

Well Integrity – Exercise

Well Integrity in Subsea wells

Federico Juarez – AkerBP



A focused portfolio on the NCS



Skarv / Ærfugl

Solid base performance and area upside potential



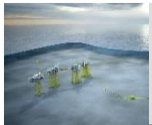
Alvheim area

High production efficiency and low operating cost



Ivar Aasen

Production ramp-up and IOR opportunities



Johan Sverdrup

World class development with break even price below 20 USD/bbl*



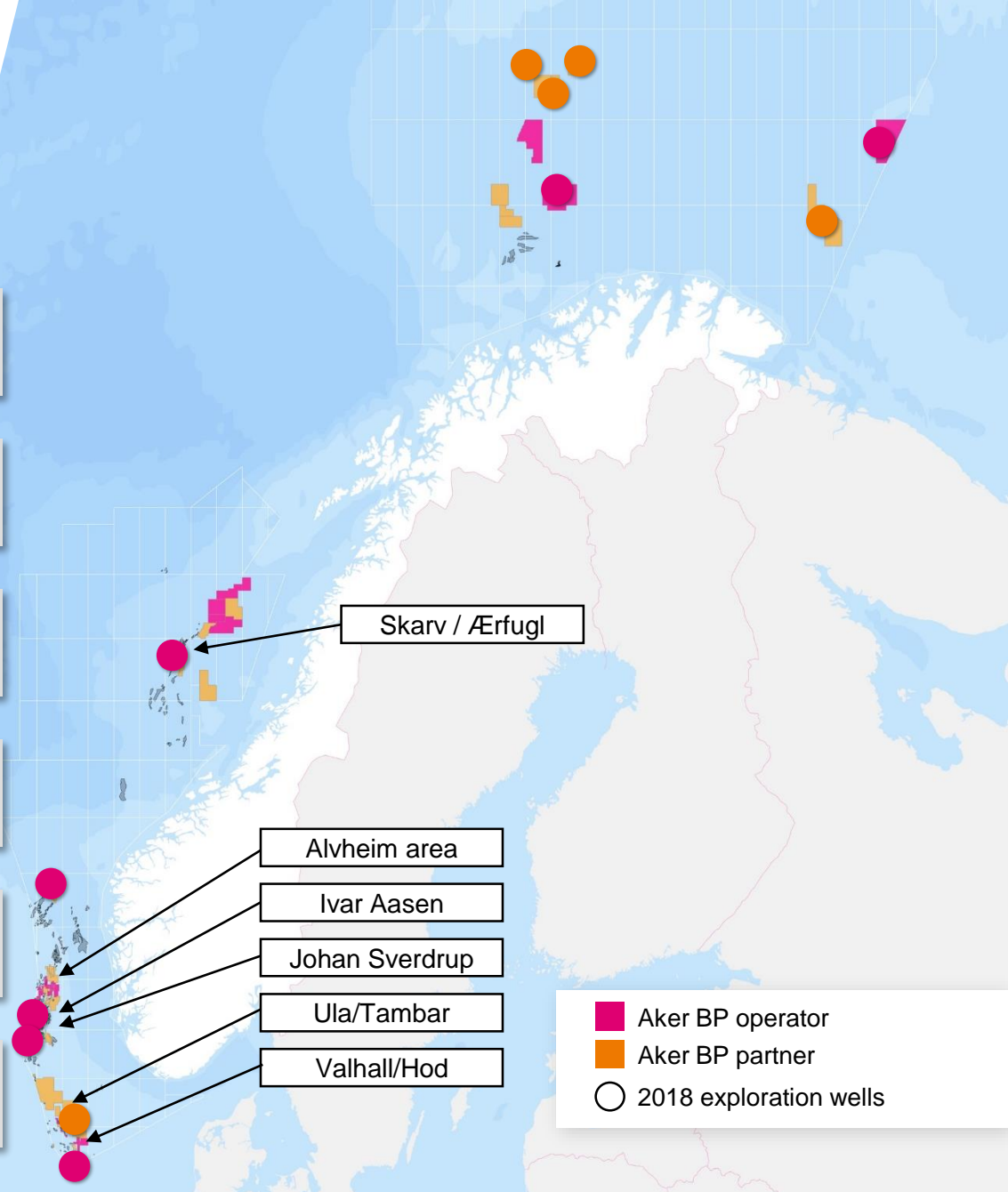
Ula/Tambar

Late life production with significant upside potential



Valhall/Hod

1 billion barrels produced, ambition to produce additional 1 billion barrels



ORGANIZATION

Well Integrity AkerBP



■ Tommy Skjerven
Manager Well Integrity&Intervention



■ Federico Juarez
Well Integrity Engineer
Skarv & Alvheim



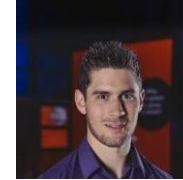
■ Michelle Monteau
Well Integrity Engineer
Ula & Tambar



■ Vinh Tran
Well Integrity Engineer
Ivar Aasen



■ Anders Hjellen
Well Integrity Engineer
Valhall



■ Oliver Knight
Well Integrity Engineer
Pre-rig and P&A planner



■ Minh Pham
Well Integrity Engineer
Wellhead and XT



■ Kjell Corneliussen
Well Integrity Engineer
Integrity support

The presenter – Federico Juarez

- 2009 – Petroleum Engineering – UNAM National University of Mexico
 - 2009 – Specialization in Production Engineering. Thesis: Subsea Separation
- 2011 – MSc. Petroleum Engineering– NTNU Norges Teknisk-Naturvitenskapelige Universitet
 - 2011 – Specialization in Drilling and Well. Thesis: Analysis of pump systems for start-up of low pressure wells.
- 2011 - 2013 – Equinor– Completion Engineer of subsea wells
- 2013 - 2014 – ConocoPhillips – Drilling Engineer
- 2014 – 2018 ConocoPhillips – Well Integrity Engineer
- 2018 – AkerBP – Well Integrity Engineer



**All drawings and data presented in this presentation are not real
and only meant for illustrative purposes.**

Case #1 – Subsea oil producer

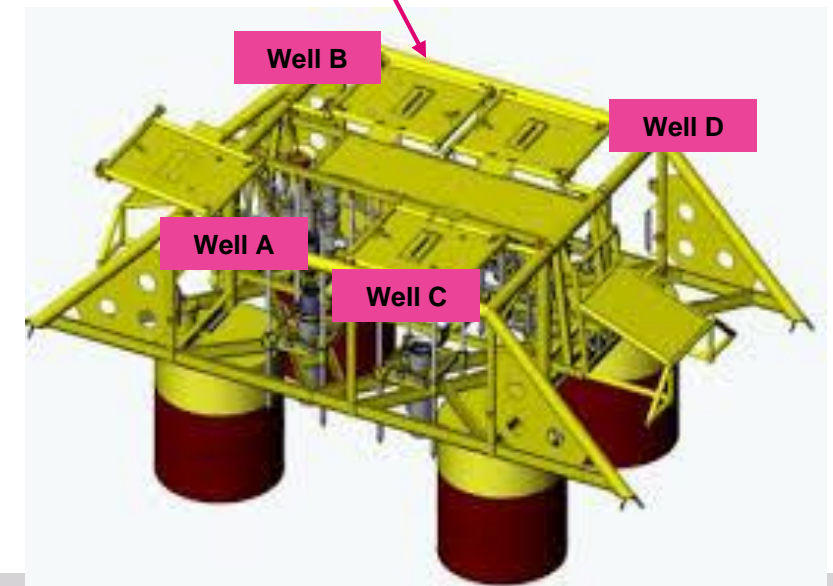
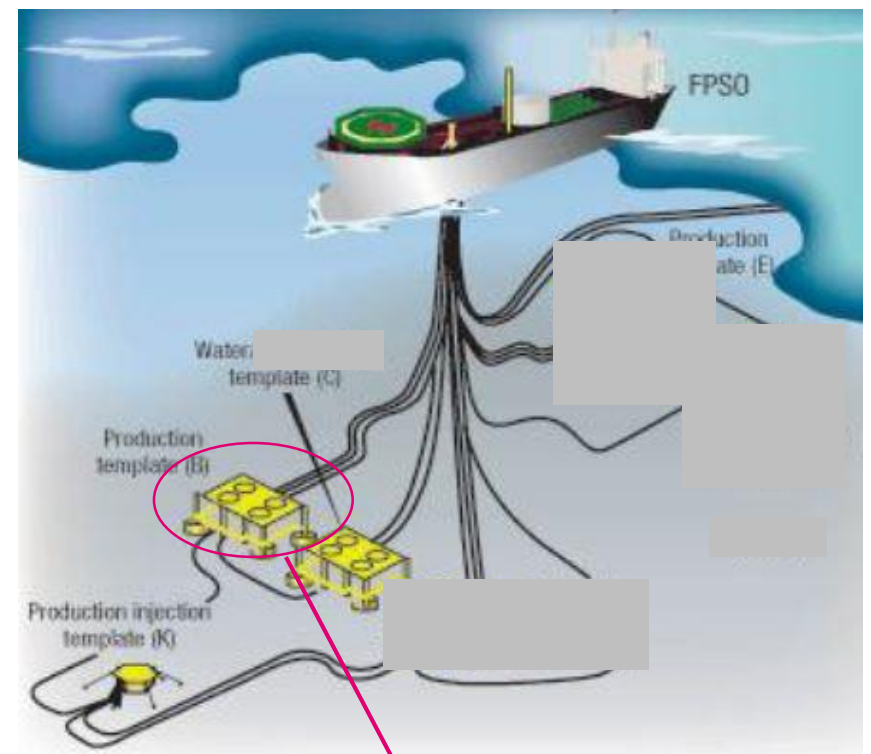
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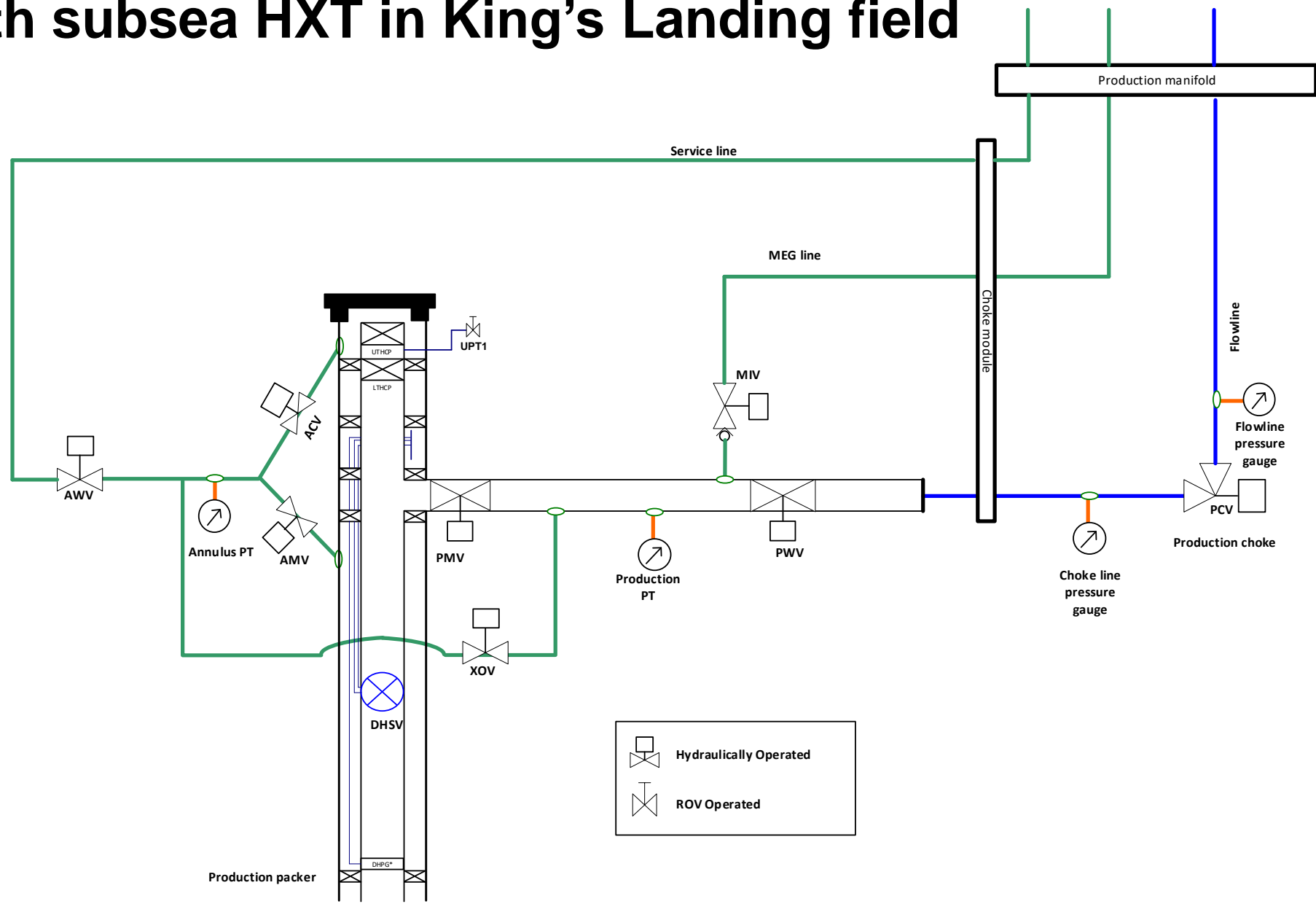
Location – Field layout

- Wells A and B are subsea wells with horizontal valve trees located in the King's Landing field. No gas lift.
- Water depth is 500 mTVD. All wells on template are on 6M PM program and 1Y ROV inspection.



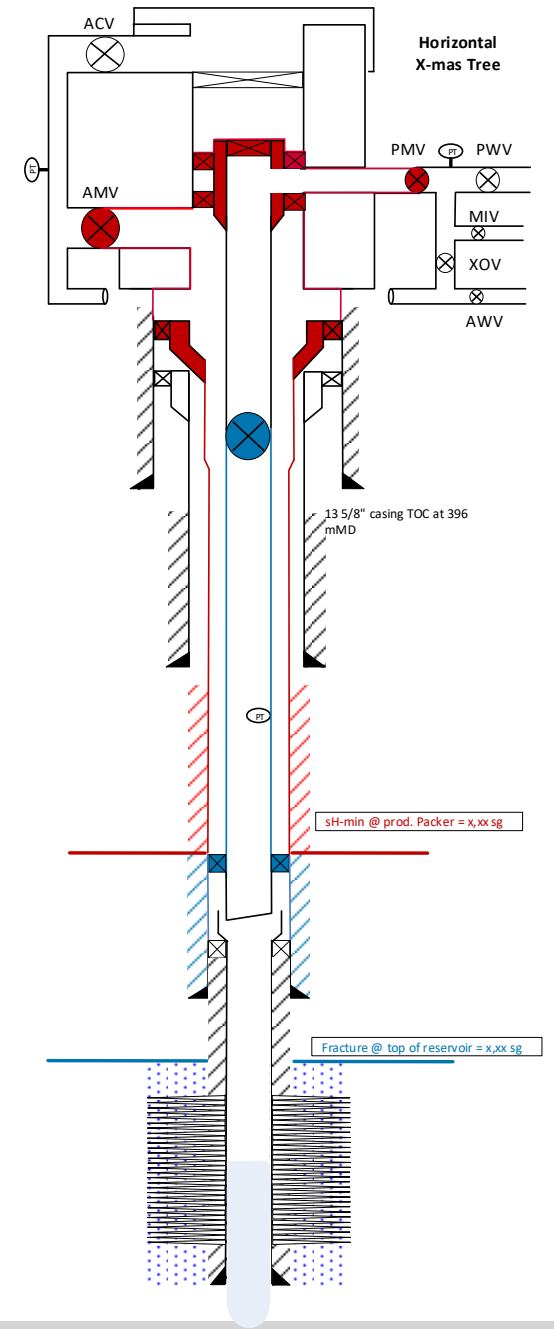
Template: [Link](#)

Subsea well with subsea HXT in King's Landing field



Well details – Case #1

- Subsea gas and condensate well A with HXT. Water depth = 500 m.
- Monitoring A-annulus on HXT. No downhole A-annulus gauge. Tubing pressure monitored both on HXT and downhole.
- ROV inspection of WH and XT done one month ago on all the wells in the field. No leaks or anomalies observed.
- Not possible to use service line for bleed off or pumping.
- Wellhead flowing pressure 195 bar.
- Well Integrity category: Green well (*healthy well with no failures or minor issues*).



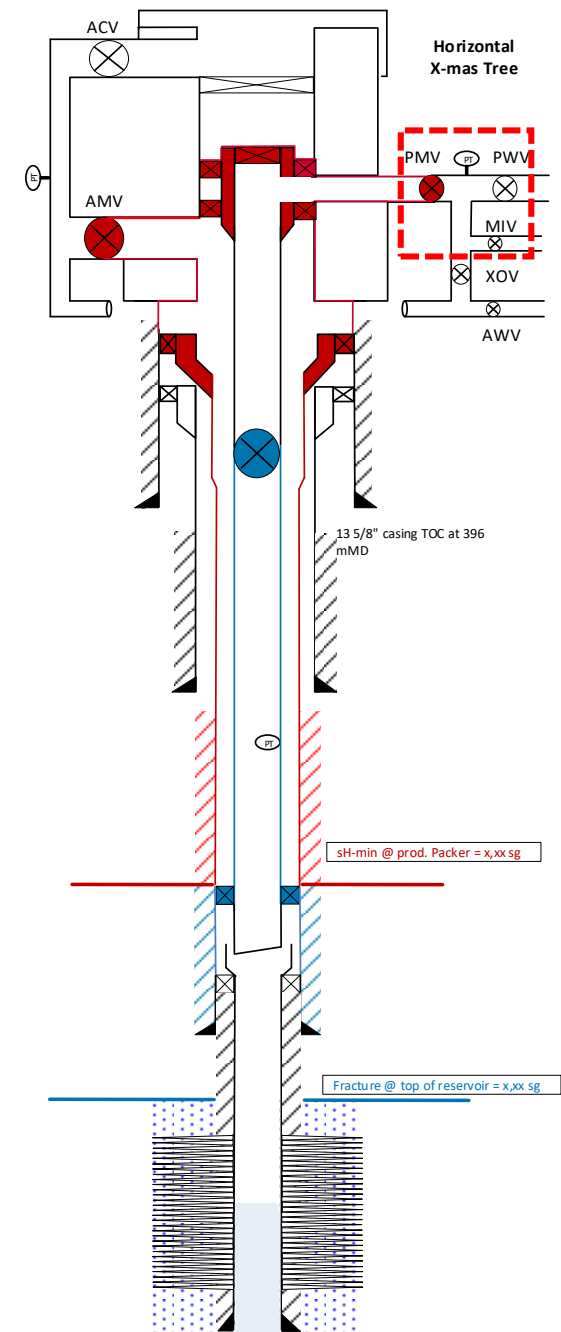
Well issue

- During planned testing of HXT valves, there is pressure drop observed in the pressure transmitter in the production cross.
- The leakage acceptance for PMV and PWV is 70 bar / 10 min.
- SIWHP prior to performing the integrity test was 200 bar
- Flowline pressure is 110 bar
- Well does not have a history of well barrier failures since it came on production back in 2005.
- Offshore personnel followed test procedure and acceptance criteria accordingly.

Test results reported by offshore organization:

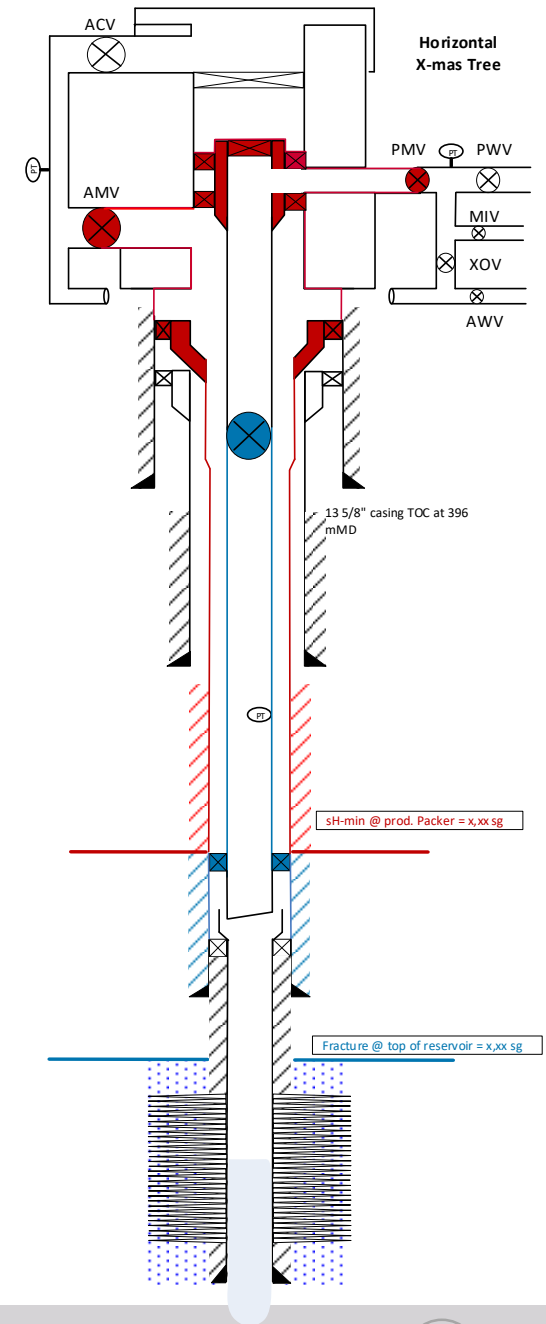
PMV: 6 bar/min

PWV: 0 bar/min



Discuss

1. Is the leak outside acceptance criteria for PMV or PWV (or both)?
2. What concrete actions would you recommend for this well?



Now, assume:

The integrity test on well A is performed during an internal audit by Well Integrity at the facility in the King's Landing field.

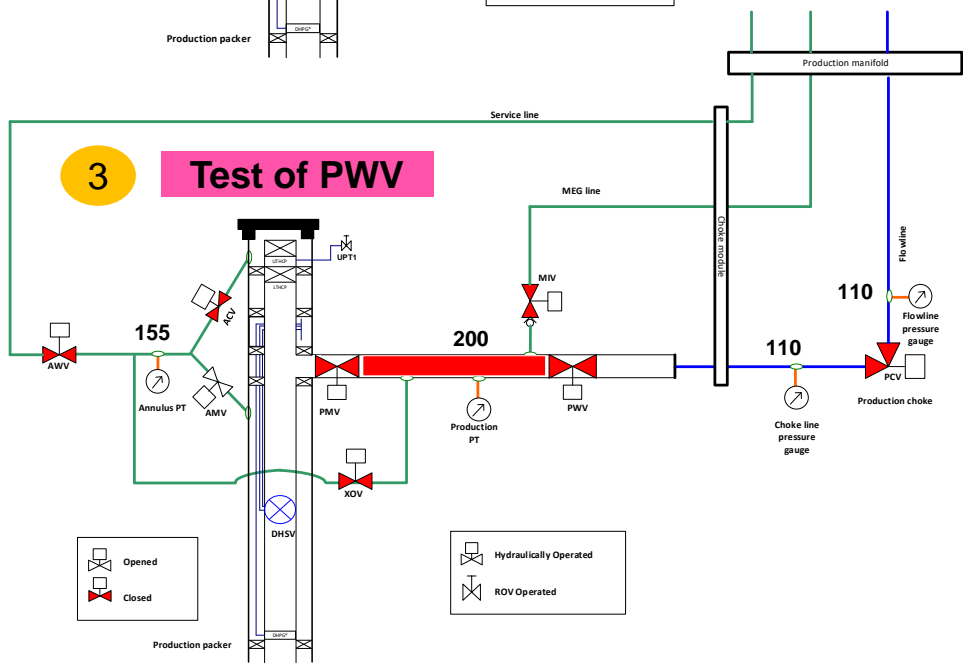
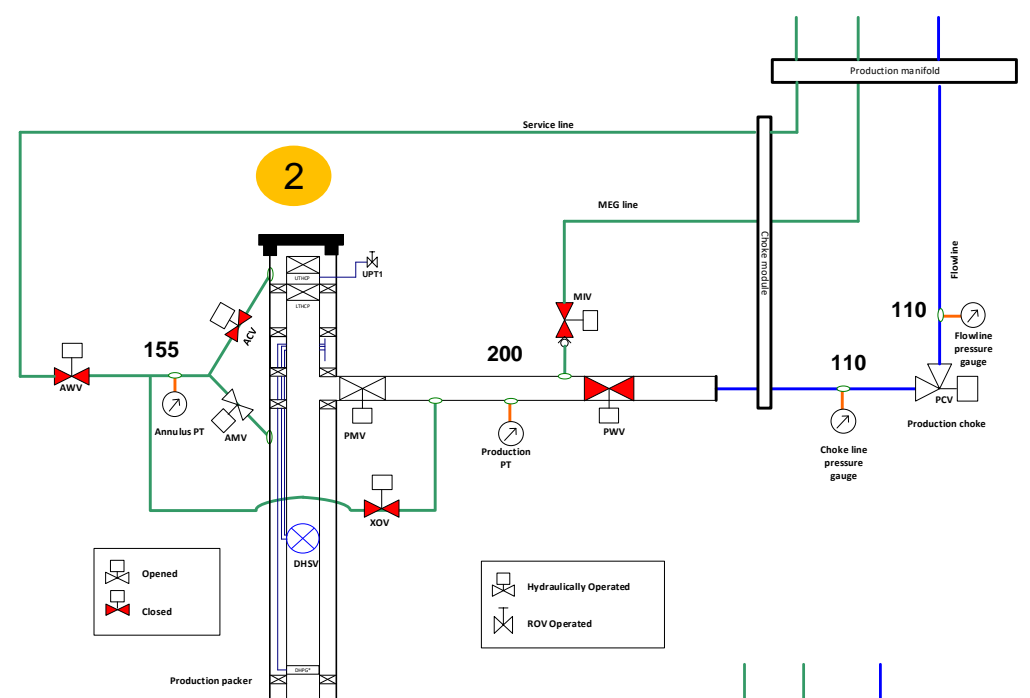
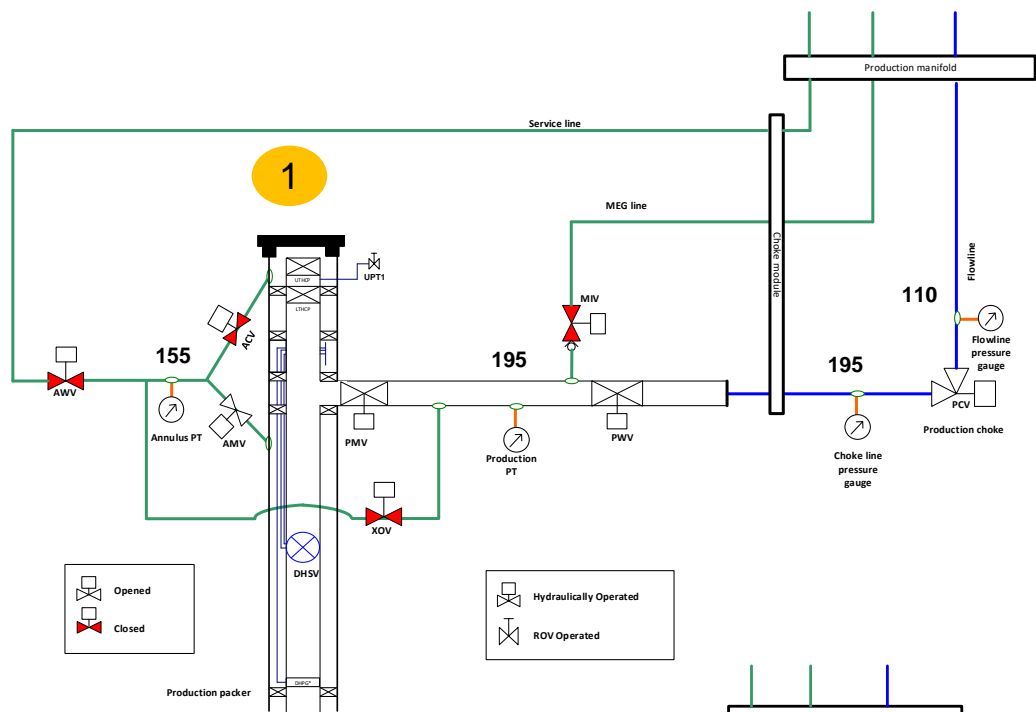
Review the integrity test illustrated in the figures in the following slides and discuss:

1. Is the leak still outside acceptance criteria for PMV or PWV (or both)?
2. What concrete actions would you recommend for this well?

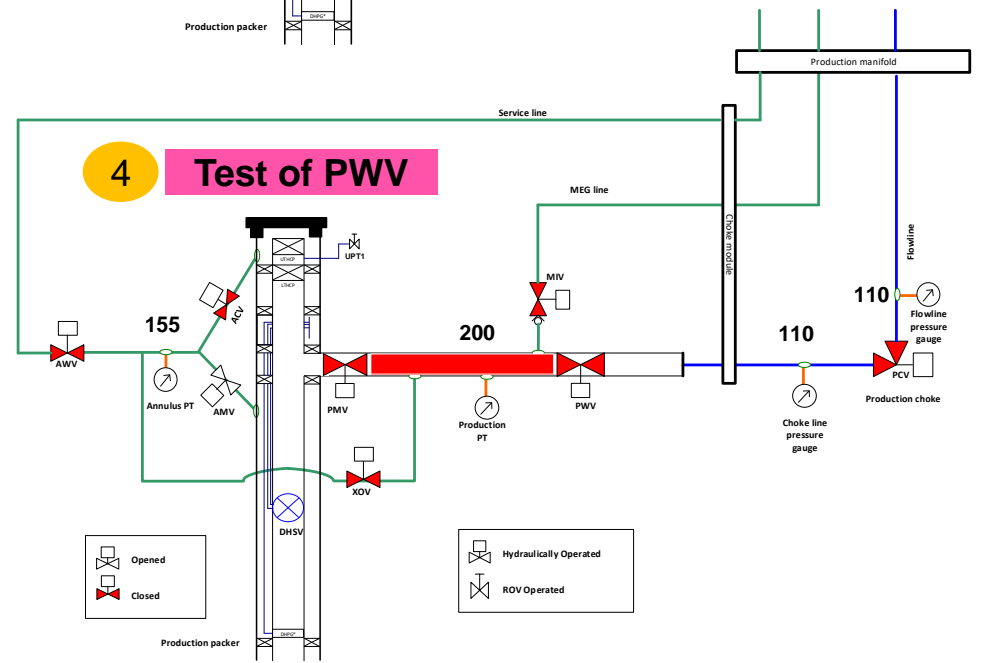
Additionally:

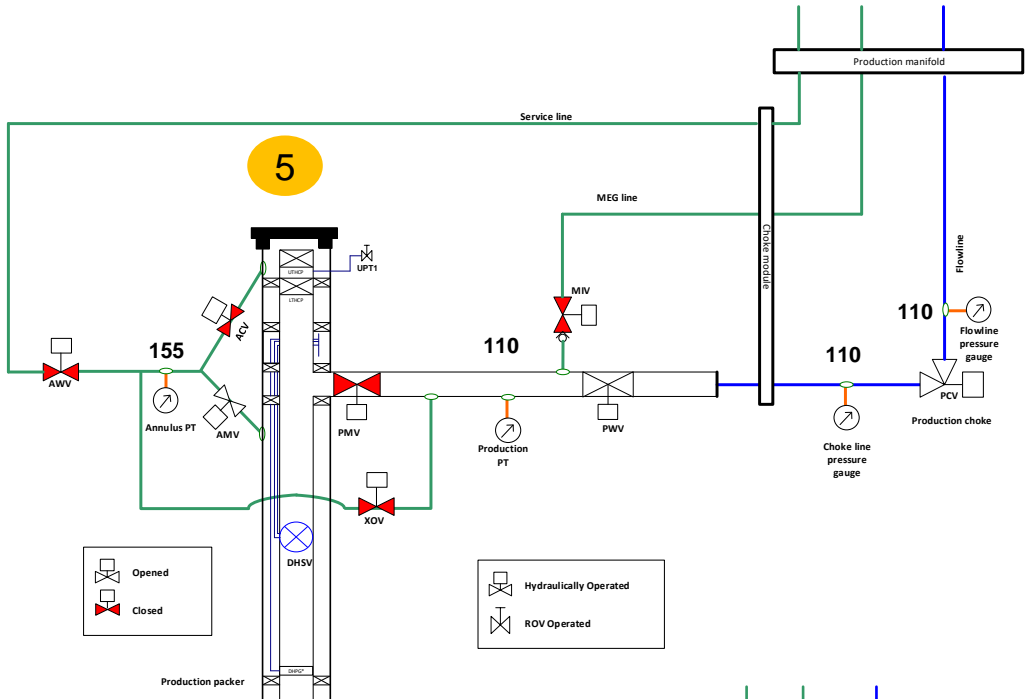
- a) What systems or procedures do you have in place to identify these scenarios?
- b) What degree of communication does exist between your onshore and offshore organization regarding well integrity testing and results.





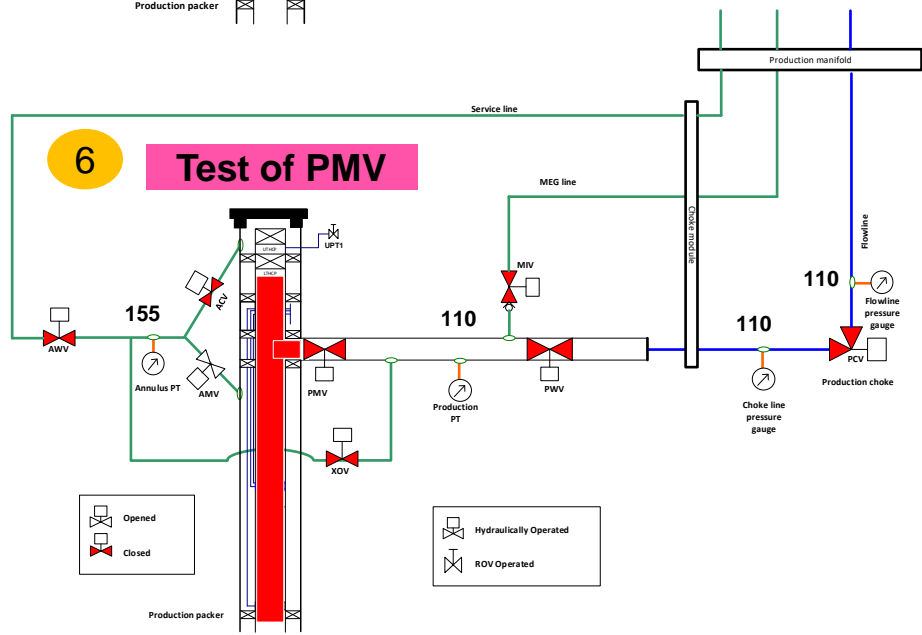
10 min later



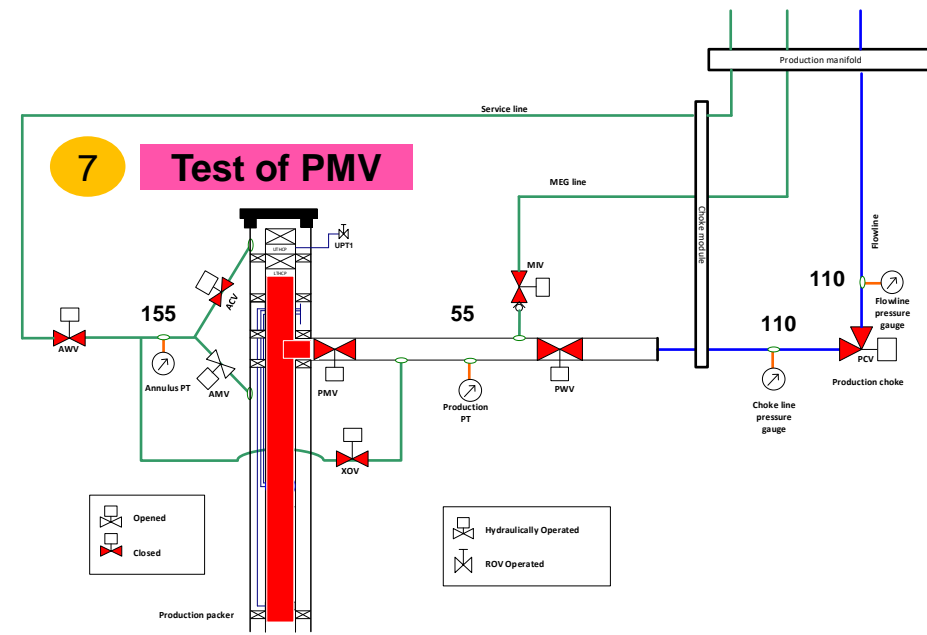


■ Leak rate measured at ca. 6 bar/min

■ Pressure stabilizes at 55 bar



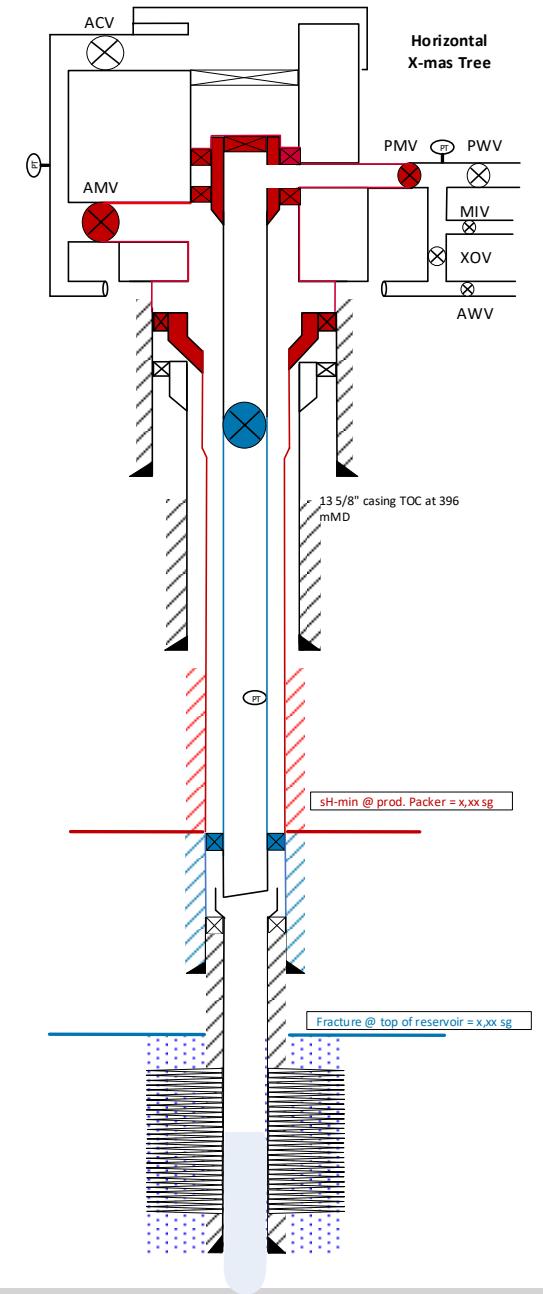
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What if?

- Two months after the previous incident, well B shows leak within criteria during well barrier test on the PMV.
- Leak rate estimated at 5,6 bar/min.
- SIWHP for this well is 280 bar.
- This well has had some history of failed PMV tests. However, leak rates have always been within acceptance criteria according to results registered by offshore personnel.
- No other failures or degradations in this well.

For your information: The ROV is performing some inspection work on subsea flowlines nearby.



Discuss

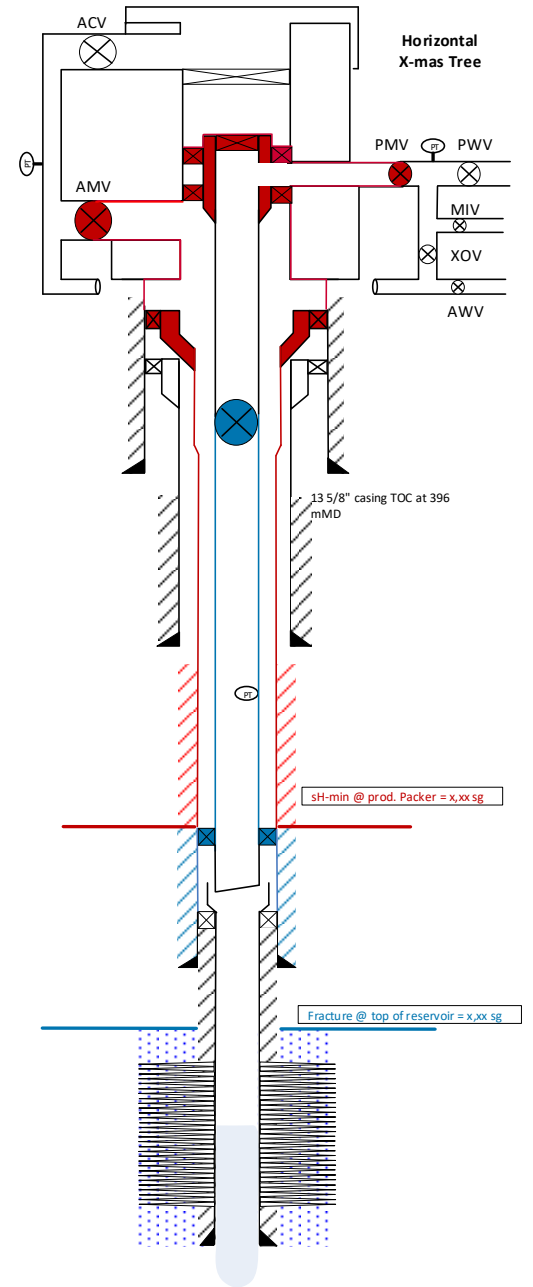
1. What are your recommendations for this well based on the experience from the previous case?

Re-evaluate with new information

Well Integrity and Subsea engineering decide to send the ROV to inspect.

The following is observed:

- ROV observes bubble rate of 0,08 l/s of gas coming out of **well B**.
 - Depth of release is around 500 mTVD, giving around 3 lt/s at surface conditions. Gas density = 0,9 kg/m³ (how many? Kg/hr)
 - The well is a subsea gas and condensate producer
 - Leak observed for a period of time prior Well Integrity recommending immediate shut-in of the well.
 - No temperature anomalies have been observed on this well.
- As a mitigating measure, a new well integrity test is performed on the HXT on **well A**. ROV observes gas leak coming out of the PMV/PWV area during the test.
 - No leakages were observed prior new integrity test of well A.
 - The leak rate observed on pressure transmitter in production cross was the same as previous test on well A.
- No leaks are observed in any of the wells (A & B) after PMV is closed. PMV is holding pressure and is leak tight.



Discuss

1. Can the wells continue on operation or should they be shut-in?
2. What well integrity categorization would you give to these wells?
3. What actions do you recommend for this well? (mitigating actions, workover, P&A). Explain the reasons behind your recommendations
4. What mitigating actions do you suggest to reduce the risk for new leaks on HXT on other wells.

QUESTIONS?



Bibliography & References

- <https://www.uio.no/studier/emner/matnat/math/MEK4450/h14/undervisningsmateriale/module-2/mek4450-dnvgl-05-templates-and-manifolds.pdf>
- [http://www.iocenter.no/publication/well-placement-maximum-production-norwegian-sea?f\[0\]=im_field_topic%3A95&f\[1\]=im_field_topic%3A82&f\[2\]=im_field_topic%3A84&f\[3\]=im_field_topic%3A93&f\[4\]=im_field_topic%3A91](http://www.iocenter.no/publication/well-placement-maximum-production-norwegian-sea?f[0]=im_field_topic%3A95&f[1]=im_field_topic%3A82&f[2]=im_field_topic%3A84&f[3]=im_field_topic%3A93&f[4]=im_field_topic%3A91)
- All drawings and data presented in this presentation are not real and only meant for illustrative purposes.
- Well Integrity seminar 2016



THANK YOU!



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