

A Solution Which Enables Continued Safe Production in Wells with Unplanned TCA or CCA Pressure

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Abstract

Sustained casing/casing annulus (CCA) or tubing/casing annulus (TCA) pressure is a common well integrity management challenge. It often results in wells being closed in pending workover. This white paper describes a new use for field proven technologies, which can allow production to continue, while costly workovers can be delayed or in some cases avoided.

Why Wells with Unplanned Pressure in the TCA/CCA are Closed in?

Unplanned TCA pressure is usually a result of a leak in a completion component or liner top packer, while unplanned CCA pressure is usually due to a cementation failure. Most OPCO's follow a 'double barrier envelope' well integrity policy, where these items are elements of the 'primary barrier envelope'. If the double barrier policy is compromised, it is usually necessary to close in the well, while awaiting workover to identify and address the problematic barrier element.

How are wells with Planned Pressure in the TCA Managed?

Gas Lifted wells were historically the highest risk wells with planned TCA pressure. Over recent years new technologies have been adopted, which now ensure a robust double barrier envelope is in place to mitigate against the release of lift gas from the TCA.



The technologies take advantage of the threaded profile (the VR profile), which is machined into both side outlets on all wellheads.

Specifically, a 'well barrier element qualified' Pressure / Temperature sensor 'VR Sense' [1] is installed in one of the VR profiles, and a hydraulically actuated 'Master Surface Annulus Safety' (MSAS) valve (with similar functionality to a sub surface safety valve) is installed in the other.



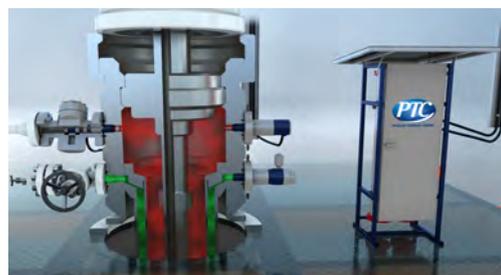
They, along with the wellhead and production casing, combine to form a primary barrier envelope around the pressurized TCA. The outer casing string and associated wellhead and valves in the first casing / casing annulus (CCA1), forms the secondary barrier envelope.

Using VR Sense and MSAS on wells with unplanned TCA / CCA pressure

The approach used in gas lifted wells can, without the need for a workover, be used on wells with unplanned TCA/CCA pressure. By restoring double barrier integrity in this way, continued production while planning the workover can be facilitated, or in some cases the need for workover avoided, delivering significant cost savings.

The only difference is that in the case of gas lifted wells, the planned annulus pressure is known, so the outer casing string pressure rating is specified accordingly.

In wells with unplanned TCA/CCA pressure, the TCA/CCA pressure must be managed below the maximum allowable pressure of the installed next outer casing. This can be achieved using a hydraulic control power unit (HCPU), which reads annulus pressure data provided by the VR Sense. The HCPU can be programmed so that when MAASP is approached, the MSAS valve is opened to automatically bleed off the annulus pressure to a suitable location.



[1] PTC White Paper: A new Approach to Annulus Pressure Monitoring: Improving Data Reliability and Well Integrity, while Reducing Lifecycle Costs

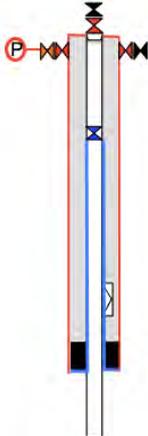
Well Integrity Assurance:
Double Barrier Policy Implementation (wells without TCA Pressure)



Primary Barrier Envelope

- This is the first barrier that prevents flow from a source.

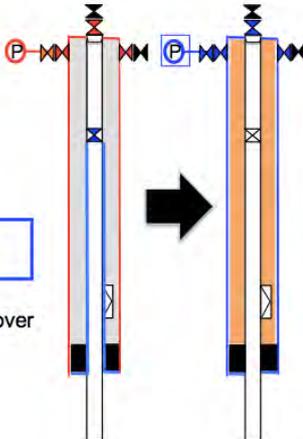
Secondary Barrier Envelope
 Prevents flow if the Primary Barrier fails



Well Integrity Assurance:
Why wells with unplanned pressure in TCA/ CCA are closed in



- Unplanned TCA Pressure**
 - Usually the result of a leaking completion
 - Part of original primary barrier envelope
- Unplanned CCA pressure**
 - Usually the result of cementation failure
 - Part of original secondary barrier envelope
- Double barrier is compromised**
 - The original Secondary barrier envelope
 - Is now the primary barrier
 - With no secondary barrier
- Necessary to close in the well for workover**
 - To address the problematic barrier element



Well Integrity Assurance:
Double Barrier Solutions in wells with planned TCA pressure



Gas Lifted Wells

- Arguably the most dangerous of wells with planned TCA
 - 4-5000 kg hydrocarbon gas under pressure in TCA

Norsok D10 States: "A large volume of pressurized hydrocarbon gas in the A Annuli represents a substantial risk". "All gas lifted wells shall have two barriers to prevent release of the A annulus gas volume"

- Double barrier solution now exists to mitigate against release of TCA gas
 - Utilizes threaded VR profile in wellhead side outlets

Primary barrier

- TCA casing / wellhead
- Pressure Sensor 'VR Sense'
- Safety Valve 'MSAS'

Secondary barrier

- Outer casing string / wellhead / valves / VR Sense in CCA VR Profile

- Approach is equally applicable in wells with unplanned TCA/ CCA pressure
 - Can allow production to continue while delaying or avoiding costly workovers

