

HALLIBURTON



TechnipFMC

CCS as a dynamic system (and implications for MMV)

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Integrated CCS Solution

Onshore Emitter's
CO₂ Capture Scope



Gathering, Treatment
and Pumping Facility



Integrated Control System



CCS Surface Tree /
Wellhead

a) Onshore Solutions



On/Offshore Injection Site (Well Pad, Platforms, Subsea)

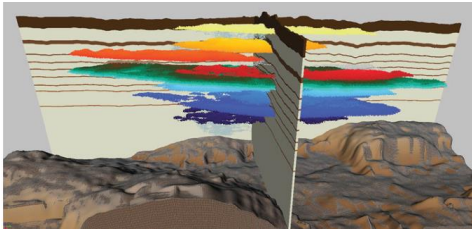
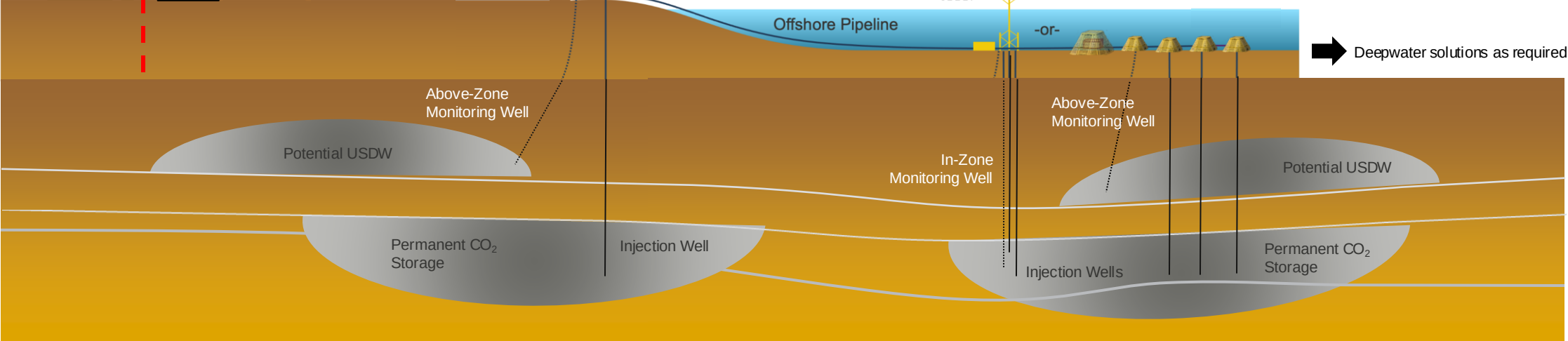
- b) Offshore Solutions
- Shallow water solutions (Dry Trees / Platforms or Jack-Up Trees)
 - Intermediate water depth solutions (Wet Trees, Fishing Friendly)



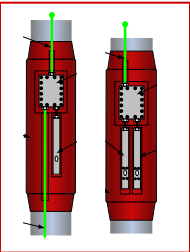
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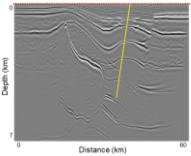
➔ Deepwater solutions as required



History-Matched
Dynamic Simulations
Constrained by
Monitoring Data
Streams



Distributed Acoustic Sensing (DAS)
Distributed Temperature Sensing (DTS)
Pressure/Temperature (P/T)

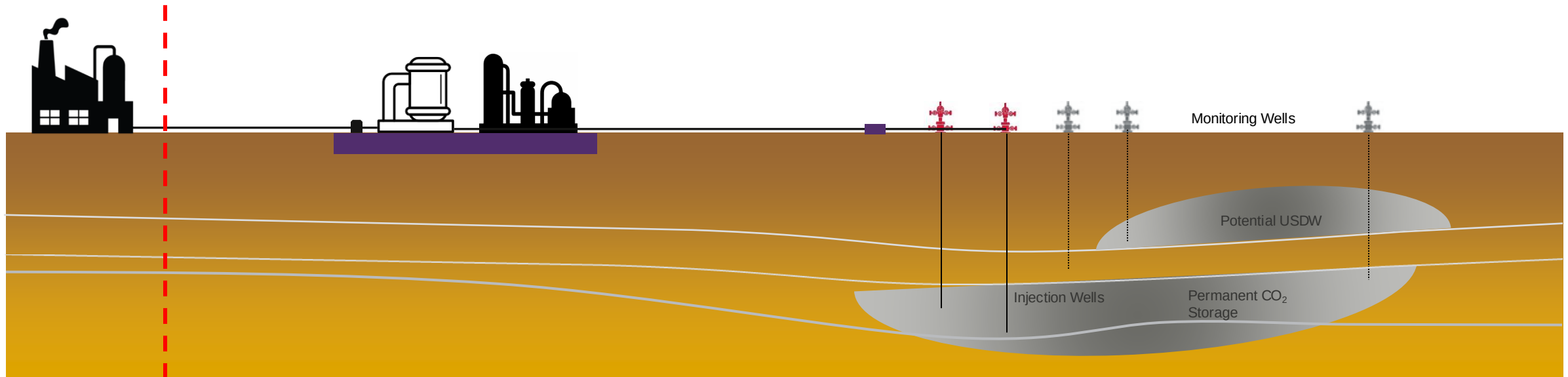


Permanent Reservoir Monitoring

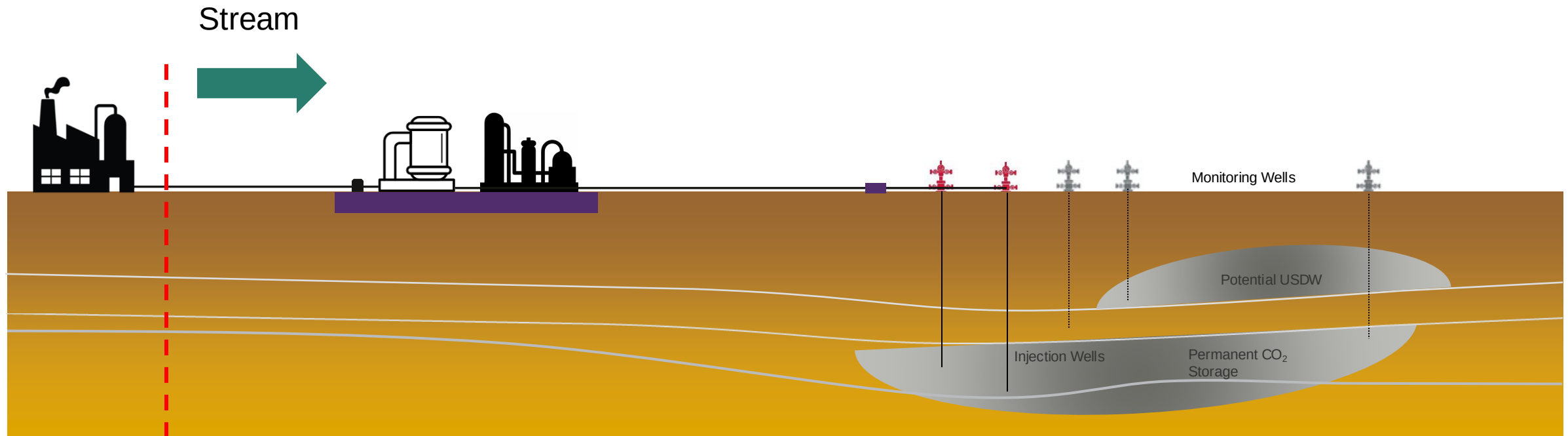
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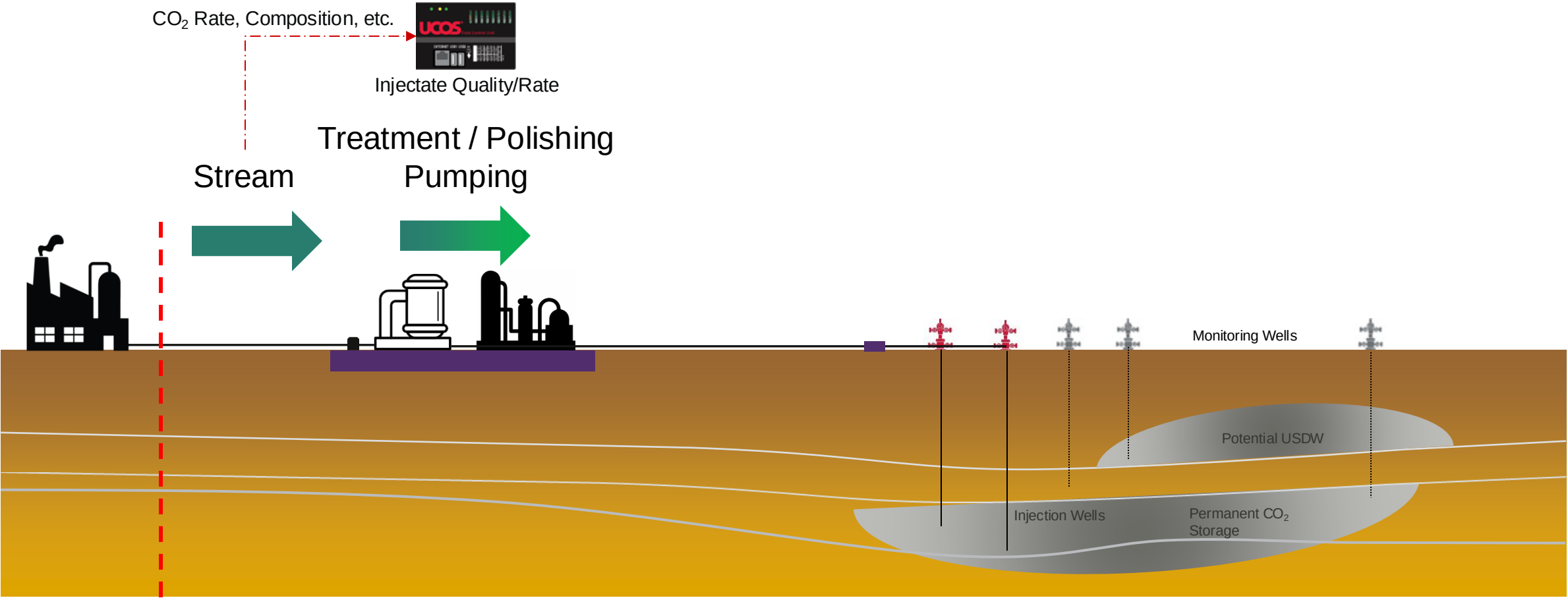
A System Dynamic View of CCS – Normal Operation



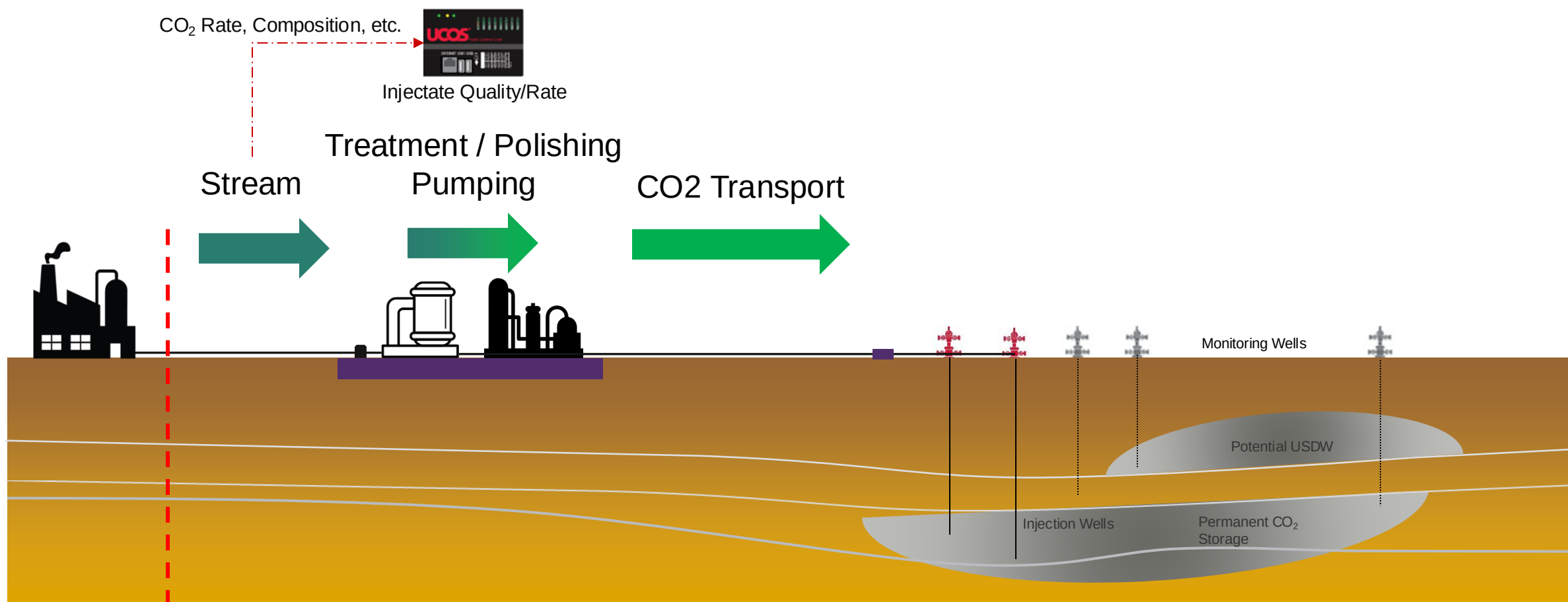
A System Dynamic View of CCS – Normal Operation



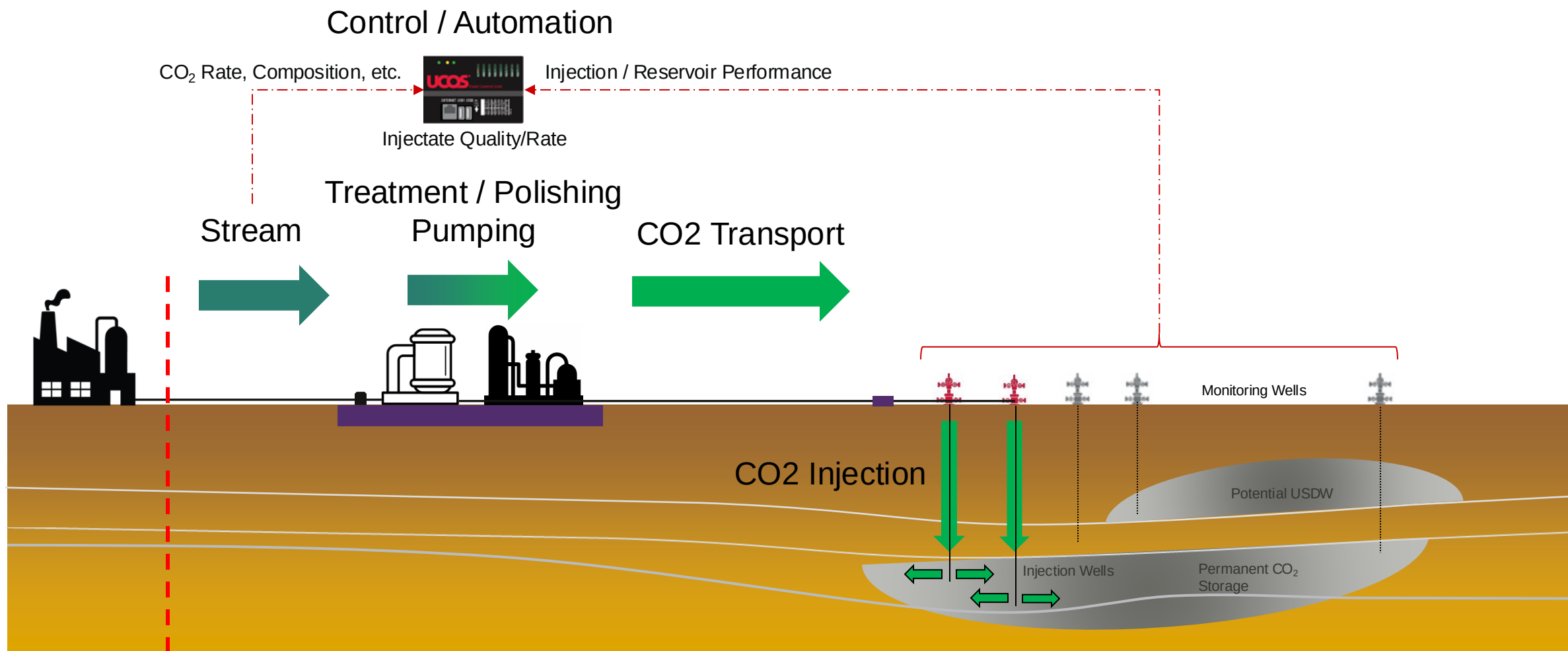
A System Dynamic View of CCS – Normal Operation



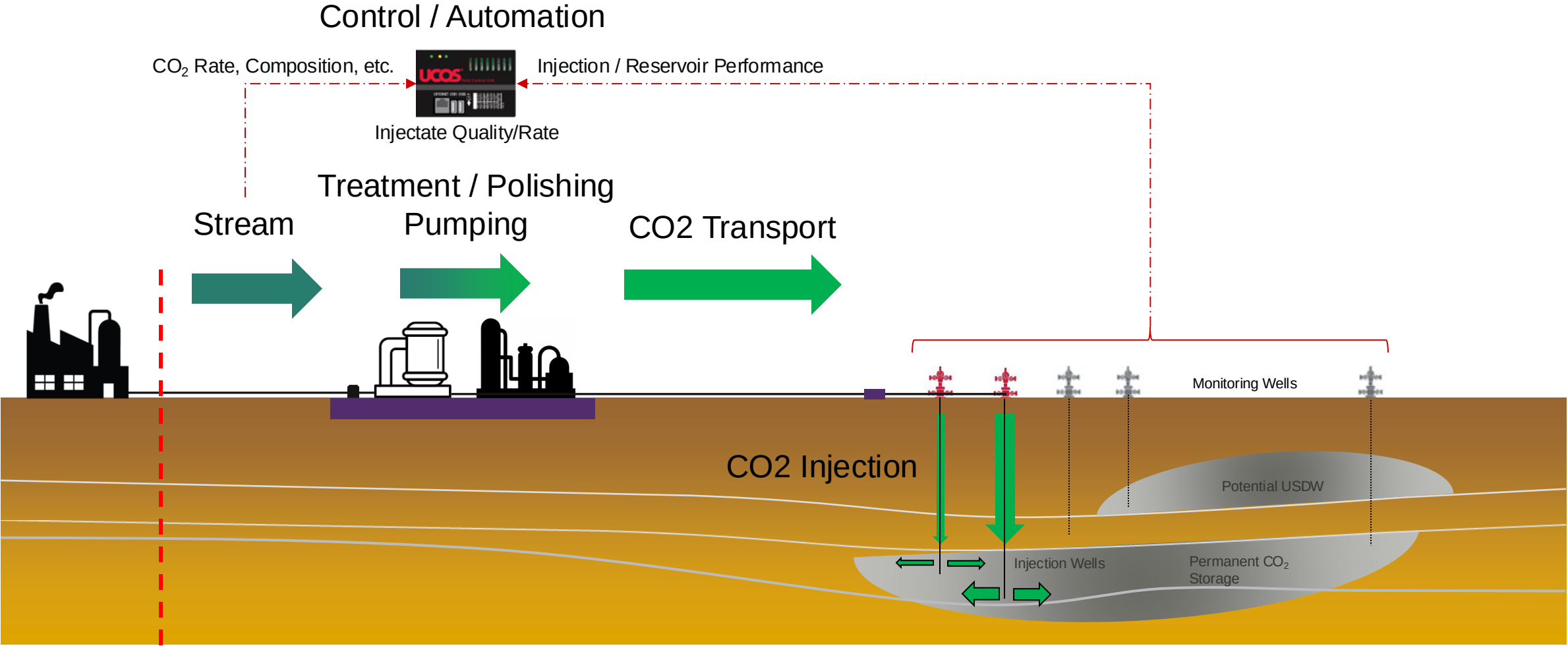
A System Dynamic View of CCS – Normal Operation



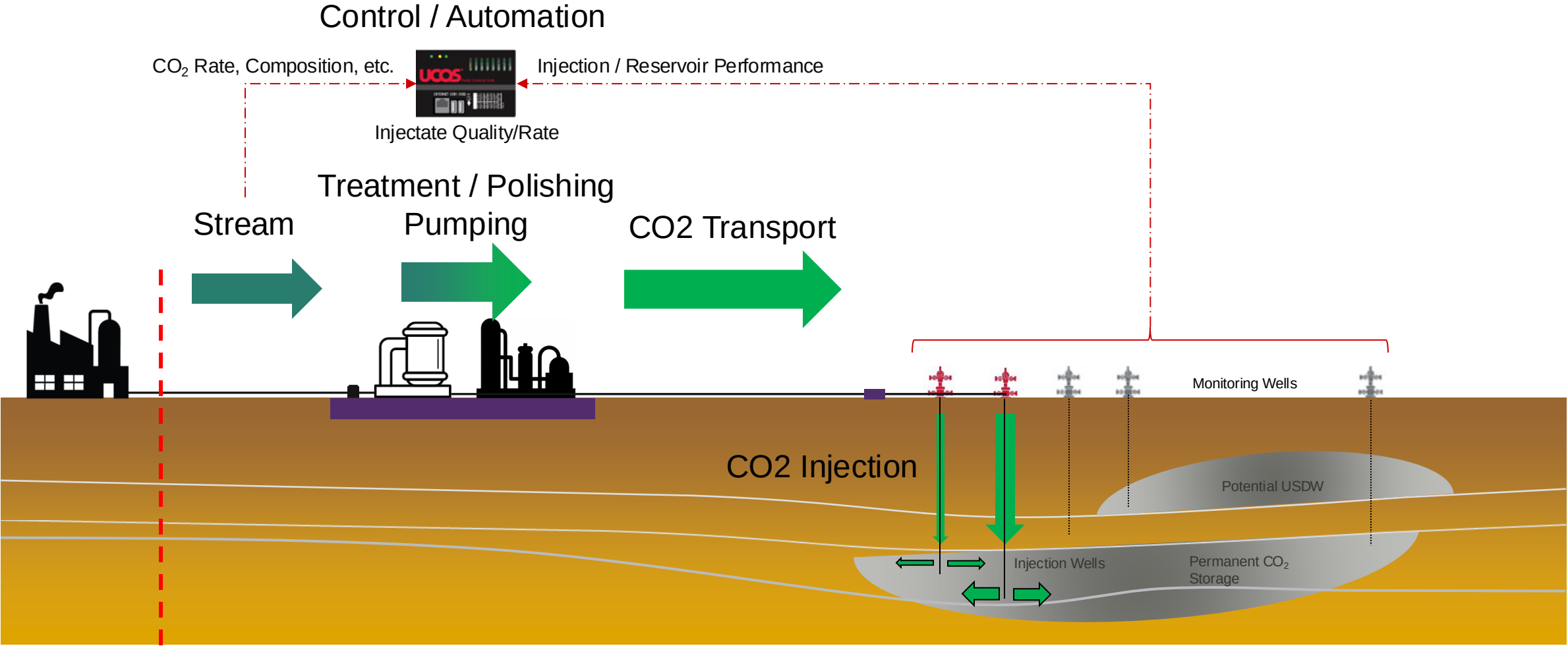
A System Dynamic View of CCS – Normal Operation



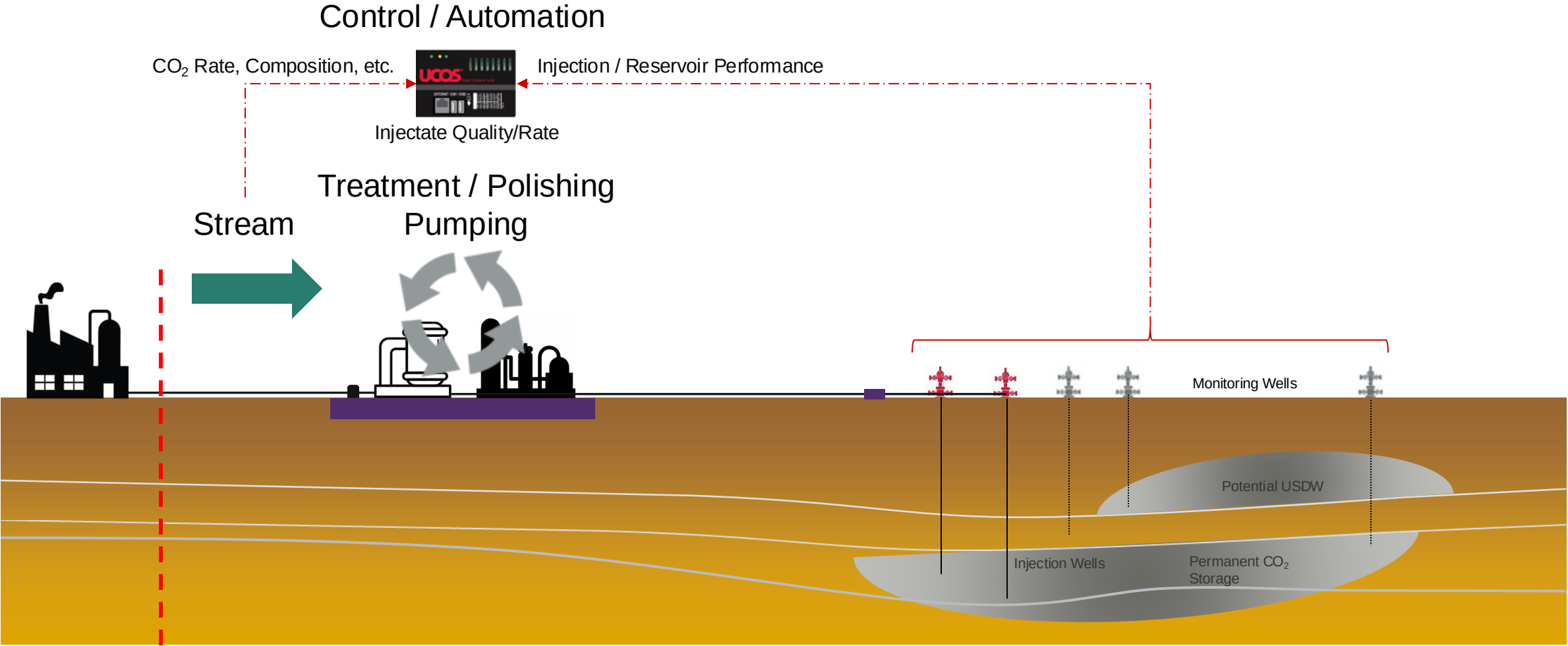
A System Dynamic View of iCTS – Automated Well Adjustments



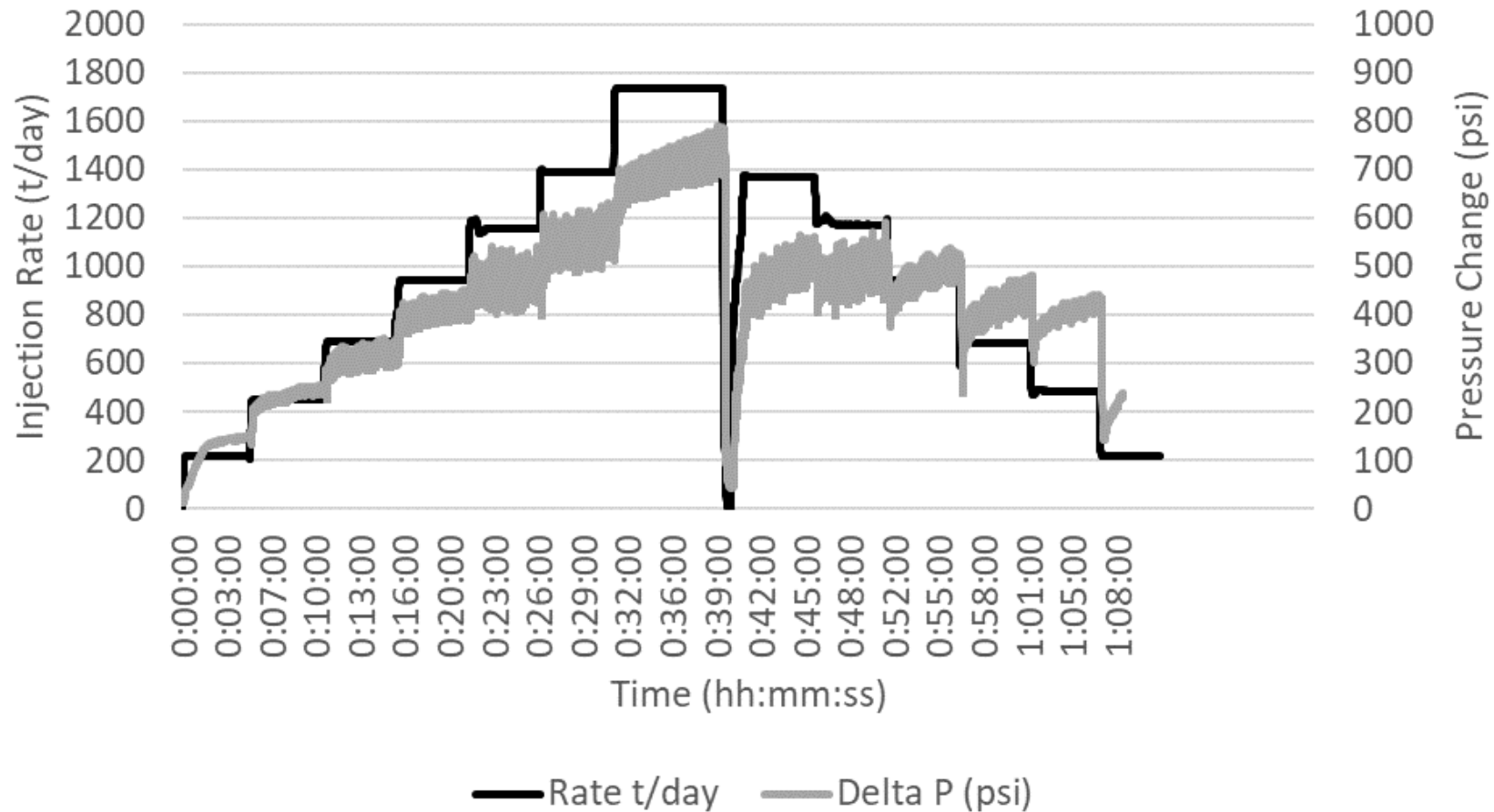
A System Dynamic View of CCS – Emitter Rate Fluctuations



A System Dynamic View of iCTS – Recirculation / Venting

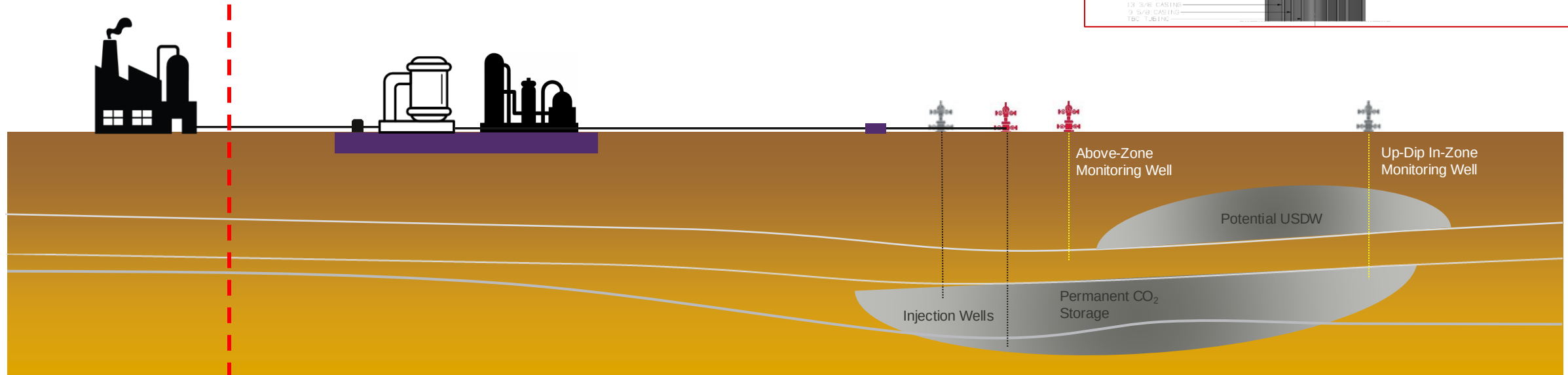
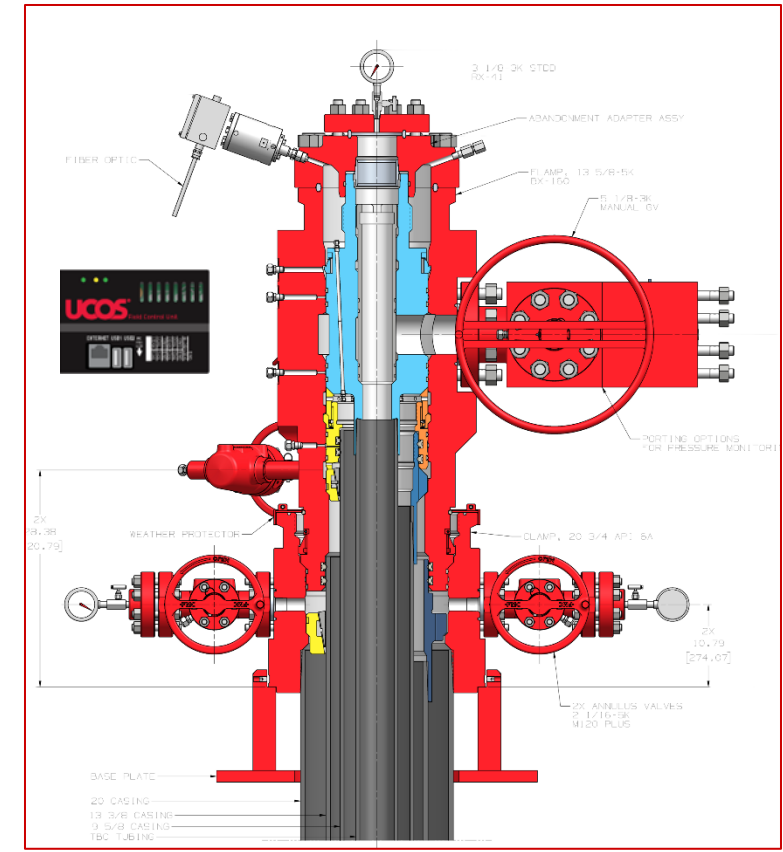


Reservoir Injectivity



Integrated MMV

- DTS
 - Temperature Log | Well Integrity | Injection Profiling
- DAS
 - Vertical Seismic Profiling | Microseismic / Induced Seismicity | Well | Integrity | Injection Profiling | Injector Allocation
- Discrete Pressure & Temperature
 - A-Annulus Monitoring | Injection Profiling | Pressure Front | Behind Casing
- Flow Rates, Composition & Sampling



Integrated CCS

- Fully integrated surface and downhole solution
- Reservoir-driven injection optimization
 - Real-time well and reservoir sensing
 - Feedback drives gathering facility output and/or well switching
- Permanent intervention-less monitoring lowers TCO
 - Real-time well integrity verification
 - Plume tracking through 4D seismic
- Integration with history matching reservoir simulations

