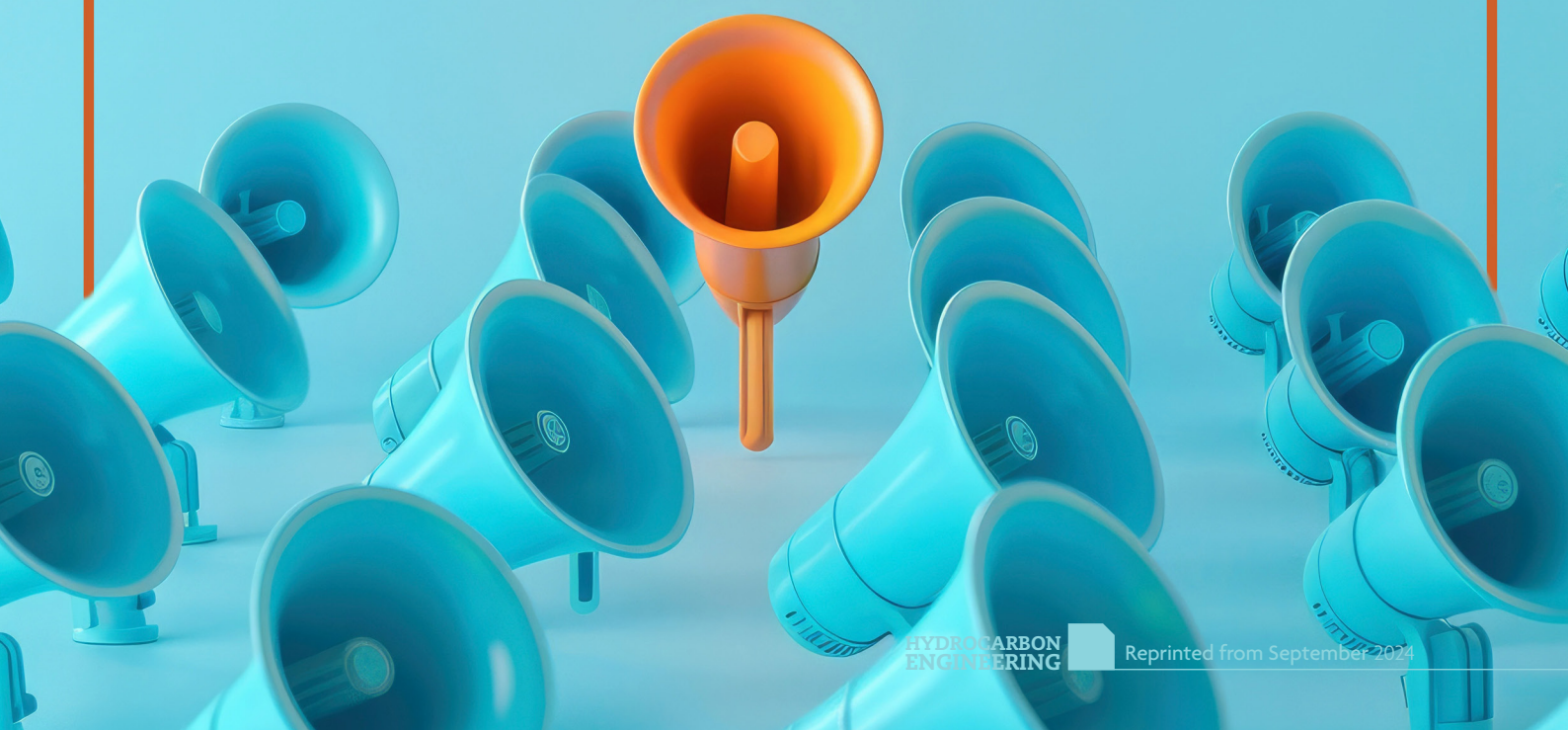


MAKING A CLEAR DIFFERENCE

Neil Murch, Tracerco, UK, considers how data and nucleonic technology is advancing process control in the downstream oil and gas industry.

The modern oil and gas industry has no time to waste. Today, more so than ever before, the focus is on maximising the efficiency of asset operations. This means not only eliminating expensive unplanned trips or shutdowns and lost throughput, but also increasing uptime and productivity. It also means ensuring the utmost safety to personnel and facilities while reducing emissions in line with global net zero targets.



For asset managers and operators of assets such as separators, coalescers or desalters, a critical component in achieving optimal operational efficiency is ensuring the maximum control of process liquids. Events such as changes to product or feedstock can impact process control measures, so providing greater visibility of other operational events inside these vessels gives greater control and supports improved data-driven decision-making.

High-resolution multi-interface control or multi-fluid profiling allows the operator to clearly see the process fluids and interfaces inside the vessel, enabling them to be controlled effectively. Effective control of what is happening inside a vessel empowers operators to enhance efficiency through optimisation of the use of chemicals, the control of emulsions and foaming, increased uptime targets, a reduction in operational maintenance costs, and support in achieving Scope 1 emissions reduction goals.

Advances in nucleonic instrumentation supported by improved data acquisition are supporting the drive toward greater visibility. Traditionally, the deployment of nucleonic instruments has been limited to the most challenging measurement applications. However, advances in hardware and software over recent years has accelerated their use in several duties across processing units – in particular, duties involving dynamic changes in process conditions. Today, robust nucleonic instrumentation systems can be designed to suit the majority of measurement applications.

A key enabler in advancing the adoption of nucleonic instrumentation in the refining industry has been the rapid rise in the availability of higher-quality data. Better data enables greater process clarity and operational certainty, while quantifying or qualifying assumptions in digital twin models. This is increasing real-time decision-making and supporting longer-term trend analysis. In short, more data makes findings from the process easier to understand and manage.

It's what's inside that counts

The ability to control the oil/water interface in a crude desalter is critical. When a high electrostatic charge is put through the separator, electricity-conducting water



Figure 1. The Tracerco profiler in use.

molecules in the oil coalesce together and are removed from the oil. However, while the electrified separation process settles the water out, solids and other contaminants can often remain in the vessel. At the interface where the oil and water separate out, an emulsified layer can form which will vary in thickness and consistency depending on the blend of crude oil being refined.

Conventional radio frequency (RF) based probes can identify water concentrations but are unable to provide an accurate understanding of the water's interface position in the vessel. To use an analogy, if a bottle was half-filled with water and oil and left to settle, the two liquids would separate and provide a clean interface between them. In this situation, the positioning of the water would be easy to identify using RF probes. However, shaking the bottle would create an oil and water emulsion with no clear interface, representative of real-world emulsion formation. While the volumes of water and oil in the bottle remain unchanged, the measuring system would fail to differentiate the actual oil/water interface.

If operators cannot accurately gauge what is happening inside the vessel during the desalting process, or accurately identify the extent of the emulsion generated, they cannot effectively control it. Increased levels of emulsion in the vessel reduce the amount of oil that can be processed, which in turn reduces process efficiency. An inaccurate understanding of emulsion levels can also lead to inaccurate estimates of the optimal quantities of chemicals required to reduce the emulsion to enable increased production.

More energy efficient carry-over and carry-under

As part of the water treatment or separation process, environmental issues can be created through inaccurate level control due to carry-over and carry-under.

In the downstream process, liquids can be desalted several times to remove as much basic sediment and water (BS&W) as possible before the oil is transferred to pre-heating and distillation. Heating the water and salt can create chemical reactions and lead to pipeline integrity issues such as corrosion, which can also increase energy demand in the pre-heater.

As well as carry-over, carry-under can also cause upsets. The water is processed in a treatment plant where as much oil as possible is removed before the water is reinjected back into the vessel as wash water. This process reduces the requirement for additional fresh water and, if high levels of oil are found in the water of the treatment plant, this can create the need for additional maintenance and energy to remove it. Furthermore, inadequate, or insufficient cleaning in the treatment plant can result in the reintroduction of high oil-bearing water back into the process, which can have an adverse effect on the emulsion levels in the vessel and reduce separation efficiency. This can create additional energy demands and processing costs for operators.

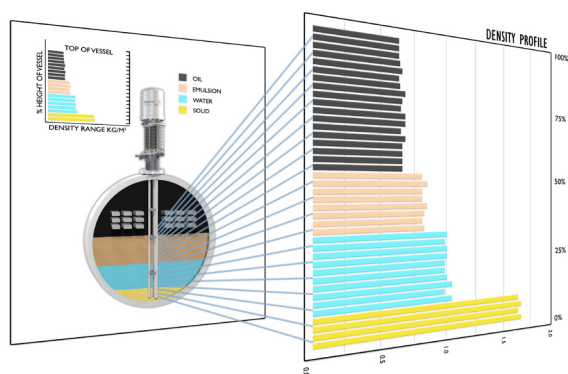


Figure 2. Desalter density profile.

Interface control

When adding a high electrical voltage to electro-static grids in the vessel, it is critical to know the location of the interface between the oil and the water. If the interface is too close to the grid, the level of current at the grid must increase because resistance reduces as the amount of water increases, which adversely impacts overall energy consumption of the unit. Excessive current requirements can force the grid to trip, meaning the capability to coalesce the water and contaminants out of the oil will be lost, forcing an unplanned shutdown or outage.

Nucleonic instrumentation is delivering advanced answers that allow operators to efficiently control processes within separators, coalescers and desalters. The technology is currently providing real-time data for a broad range of applications including downstream petrochemical, upstream oil and gas and subsea operations. Advanced nucleonic instruments are bringing greater clarity and understanding of operational performance to asset managers, leading to the enhanced safety of operations, process stability, accuracy, and reliability that can help operators to increase product throughput, manage risks, and reduce costs.

A 'window' into your vessel

Tracerco's Profiler™ nucleonic technology is the only high-resolution technology-based instrument that characterises and controls real-time process conditions. The instrument was originally developed to support upstream oil applications, but has subsequently been adopted by the downstream and subsea sectors to provide a true profile of the fluid process. The instrument provides a 'window' into the vessel to give a clear and continuous vision of the process conditions inside and facilitates accurate control to support reduced foaming and emulsions. It can be deployed in almost any separation application where accurate control and monitoring of multiple process phases is required, for high resolution of density, bulk level, or settling solids processes.

Get the measure of your operations

The greater clarity and accuracy provided by advanced nucleonic instrumentation can support operators in improving production throughput while reducing the number of unscheduled shutdowns and avoiding excessive chemical additive usage. Used for level, density, interface and multiphase measurement, data-enhanced nucleonic instruments can accurately determine the boundaries between all process fluid media.

Nucleonic instrumentation allows the operator to see process changes inside the vessel and can be designed to meet specific requirements. Dip-pipes containing multiple sources and detectors are placed at key locations and map the profile of the process fluid, measuring density continuously, or across multiple locations, identifying changes, with instrumentation varying in active measuring range depending on the required solution.

Using instrumentation that avoids moving parts can reduce maintenance requirements. Low-energy gamma sources and electronics installed in the dip-pipe eliminate the need to depressurise to enter for any required vessel maintenance. The measurement process can be automated in a closed loop control for valve or dosing pump operation, or data insights relayed to the operator can be actioned manually. Multiple level alarms can be deployed in the vessel to ensure visibility and control of each of the interfaces, such as water, oil, emulsion, foam and solids.

Deploying a system that uses both internal sensors and detectors – as opposed to systems with internal sensors and external detectors – enables a higher resolution and avoids interference from external radiation sources, which can impact data accuracy and influence reliable operations of a process plant. For example, using external detectors can make it difficult to identify if an additional signal change has resulted from a change to internal process conditions in the vessel, or from an outside, extraneous source, such as the non-destructive testing of equipment. Significant infrastructure can be required to mount and collimate external detectors on the side of the vessel, along with additional cabling, increasing installation costs.

Insights through instrumentation

As nucleonic instrumentation advances in the future, increasing the volume of data available and utilising that data more effectively will be key to providing even more clarity. Enhanced data precision will leverage greater process control and improved decision-making for enhanced operational efficiency. This will support reductions in unplanned shutdowns and help to reduce Scope 1 emissions from instances of flaring and greenhouse gas emissions, inaccurate assessments of chemical requirements, and the unnecessary use of excessive energy. It is the difference that anyone can see. 