

Driving process optimisation and reduced downtime with advanced level measurement

Oliver Riddle
Rufat Mammadov

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Agenda



- 1. Introduction**
- 2. First principles**
- 3. Level and Density Measurement**
- 4. Tracerco Profiler™**
- 5. Process review**
- 6. Q&A**

Giving perspective in your operations to deliver invaluable insights for process optimisation and to help reduce risk.

Why use nucleonics?

Process

Variations in feed or high temperature and pressure fluctuations

Reliability

Maintain operations – fit and forget

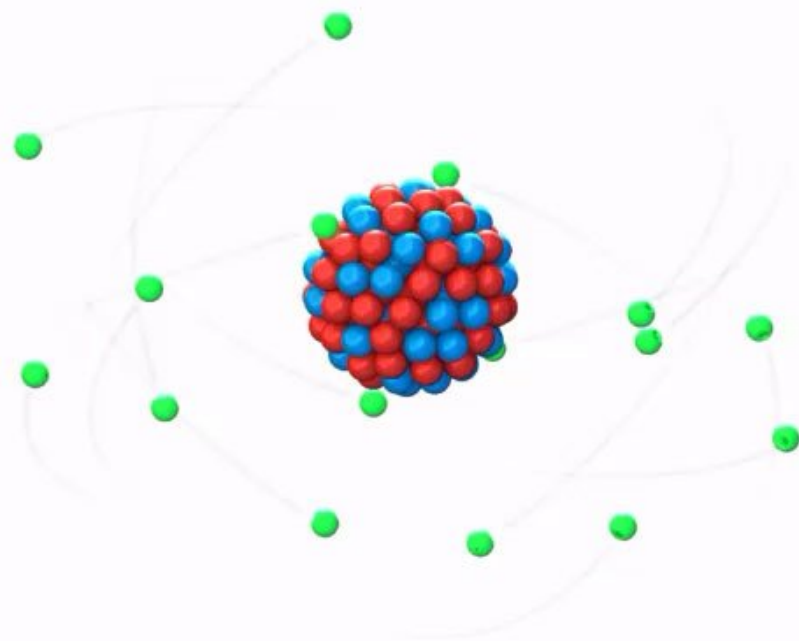
Accuracy

Continued isotope ensures accurate and repeatable measurement

First principles

Tracerco
Insight through innovation



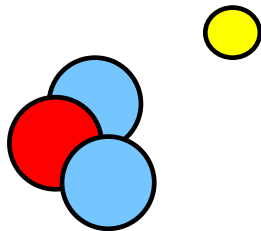


What is ionising radiation?

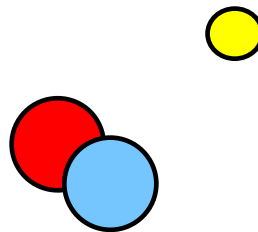
Matter consist of tiny particles which are atoms

Atoms with the same number of protons and different number of neutrons are isotopes

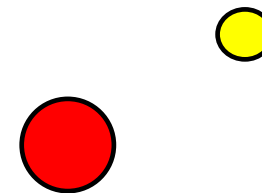
Many isotopes are unstable, they become stable through changes in the nucleus, known as radioactive decay



Hydrogen (H-3)
[Tritium]
Radioactive



Hydrogen (H-2)
[Deuterium]
Stable



Hydrogen (H-1)
Stable

Typical process challenges

Pressure and density changes – leading to incorrect levels

Unit reliability – increased costs and lower operating margins

Corrosion in overheads
- fouling and damage

Process control – unplanned trips and shutdowns

Chemical usage – impurity removal and emulsion/chemical control

Downstream process – impact on FCC and other units

How do we overcome these challenges?

Solutions based approach to applications

- ☐ Measures change in attenuation between source and detector
- ☐ No moving parts
- ☐ Easy to upgrade conventional level system or retrofit





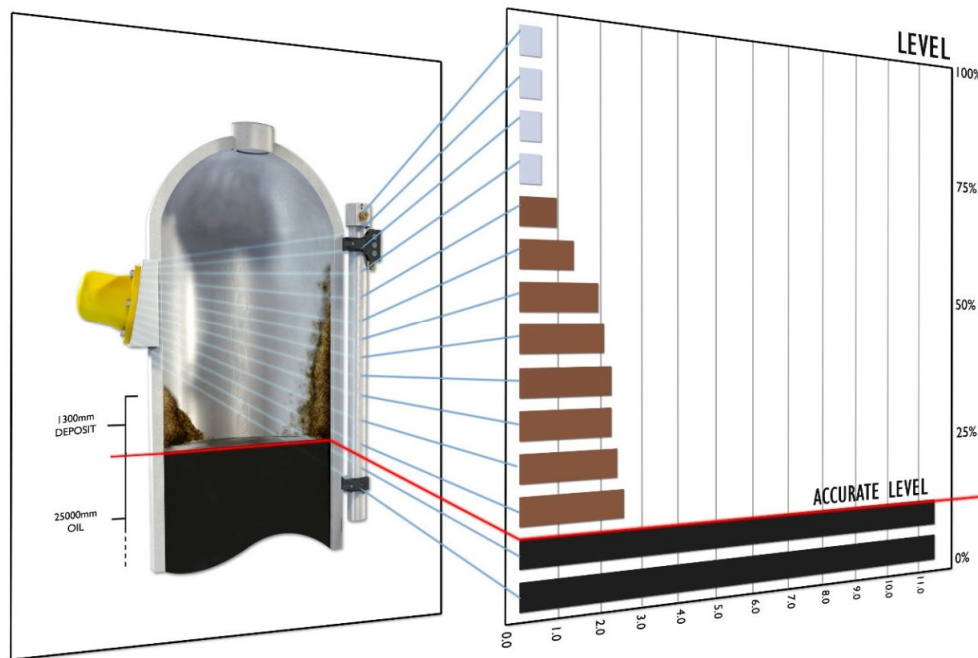
Non-contact solutions for bulk level



Versatile options

- ☐ Measures change in attenuation between source and detector
- ☐ No moving parts
- ☐ Easy to upgrade conventional level system or retrofit
- ☐ Typically 4-20mA over HART
- ☐ Can be Ex ia or Ex d
- ☐ 2, 3 or 4-wire
- ☐ SIL2 options available

Segmental level gauging



Scintillation challenges

- ☐ Signal reduction due to deposition or plugging
- ☐ Higher indicated level
- ☐ Non-repeatable measurement
- ☐ Lack of confidence

Level+ solution

- ☐ Build-up correction
- ☐ Repeatable and accurate
- ☐ Operator confidence
- ☐ Optimise production/reduce downtime



Level+ (PRI150)



Segmented Geiger-Müller technology

- ☐ Bulk level applications
- ☐ More temperature stable than scintillation technology
- ☐ Segmental level
- ☐ Advanced signal processing
 - ☐ Build-up and pressure compensation
- ☐ Low maintenance



Level (T250)



Segmented Geiger-Müller Technology

- ☐ SIL2 IEC 61508:2010 certified
- ☐ High accuracy and repeatability
- ☐ Large measurement range
 - ☐ Ranges up to 9.1m with single detector or 18.24m with two
- ☐ Configurable outputs and trip levels
- ☐ Non-intrusive

Density measurement instrumentation

Density

- ☐ Wide range of vessel sizes
- ☐ Up to 3m range from a single detector
- ☐ Can be daisy-chained for longer ranges





Density measurement instrumentation (T251)

Advanced scintillation technology



- ☐ Level, interface or density measurement
- ☐ Sensitive detector
- ☐ Spectrum scanning technology
- ☐ Class leading stability
- ☐ Industry leading reliability (ISO 13628-4:2004)
- ☐ Low power (<1W)
- ☐ Overcount protection (empty pipe)
- ☐ Local display/configurator available (T254-2)

Density measurement instrumentation

Process density monitoring

- ❑ Wide range of pipe sizes
- ❑ Can be used for deposition monitoring
- ❑ Used in mass flow conveyor applications



Density measurement instrumentation (T251)

Single interface

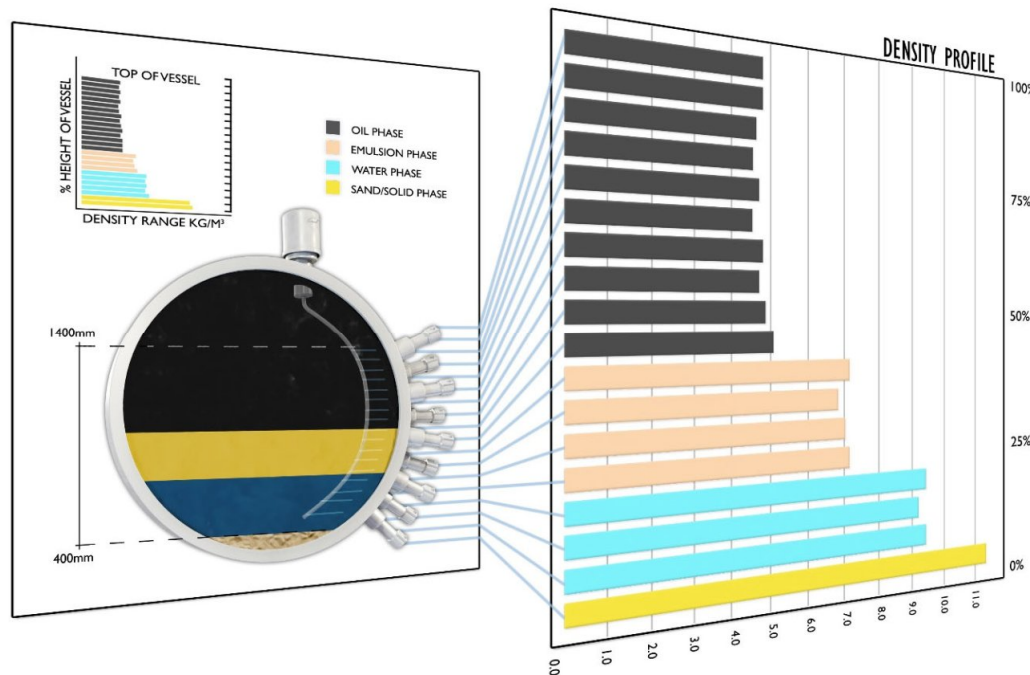
- ☐ Point or interface level measurement
- ☐ Liquid/liquid or liquid/solid



Profiler™

Reliable multi-phase
control, in real time

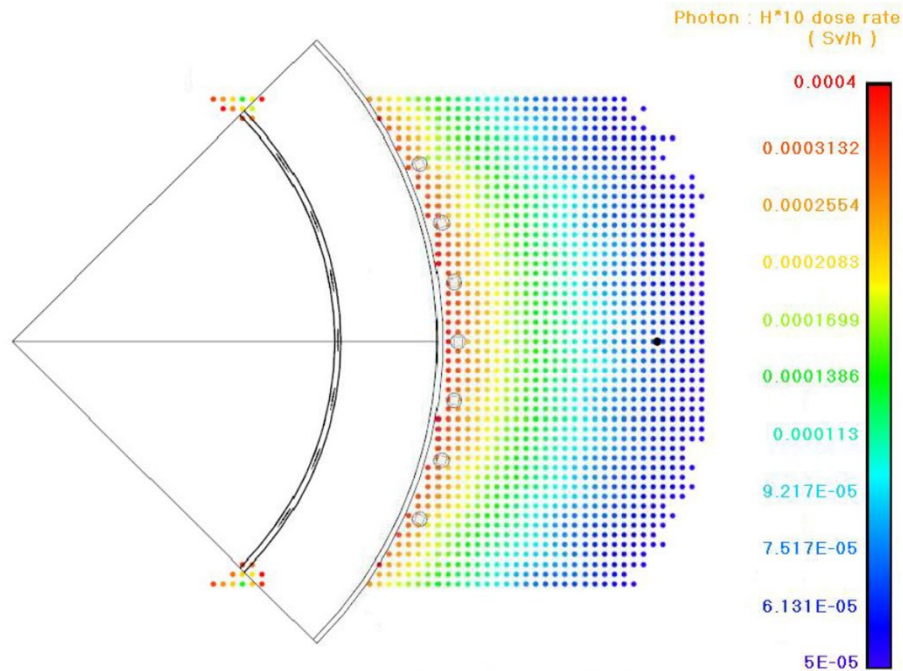
Conventional “profiling” method



- ☐ Detectors link to graphical interface/control panel
- ☐ Detector spacing typically 6 inches
- ☐ Single detector failure affects system
- ☐ Collimation adds weight
- ☐ Installation costs are high as there are external mounting structures
- ☐ Effected by radiography

Radiation safety and operation – external detectors

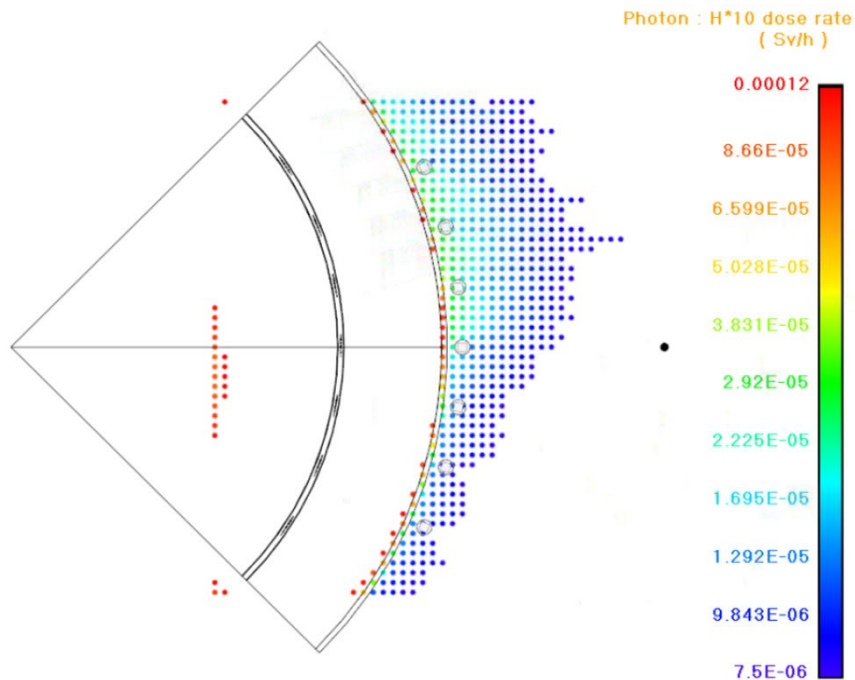
Oil



- For the external system to work correctly, there must be a dose rate in oil so that the interfaces can be differentiated between
- The higher the dose rate, the more accurate the system
- This is predominantly ok for flooded vessels

Radiation safety and operation – external detectors

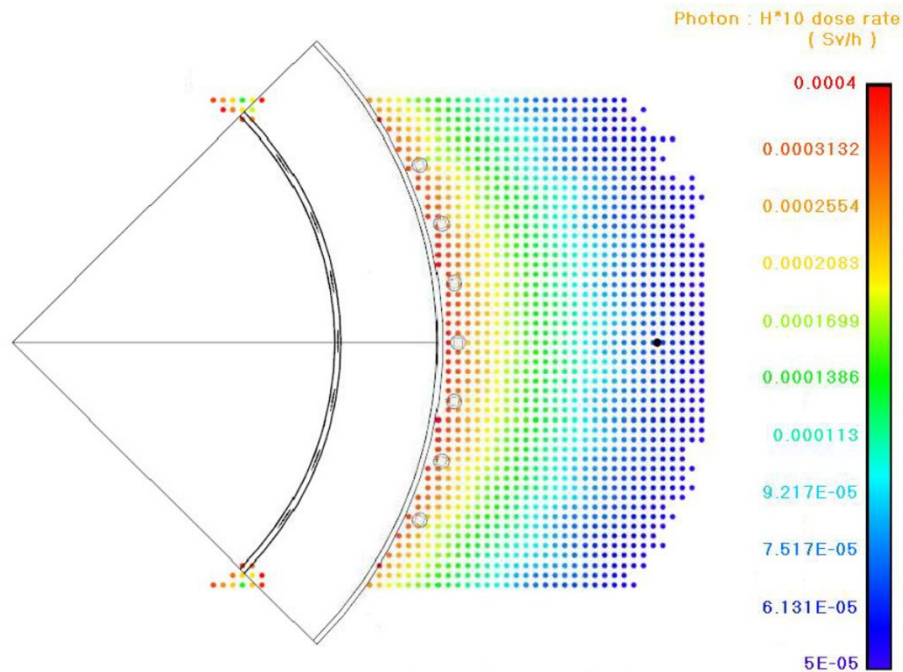
Interface



- When we introduce an interface, we can see water attenuates more of the radiation as it is denser than oil ($\approx 1000\text{kg/m}^3$ vs $\approx 800\text{kg/m}^3$)
- The detectors measure this difference and give an output

However...

Air



- When air is introduced into the measurement range, the dose rates can exceed 400 μ Sv/hr on the wall and 60 μ Sv/hr at 1m (+155%) higher than legally allowable
- (7.5 μ Sv/hr@1m)



Profiler™

High resolution Geiger-Müller

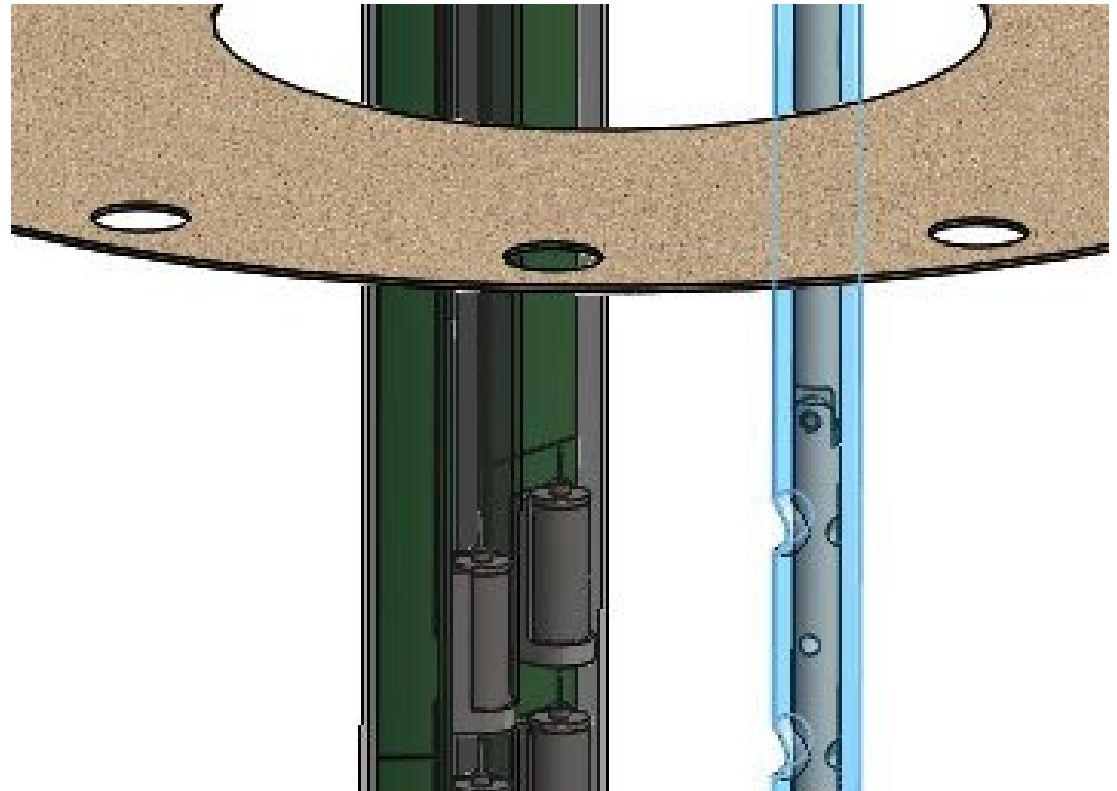


- ☐ Combined bulk level, multi-interface and density instrument
- ☐ Industry leading resolution
- ☐ Real time operator data
- ☐ Wide range of operating temperatures
- ☐ Analogue and digital outputs
- ☐ Low maintenance
- ☐ Bespoke design solution to suit exact need

Bespoke design

Completely customisable

- ❑ Designed in accordance with vessel and process conditions
- ❑ Range of resolutions available
- ❑ Density accuracy to suit application



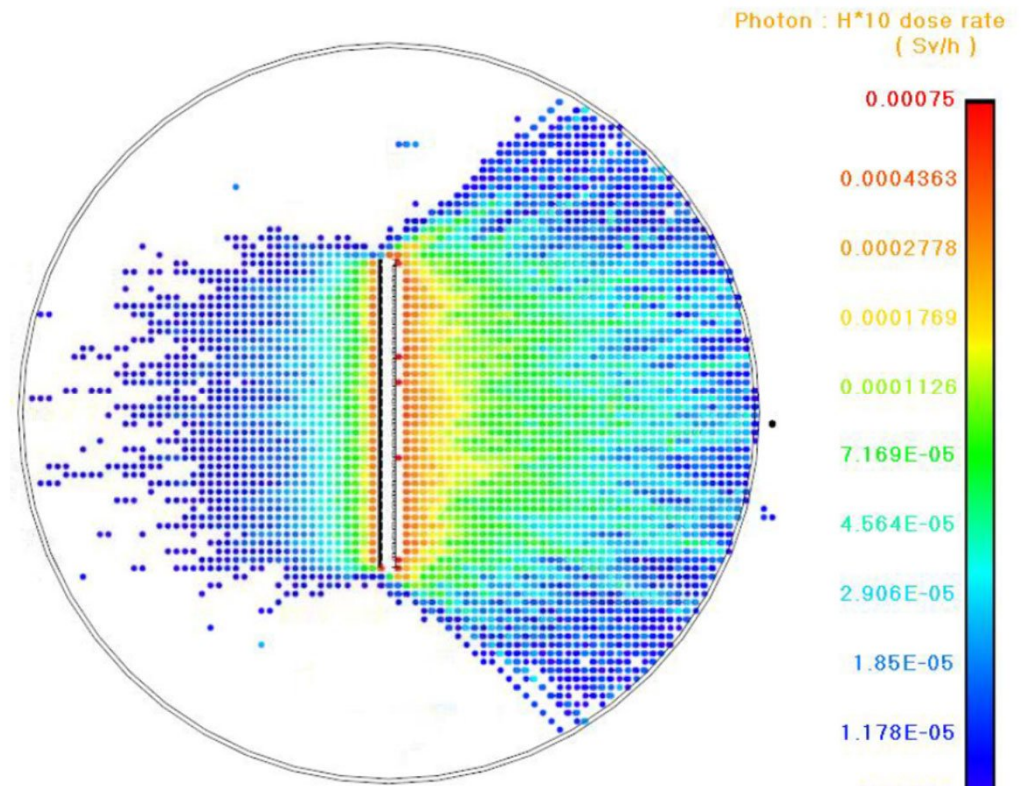
Profiler™ arrangement



Radiation safety and operation – Profiler™

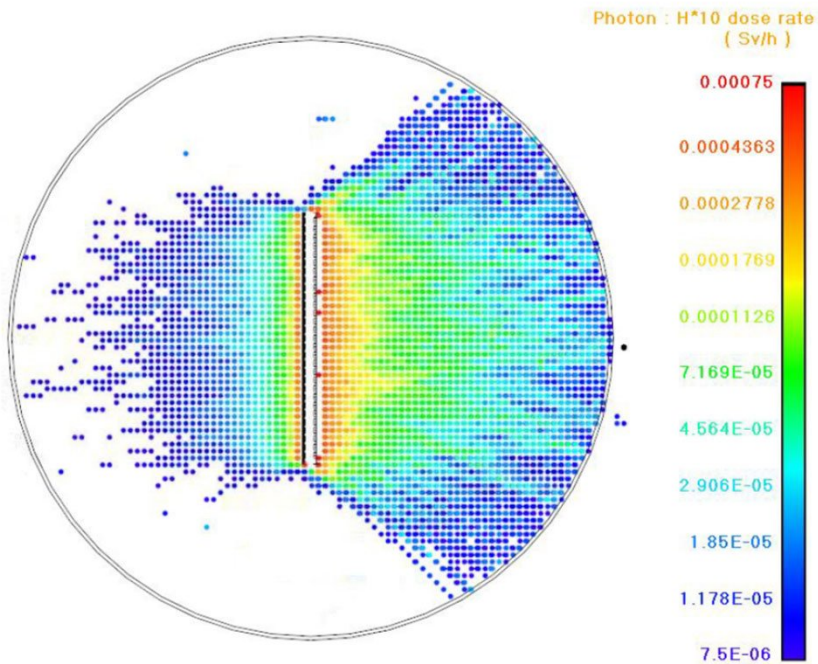
Air

As the Profiler™ measures level and interface internally over a short path length (source-detector), it has no dose external to the vessel regardless of process conditions or measurement range.

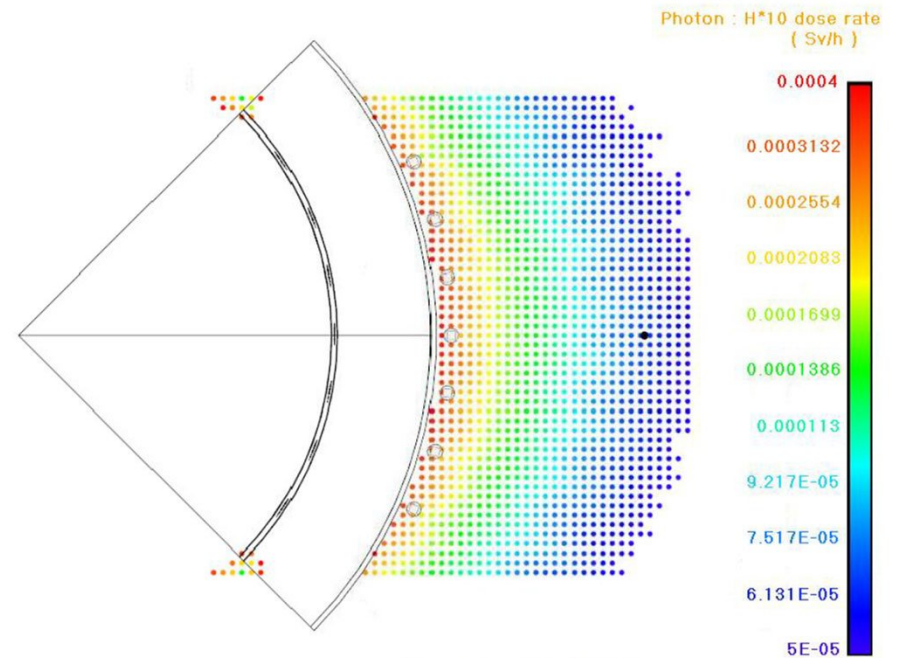


Profiler™ safety comparison

Internal sources and internal detectors

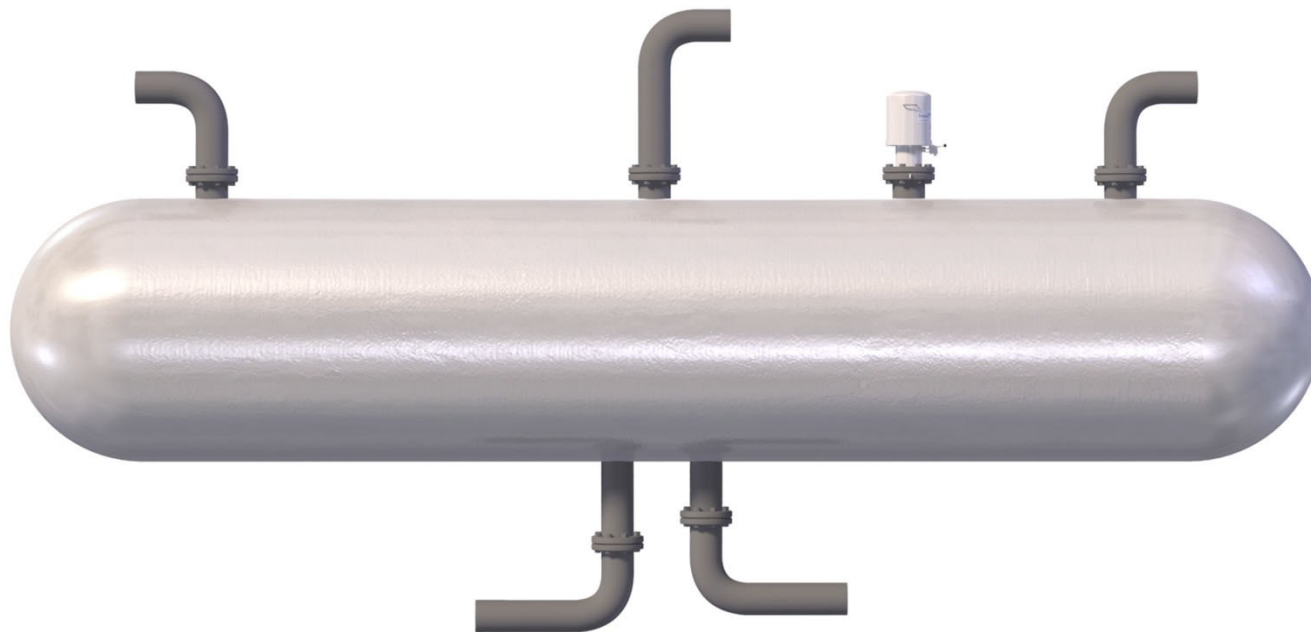


Profiler™



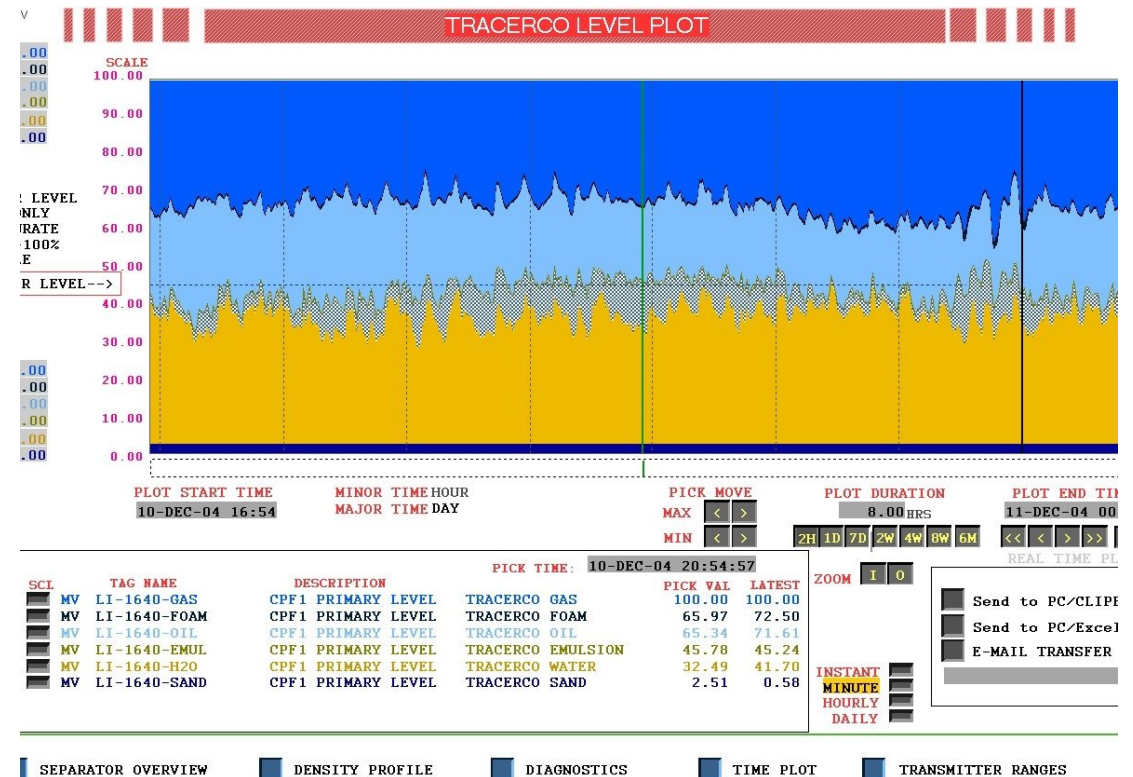
External

Radiography resilient



Operator visualisation

- ☐ Control from one central location with accurate overview of plant
- ☐ Real time alarms enable quicker reaction in the event of anomalies
- ☐ Real time and historical density and level data is recorded to offer enhanced diagnostics
- ☐ Effective management and operation of instrument and plant
- ☐ Reduced installation cost





Profiler™ advantages



Characterise and control real time process conditions

- Enhanced understanding of process and data driven decision making
- High resolution measurement and improved control

No moving parts, low maintenance

Reduce operating costs

- Optimise the use and effect of chemicals
- Reduce manual sampling

Reduced downstream corrosion

- Enhanced control allows for more efficient salt removal

Radiography resistant

Improved environmental compliance

- Reduced carry under

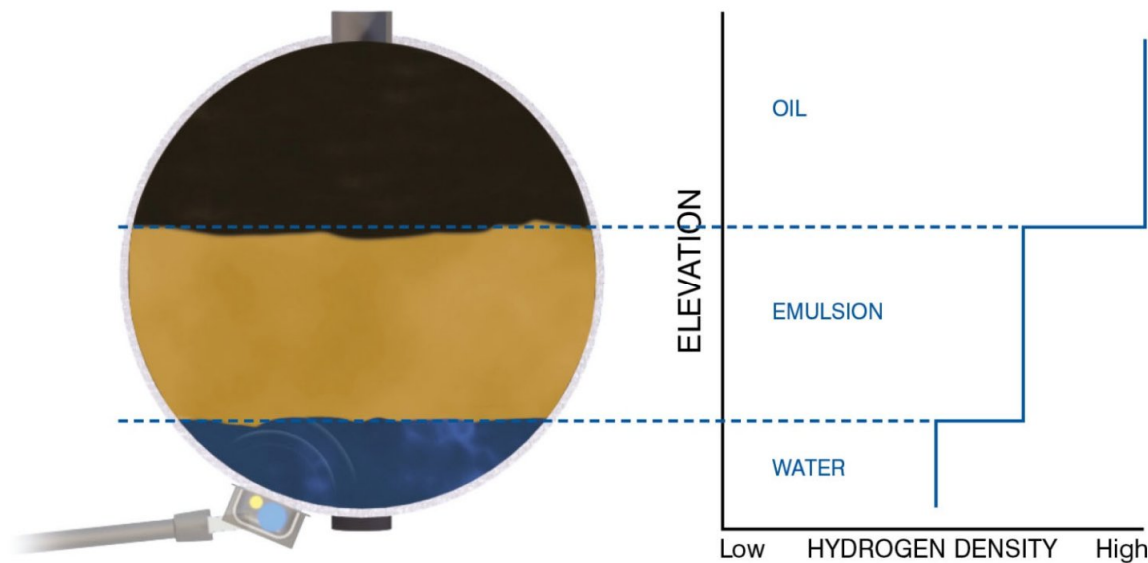


Process review

A client focused, solutions
based approach

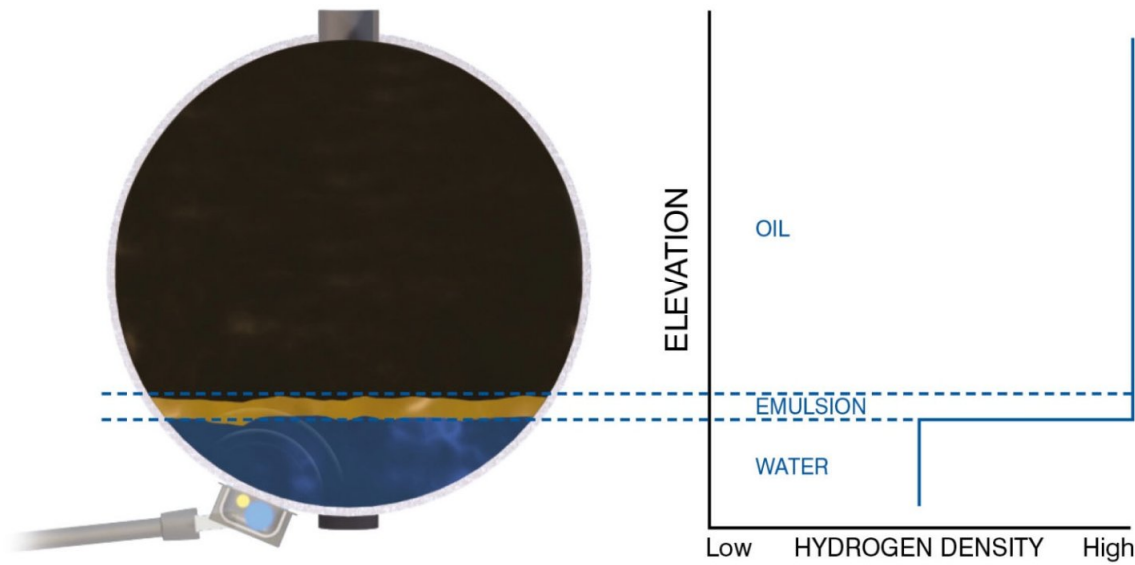
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Insight through innovation

Actual operation



- The malfunctioning level transmitter led to carryover of emulsion (H_2O , $NaCl$) in the oil stream to the distillation columns, in turn corroding overheads due to increased chlorides.
- There was also carry under of oil in water affecting wash water purity and environmental non-conformances.

Optimal operation



- Clean, defined interface
- Within operating parameters
- Visualisation of emulsion for control

Preliminary findings

Control

Poor level control from existing agar probe

Carry-over

Carryover of emulsion (H_2O , NaCl) in the oil stream to the distillation columns

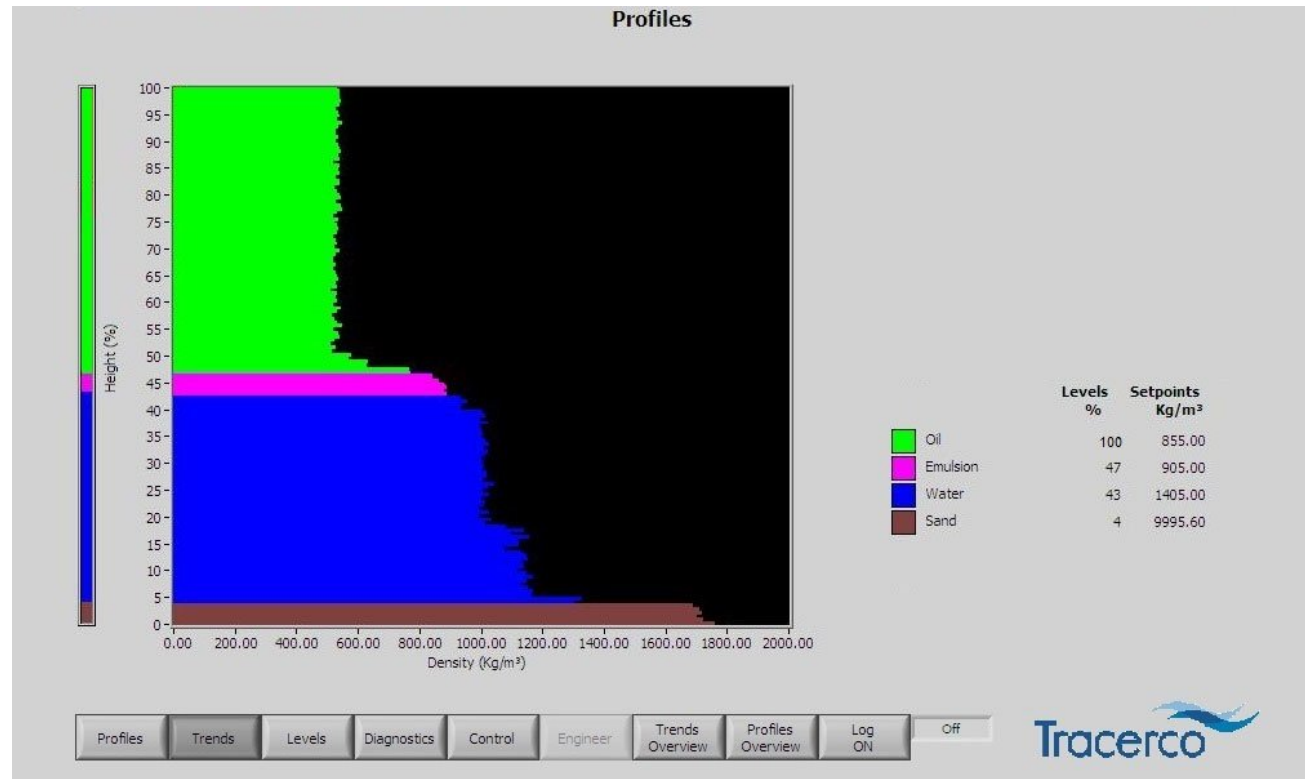
Carry-under

Carry under of oil in water affecting wash water purity and environmental nonconformances

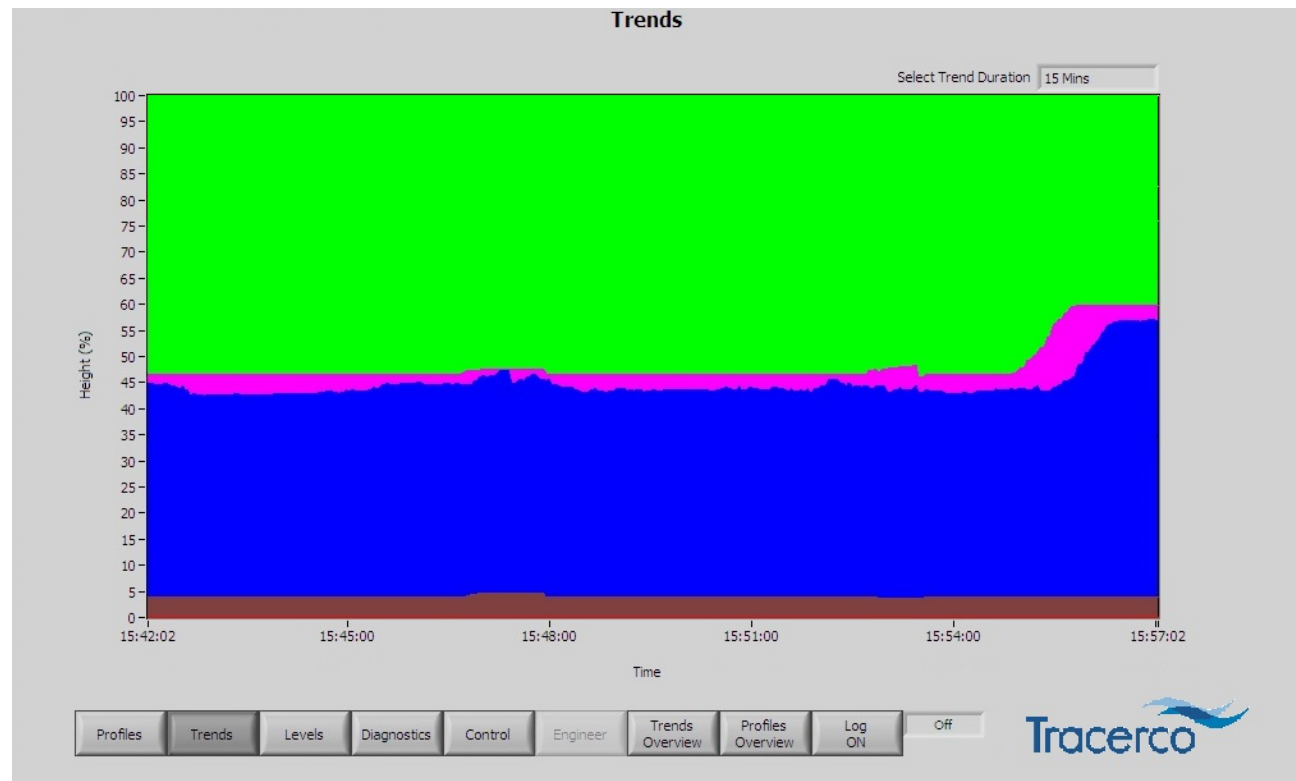
Corrosion

Corroding overheads due to increased chlorides

Real time monitoring and control



Historical trending



Summary



Enhanced
understanding of
process

Reduced corrosion

Reduced demand on
distillation pre-heat

Improved SRE

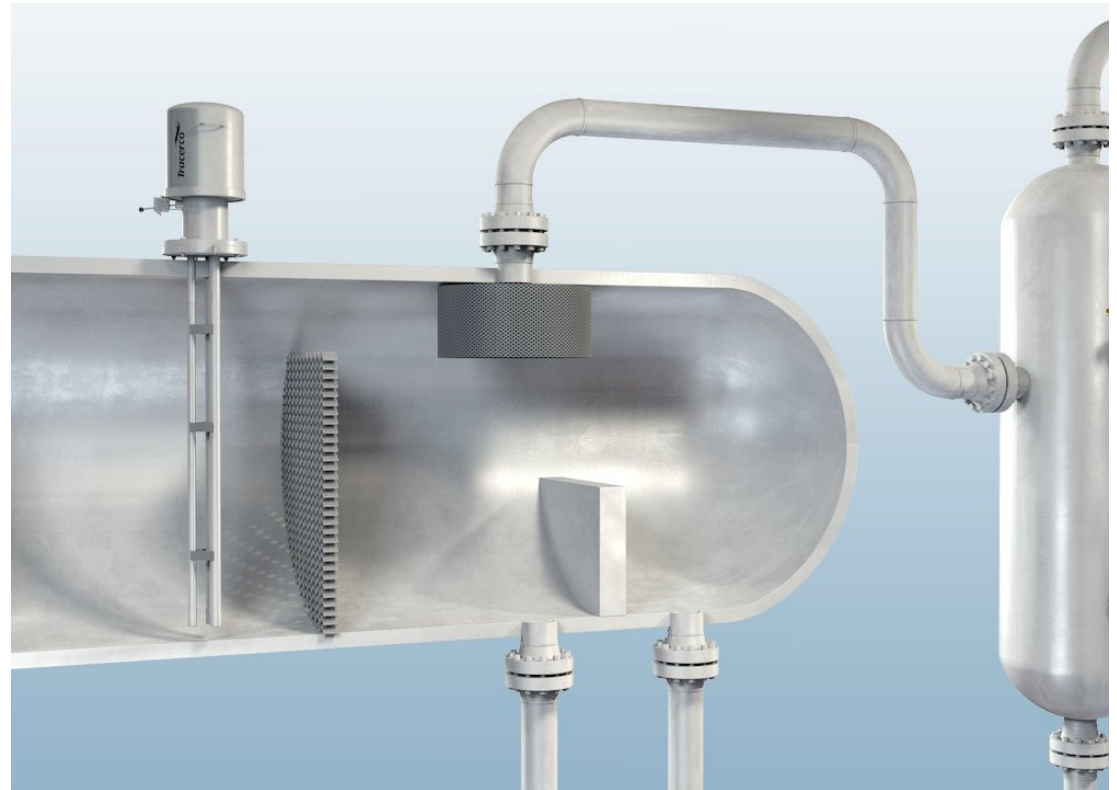
Reduction in BS&W

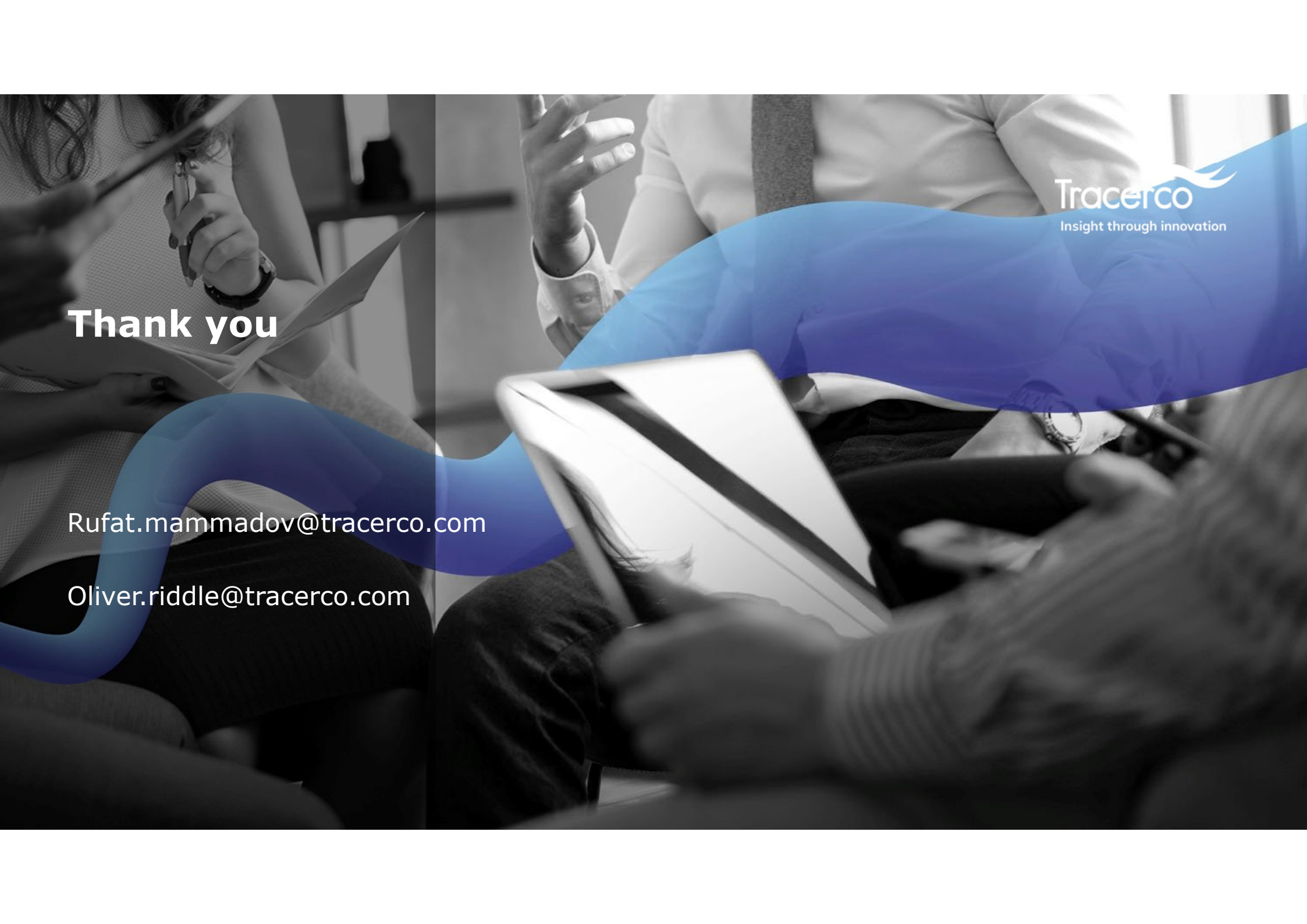
Reduction in chemical
dosing

Typical applications

The Profiler™ is suitable for use where high accuracy control is required

- ☐ HF/SF Alkylolation
- ☐ Separators
- ☐ Production traps
- ☐ Slug catchers
- ☐ Desalters
- ☐ Dehydrators
- ☐ Coalescers
- ☐ Settling tanks
- ☐ Wash tanks
- ☐ Primary separation cells
- ☐ Subsea storage tanks





Thank you

Rufat.mammadov@tracerco.com

Oliver.riddle@tracerco.com

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