wash the entire interval with 420 gpm from bottom to top of perforations.

Operational sequence:

Once inside blank casing, shear out the ball-seat to open the end of the string.

Circulate bottoms up with 600gpm while rotating the string (120 rpm). Record any returns at the shakers.

Operational sequence:

Drop the activation ball to direct the flow between the swab cups. RIH to the bottom perforation and start displacing spacer out into the annulus.

Operational sequence:

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Continue displacement of the spacer into the annulus by using the “pump and pull” method.

Operational sequence:

Stop pumping when the pressure increases entering the blank casing section.

Stay below 75% of shear pressure for the ball seat.

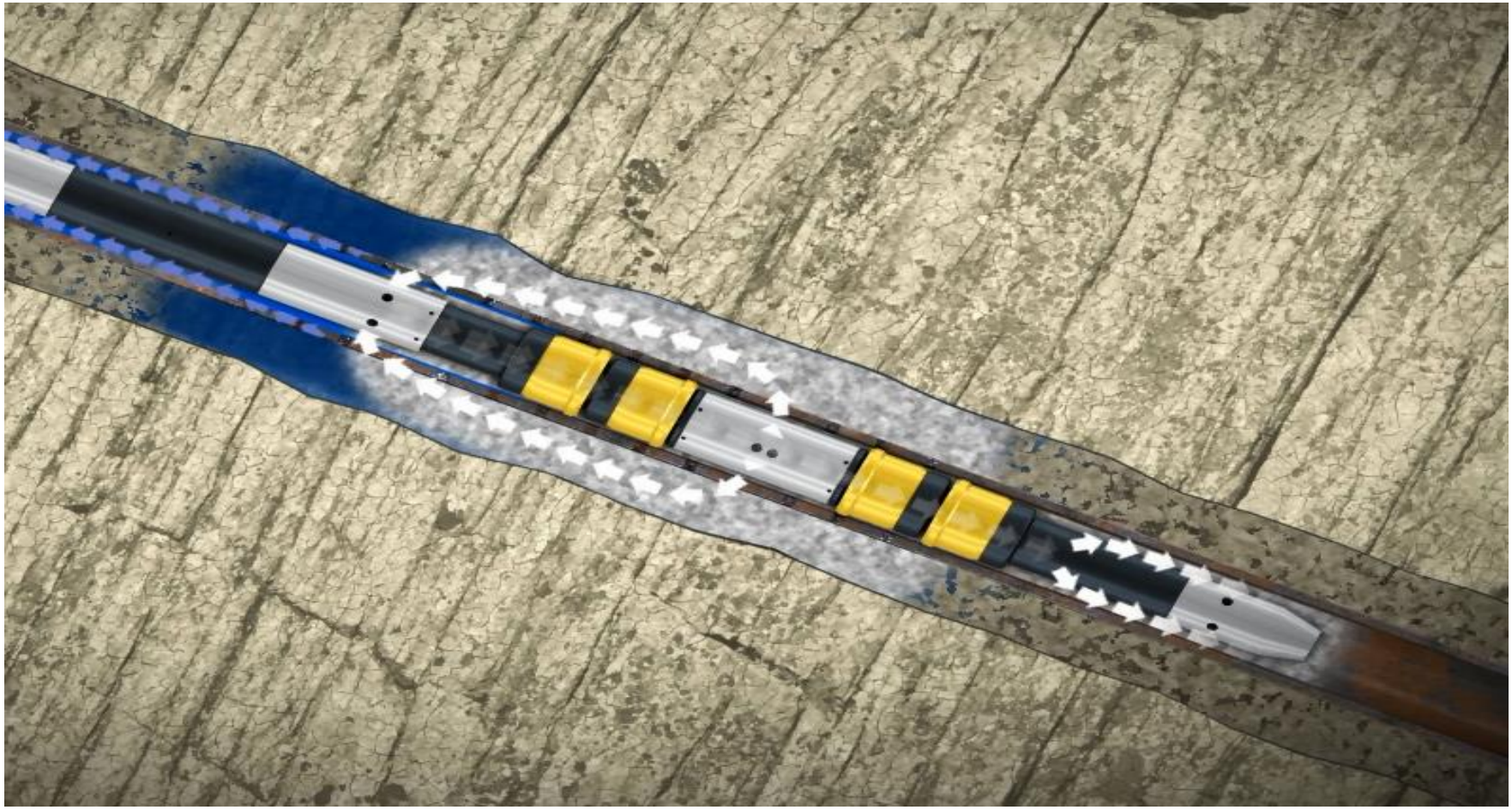
Operational sequence:

RIH to the bottom of the perforations and start pumping cement.

Use the same rate and pulling speed as in the spacer placement.

Operational sequence:

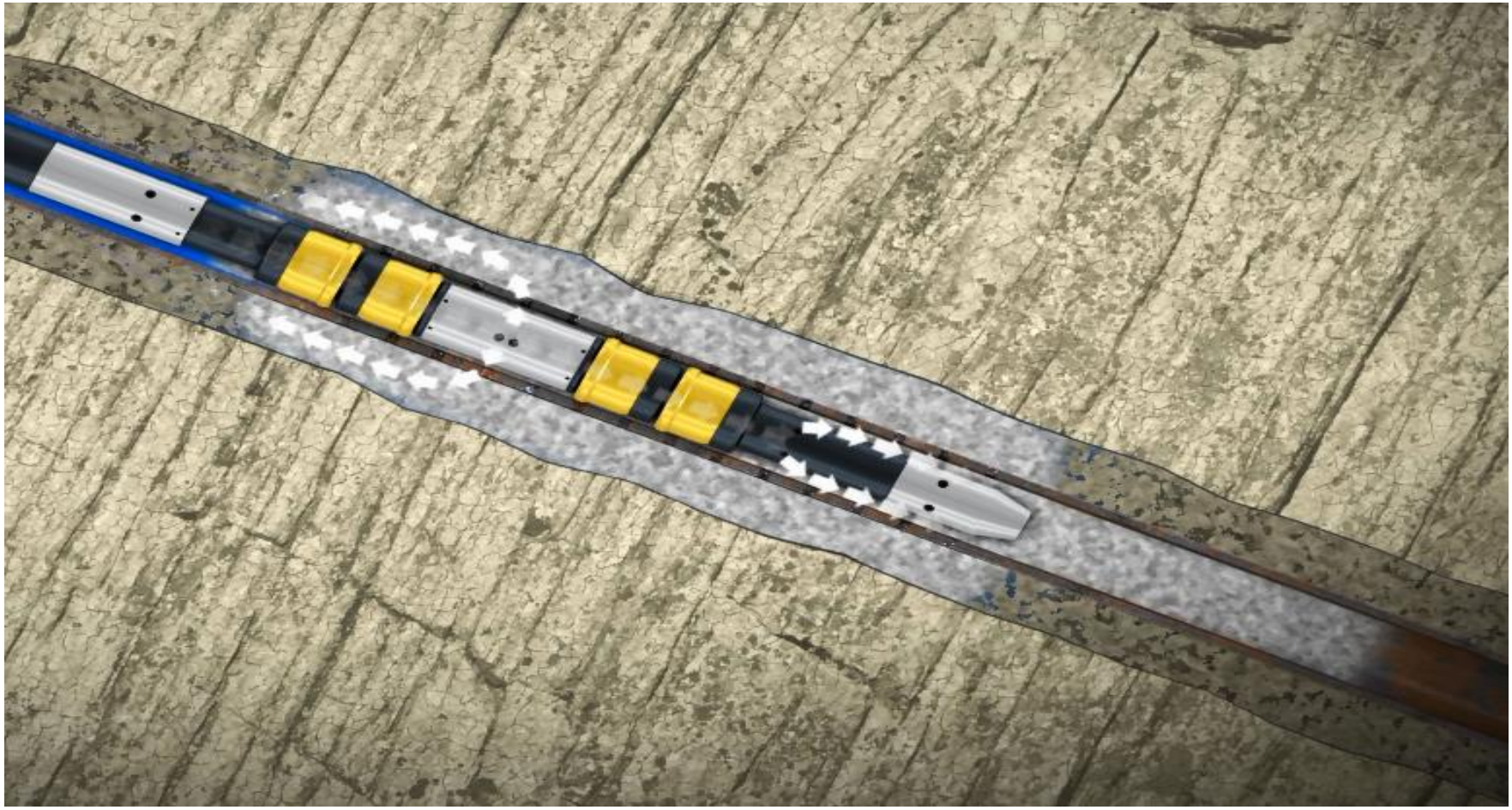
Continue pumping cement while POOH.



Operational sequence:

When reaching the blank casing section above the top perforation the pressure will increase.

Stop pumping cement. The by-pass system will ensure that no swab/surge will occur.



Operational sequence:

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Pressure up to blow out the ball seat.

Theoretical shear pressure may be found on the check-list drawing.
This will open the bore for full flow through the PWT.

Operational sequence:

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Pull out 5 stands and circulate out any excess cement.

Watch for cement in returns.
The by-pass system will guide returns to rig.

Operational sequence:

After circulation, POOH with the PWT.

Operational sequence:

The section is now cemented according to P&A standards.

If evaluation is needed, the plug may be drilled out and the casing logged.

Perforation Wash Tool Animation

Thank you

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