



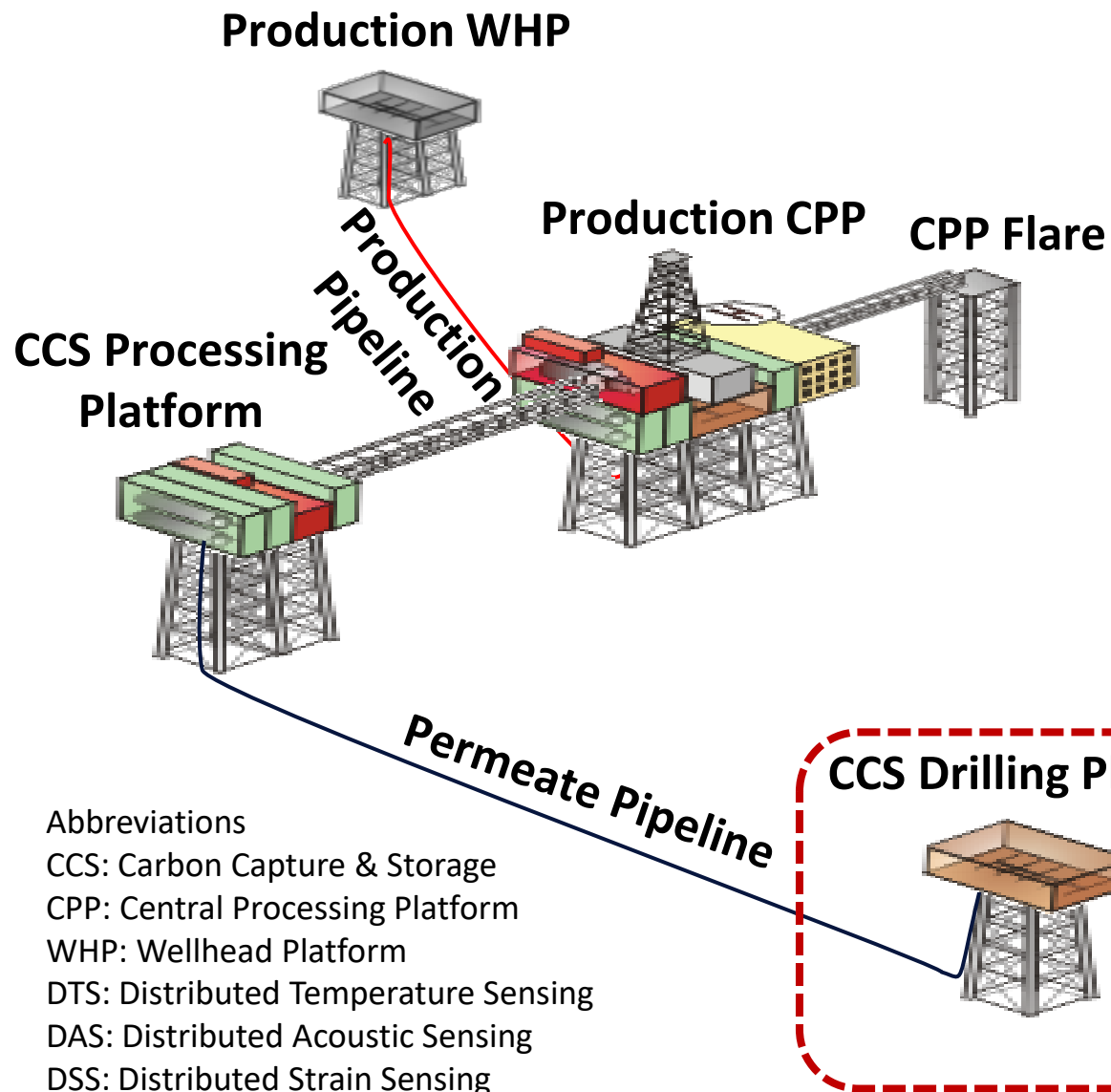
Carbon Storage and Management

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Lower Completion Strategy for Carbon Capture Storage Wells

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Abbreviations

- CCS: Carbon Capture & Storage
- CPP: Central Processing Platform
- WHP: Wellhead Platform
- DTS: Distributed Temperature Sensing
- DAS: Distributed Acoustic Sensing
- DSS: Distributed Strain Sensing

Case study focus on Lower Completion:

- ✓ Design for injectors
- ✓ Challenges of converting existing producers to observation wells

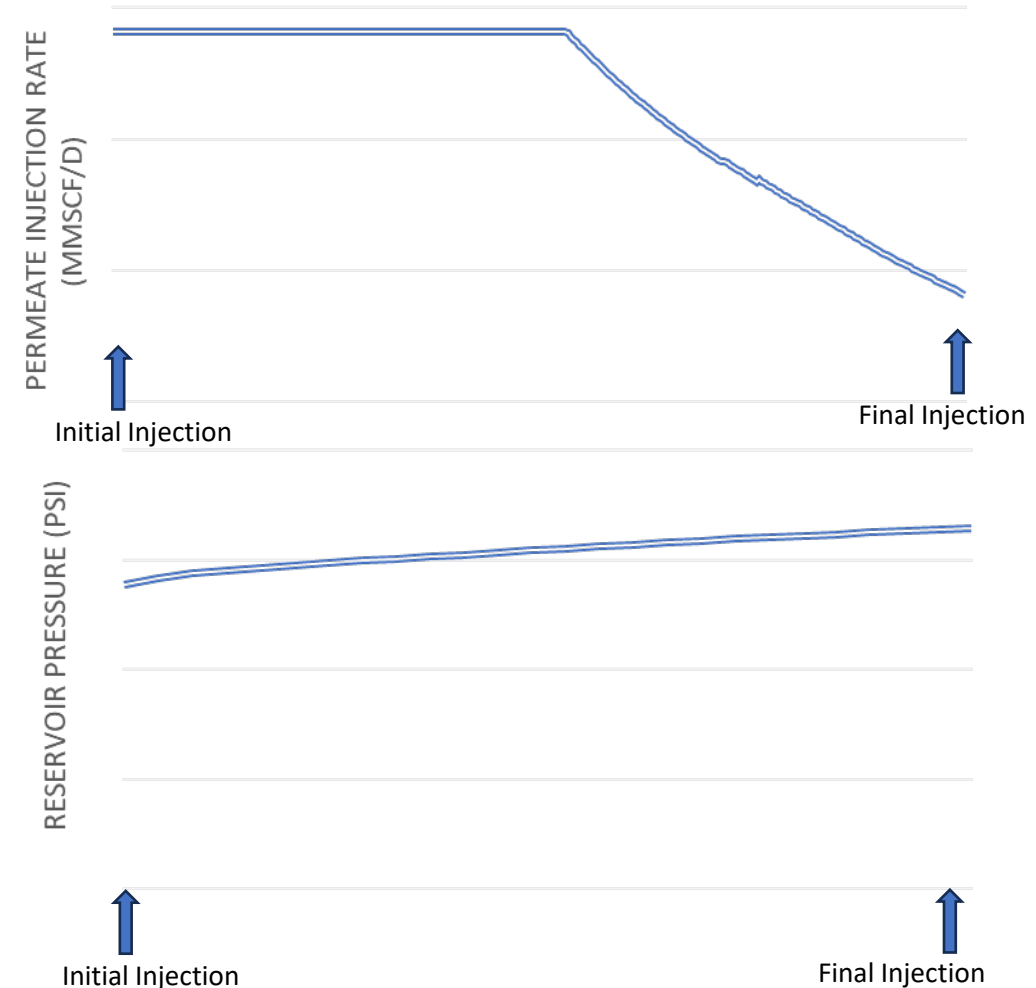
**Fibre Optics : DTS/DAS/DSS
All wells (Injectors and Observation)**

- ✓ Well Integrity Monitoring
- ✓ Reservoir and overburden integrity monitoring
- ✓ CO₂ plume migration monitoring

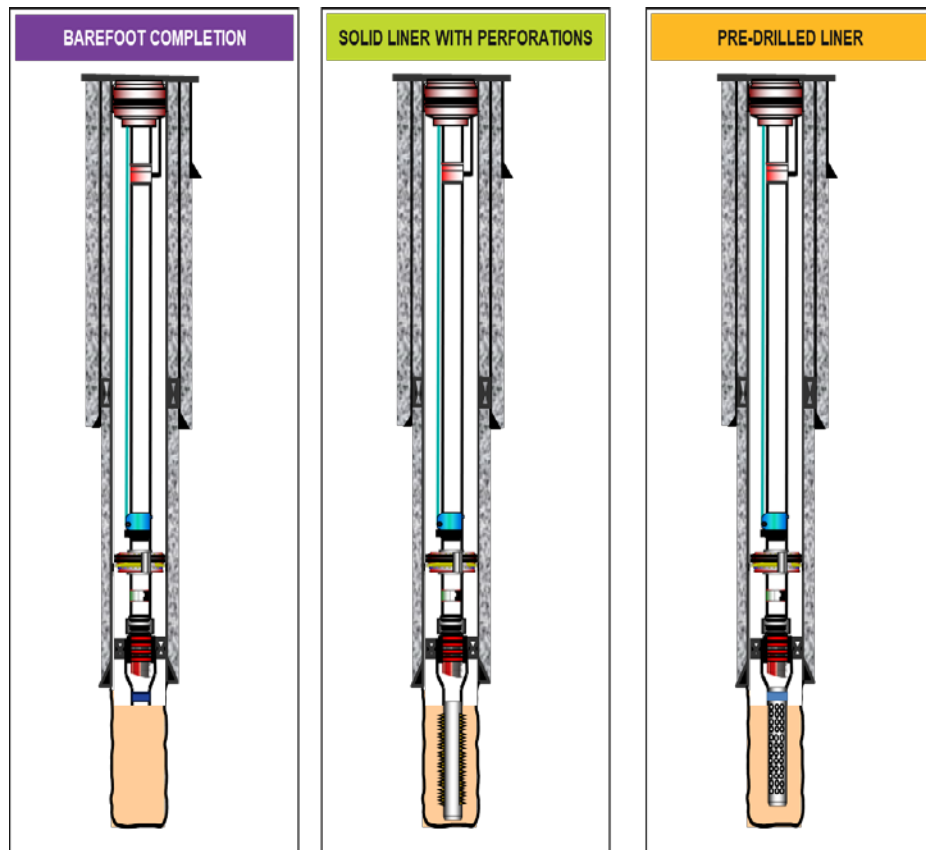
Reservoir Modelling Forecast of Permeate Injection

Injectors Properties	Average
Permeability (mD)	200-350
Porosity (%)	0.2-0.35
Maximum Tubing Head Pressure (THP) (barg)	138

- Design well to meet this requirement
- Reservoir pressure increases with CO₂ injection rate
- Maximum THP limited by compressor design



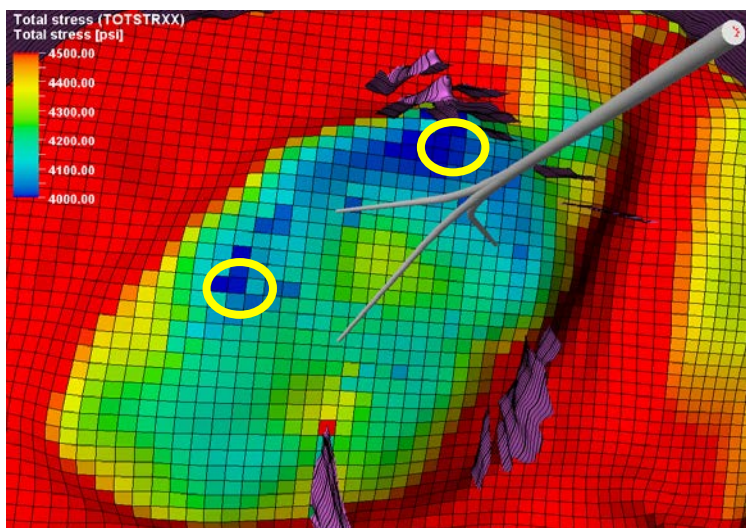
Permeate Injection Performance Evaluation



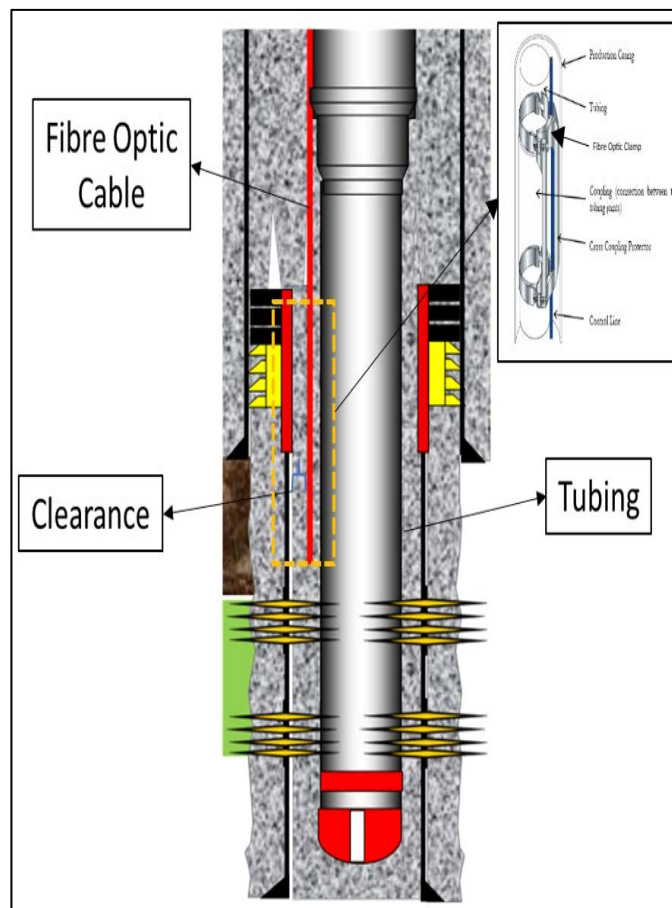
Options Evaluated	EHD (inch)	Modelled Permeate Rate Performance
Barefoot Completion	N/A	23% more than Base Rate
3 3/8" Perforating Gun, 12 spf, 60°	0.4"	16% more than Base Rate
3 3/8" Perforating Gun, 6 spf, 60°	0.4"	Base Rate
3 3/8" Perforating Gun, 6 spf, 60°	0.35"	9% less than Base Rate

- ✓ Gun size evaluation for 5.5" liner
- ✓ Barefoot performed 23% more than Base Rate option
- ✓ Higher spf, more area open to flow thereby reduces mechanical pressure loss

Tubing Size Selection Derisked from Existing Well Lower Completion



- Observation wells placed at geomechanically weaker area
- Fibre optic deployed for monitoring



Description	4 ½ " Tubing	3 ½" Tubing
Total Clearance (")	0.133	0.729
Radial Clearance (")	0.0667	0.346
Well Inclination (deg)	70-85	

- ✓ 81% radial clearance improved downsizing tubing to 3 ½"
- ✓ Prevented NPT due to tubing stuck
- ✓ 3 ½" tubing able to fullfill MMV requirements

Conclusion

Selecting appropriate lower completion strategy is paramount and need to be studied early to ensure success of a CCS project

- ✓ Having barefoot completion is an advantage for injectors, execution may require wellbore stability study
- ✓ Early assessment of injection tubing head pressure to be studied with reservoir drive mechanism and increasing reservoir pressure
- ✓ Higher shot per foot density gun can improve area open to flow for solid liner option
- ✓ Critical to understand the compatibility of running new tubing with completions in the existing wells
- ✓ Having a smaller tubing size can reduce the risk of tubing stuck and NPT during operations
- ✓ However, proper tubing size selection required to fulfill the MMV requirements



Acknowledgements/ Thank You / Questions

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