

Enhancing Coke Drum Monitoring with DrumVision™

Advanced neutron backscatter technology provides greater insight into process conditions and supports more informed operational decisions.

The Challenge

Coke drums in delayed coking units are among the most difficult vessels in a refinery to monitor. They are typically up to 30 m tall and 10 m in diameter, operating at around 500°C. In each 12 - 24 hour cycle, heavy residual oil is thermally cracked, producing lighter hydrocarbons that vapourise and leave the drum, while solid petroleum coke builds up on the walls.

For operators, one key area to monitor during the coking cycle is the foam level. If the foam reaches the top of the vessel, it can result in an overflow, potentially causing days' worth of shutdown and loss of revenue.

Historically, neutron backscatter technology has been used for monitoring coke drums. However, many existing neutron backscatter instruments are now approaching their recommended 15-year working life. As these systems become obsolete, the market has increasingly shifted towards gamma-based top-level measurements.

The Solution

Unlike conventional coke drum measurement technologies that provide a bulk top-level measurement, DrumVision™ can identify differences between the various phases within the coker, providing a more detailed view of what is happening inside the vessel.

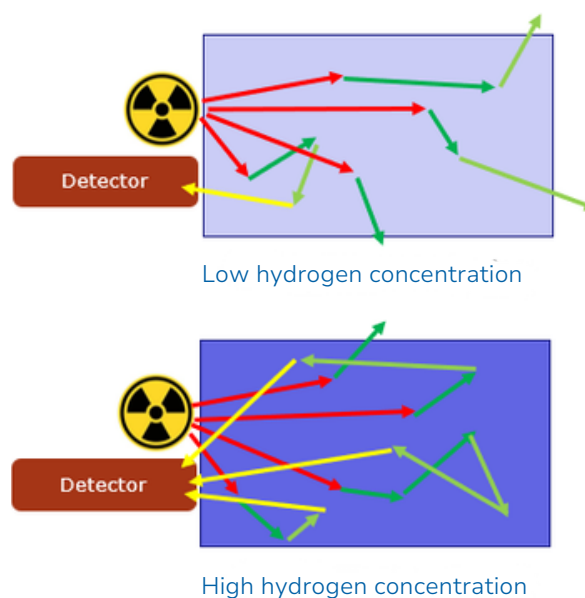


Figure 1: A comparison of neutron interactions between materials with high and low hydrogen concentrations.

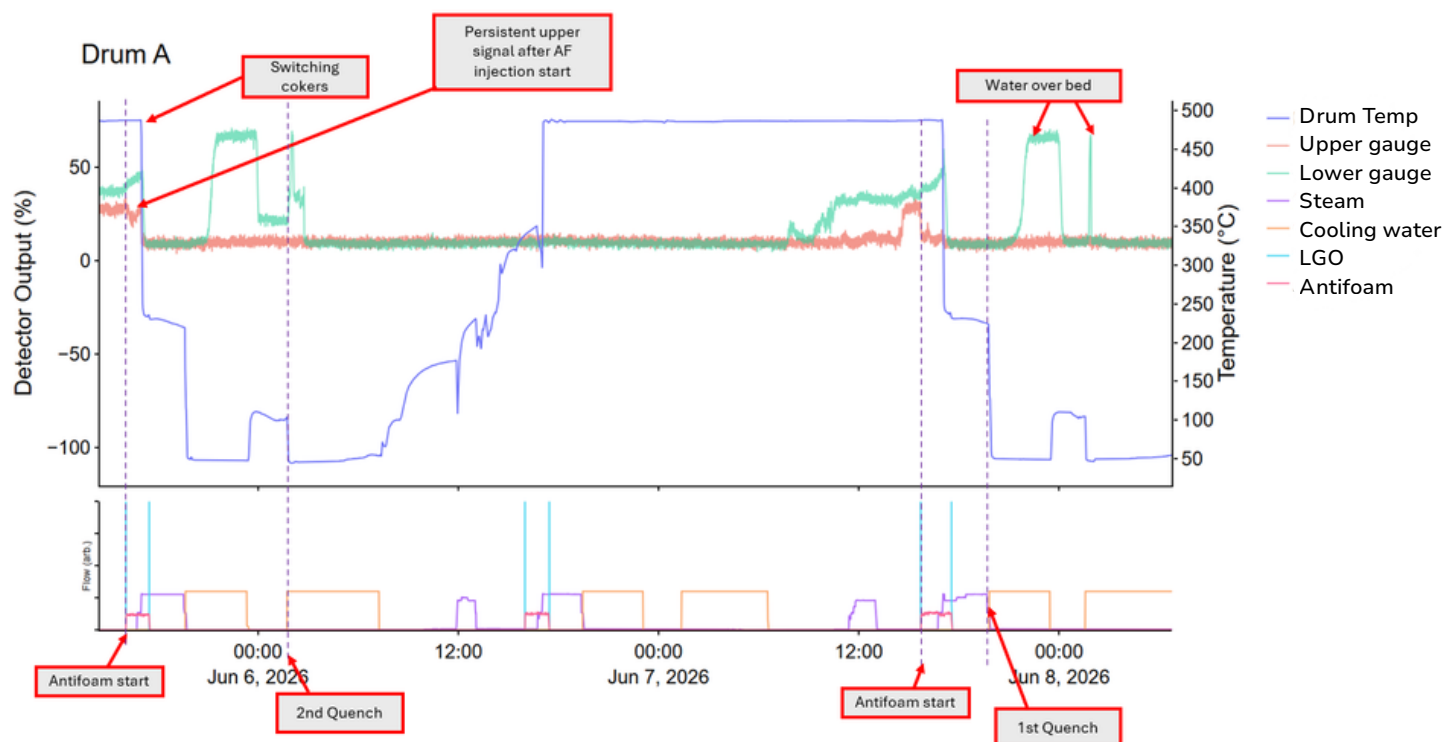


Figure 2: DrumVision™ interpretation of the coking cycle.

Neutron backscatter technology utilises high energy neutrons that pass through the drum wall and interact with the material inside.

When a fast neutron collides with a light nucleus, particularly hydrogen, it loses energy rapidly and is scattered back as a thermal, lower energy neutron. As different process materials contain different amounts of hydrogen, each material produces a difference measurement response.

This enables DrumVision™ to provide greater insight into the changing conditions within the coke drum than conventional gamma top-level measurements.

DrumVision™ uses a solid scintillation detector rather than Helium-3 or Boron-Trifluoride gaseous detectors.

The instrument also incorporates shielding providing additional benefits:

- Permanent calibration
- High levels of safety
- No requirement to regularly re-gas the detector

The data produced by DrumVision™ provides an extensive view of what is happening inside the coker. The measurements can show the relationship between the process materials and the introduction of antifoam agent, providing the potential to optimise antifoam use.



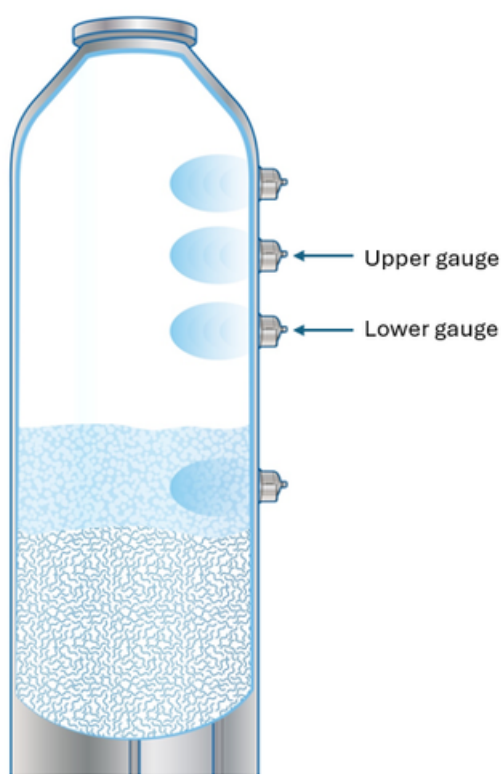


Figure 3: Two-point measurement configuration on the coke drum, showing upper gauge and lower gauge detector positions.

The Results

Following the implementation of DrumVision™, a European refiner was able to gain greater visibility of the process conditions inside the coke drum, providing the control room with insight beyond a conventional bulk density or top-level measurement.

The technology enables operators to identify patterns and changes in process materials directly behind the vessel wall, helping provide a clearer understanding of the coking process.

Key benefits include:

- Improved visibility of process conditions inside the coke drum
- Ability to identify changes between different process phases
- Potential to optimise antifoam addition
- Stable performance across a wide operating temperature range
- Reduced requirement for repeated calibration
- Improved long-term reliability through the use of readily available scintillator materials
- No pressurised detector gas to leak or replenish
- Removal of BF_3 gas, eliminating a potential health hazard in the event of mechanical damage
- Compatibility with existing arrangements used by obsolete neutron backscatter devices

The Conclusion

DrumVision™ provides customers with insight into the process on the other side of a vessel wall, helping operators understand changing conditions within the coke drum without the need for repeated recalibration.

By providing visibility of process phases and changes rather than simply a bulk top-level measurement, DrumVision™ gives control room operators greater insight into what is happening inside the vessel and supports more informed process management.

Tracerco's innovative neutron backscatter technology gives customers the insights they need to help solve complex monitoring challenges in delayed coking applications.

To learn more, read our case studies at [tracerco.com/downloads/case-studies](https://www.tracerco.com/downloads/case-studies)