WRc Instrument User Group

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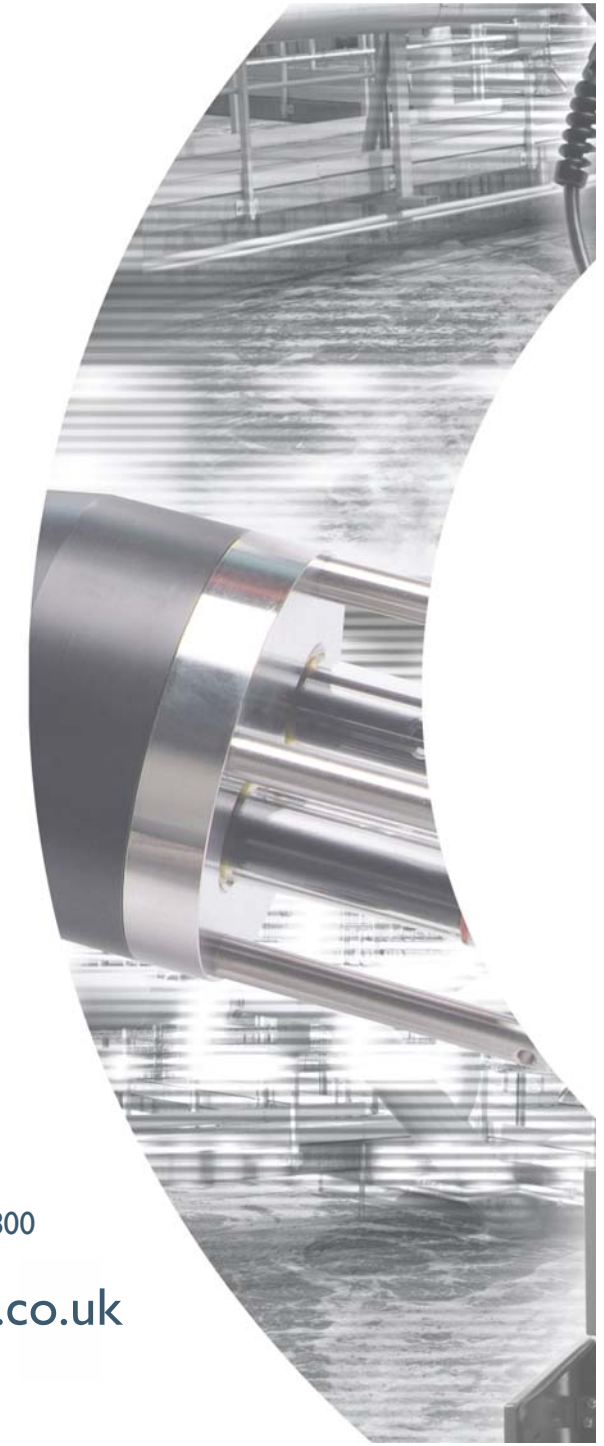

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Dissolved Oxygen

- What can good DO measurement achieve?
- Where to put the sensor?
- Installation and Self Cleaning
- Sensing Technologies
- Operational Considerations and Costs

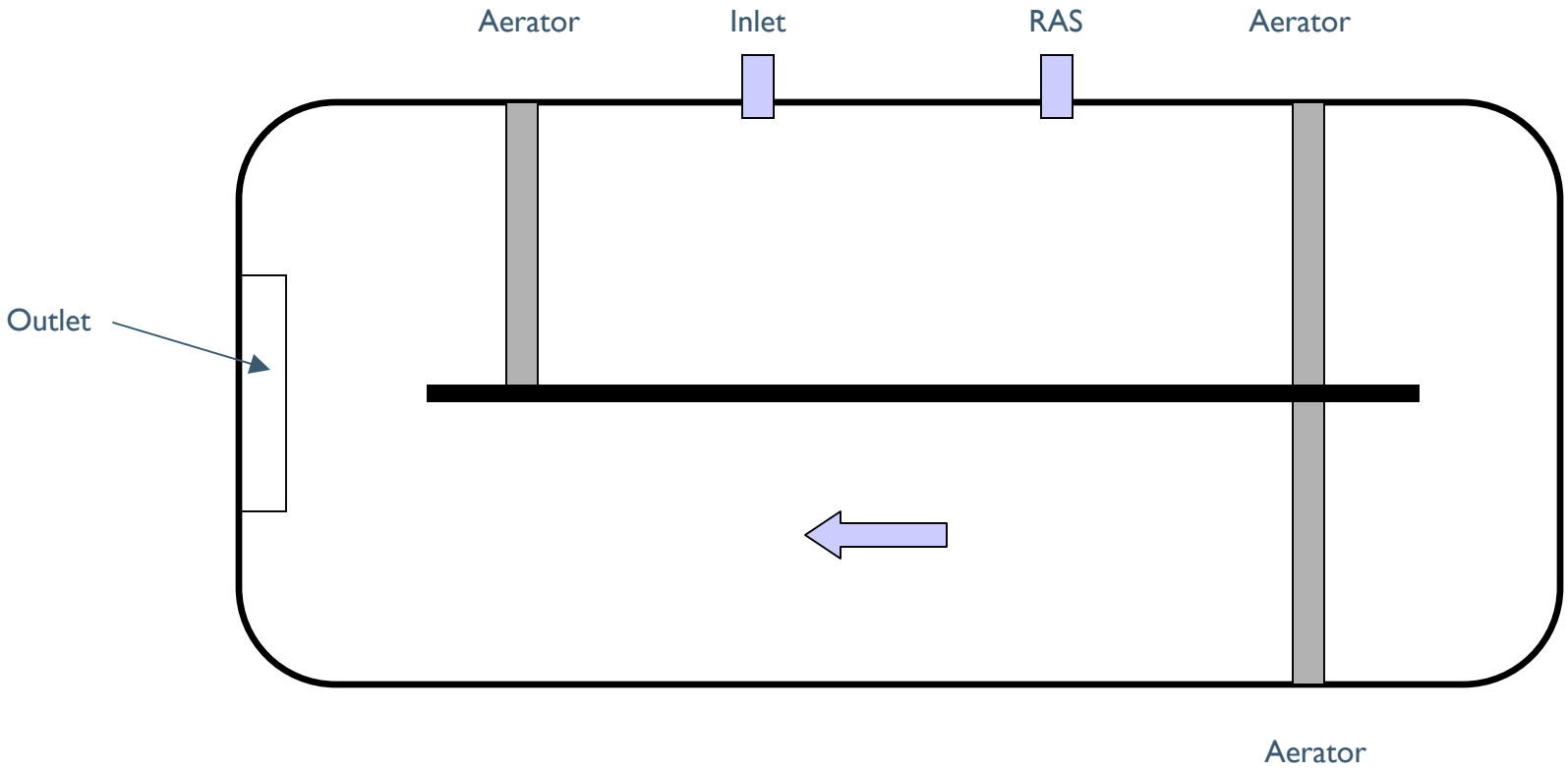
What can good DO measurement achieve?

- Done Well
  - Reduced Energy Use
  - Increase Plant Life
    - Blowers and Aerators working less
  - Better Effluent Quality
  - Improved Sludge Control
  - Warning of process problems
  - Happy Site Manager
- Done Poorly
  - Poor Effluent Quality
  - Drain on ICA resource
    - Repairs
    - Calibration
  - Wasted Energy
    - Over Aeration
  - Bulking of Sludge
  - False Alarms

Location

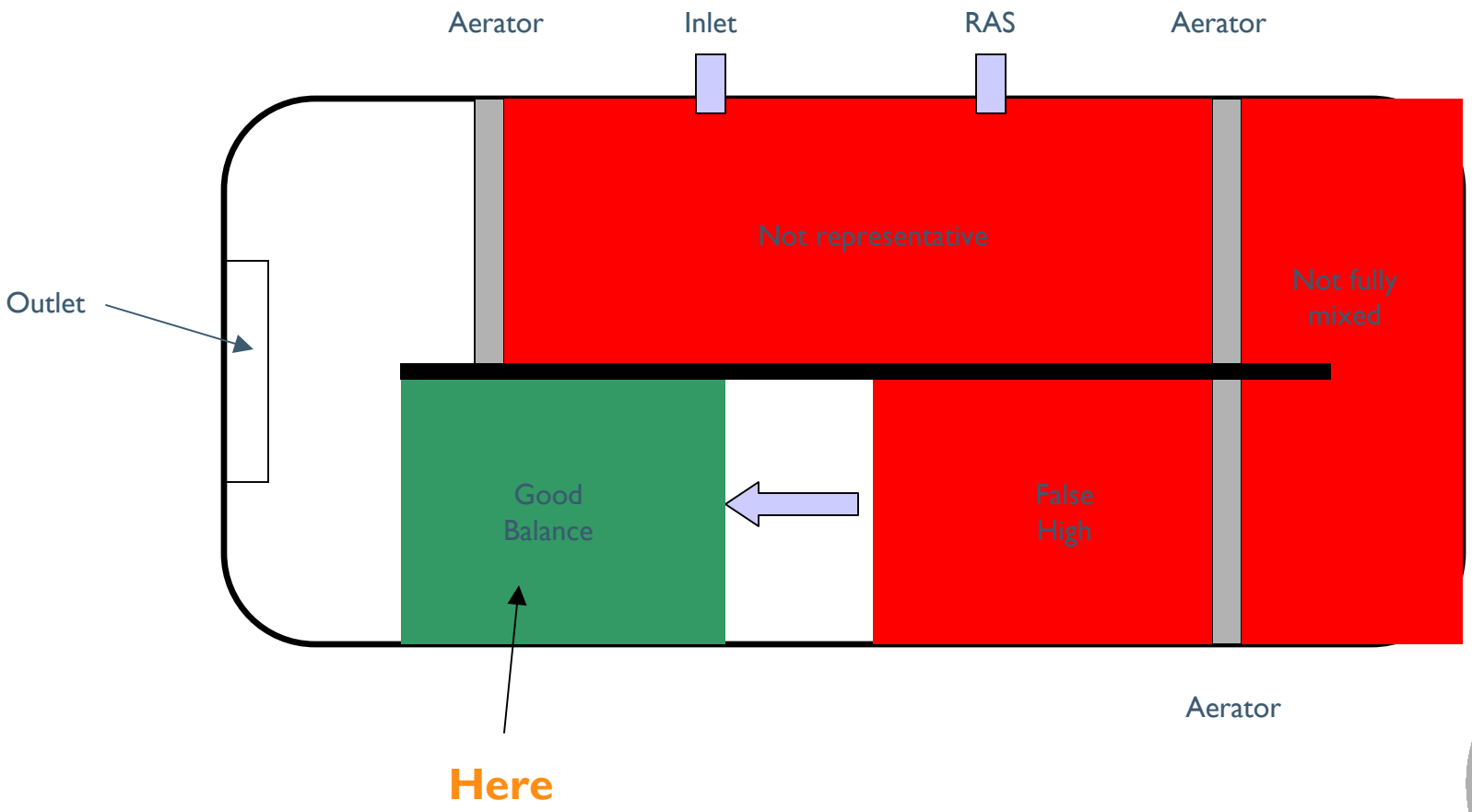
- Find
  - Representative Area
  - Well Mixed Sample
  - Safe to reach sensor
- Avoid
  - Dead Zones
    - Corners of Tanks
  - Extreme Turbulence
  - Area Next to Aerator
  - Hazardous Access to Sensor
    - Reaching over handrails

Oxidation Ditch



Where should the DO sensor go?

Oxidation Ditch



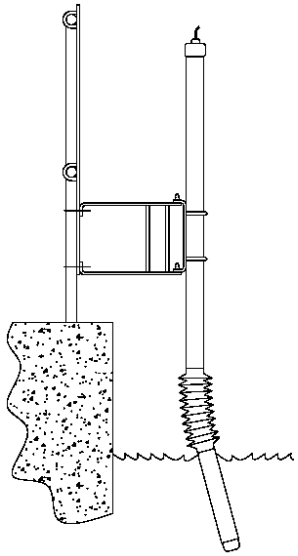
Sensor Installation and Cleaning

- Floating Ball
  - Provides self cleaning action on face of sensor
  - Prone to ragging and fats/grease
- Rigid Shaft
  - Places sensor below the surface
  - Prone to ragging
- Flexible Shaft
  - Ragging falls off by moving the sensor
  - Places the sensor below the surface
  - Provides self cleaning action on face of sensor

Floating Ball

Fixed Shaft

Flexible Shaft



Sensing Technology

- Optical
  - Original idea – 1939 by Kautsky
  - Re-introduced about 7 years ago - led by Hach
  - Modern electronic signal processing allows the use of luminophores that are quenched by the presence of oxygen
  - Current Favourite
    - Membrane caps need replacement on a yearly basis
- Galvanic
  - Clarke – circa 1959
    - Requires an excitation voltage, cells 'run down' as the oxygen uses up the electrolyte
  - Makereth – circa 1964
    - Oxyguard's unique electrolyte regenerates and lasts for 3+ years in wastewater

Basic DO Sensing

The Sensing Environment for a **Galvanic** Cell consists of a cathode and anode surrounded by an electrolyte. The oxygen passing through the membrane changes the electrical properties on the circuit and hence DO can be monitored.

Variations:

Clarke Cell - Circuit is energised

Makereth Cell - No excitation

Membrane Materials

Electrolyte Composition

Anode/Cathode Materials

The Sensing Environment for an **Optical** Cell consist of an optical arrangement where the membrane is excited by an LED to cause a luminescent repsonse. The oxygen passing through the memrbane causes the luminescent properties to change and hence DO can be monitored.

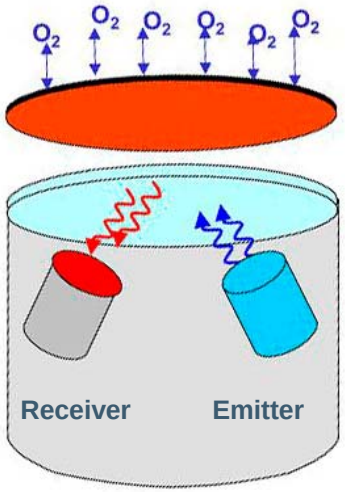
Variations

LED Wavelength: Green or Blue

Membrane Material

Very Similar?

Active Membrane with Luminescent Moldecules on an Inert Material



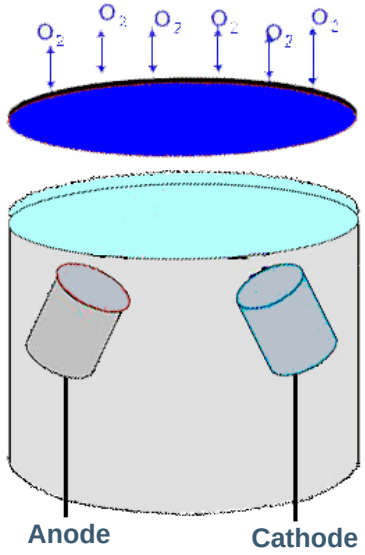
Signal Stength = f([O2])

Duration of the Signal = f([O2])

Signal Phase = f([O2])

The DO changes the luminescent properties of the membrane, the change in light intensity is converted into a DO measurement.

Inert Membrane allows DO molecules to pass into the electrolyte



Signal Stength = f ([O2])

The electrical properties of the electrolyte are changed by the DO passing throughthe membrane, generating the signal that is measured.

Does the sensing technology matter?

- Lots of PR about Optical, and some replys from the Galvanic side
  - All tend to ‘choose’ the comparison
    - ATi vs Minworth
    - LDO vs Clarke Cell
- Compare a good optical sensor and a good galvanic sensor and there is little to choose between them
  - Optical has a response time advantage
  - Membrane caps can have a short life
    - 12 month enforced replacement for some
  - Good Galvanic sensors will last 3+ years between refurbishments

Some claims examined

- A new trend-setting technology for the online measurement of oxygen will fundamentally revolutionise the discipline of water analysis.
  - **No more calibrating**: Minimal maintenance
  - **No more replacing of the membrane and electrolyte**: Easy handling
  - **No flow rate required**: Accurate and dependable measurements
  - **No more poisoning of the electrode by H2S**: Usable for difficult applications
  - **No polarization times**: High availability

Operational Considerations

- Calibration
  - Required?
    - Yes – otherwise how do you know that the system is functioning correctly
- Cleaning
  - Required?
    - Yes – but you don't need expensive troublesome compressors
- Service
  - Membrane/Cap Replacement
    - Yes – optical and galvanic both need membrane replacement

Summary

- Good Optical AND Galvanic sensors work
  - Choose a good sensor, the principal of operation is only part of the decision
  - Correct installation is key to success
- Maintenance is required and must be included in operating budgets
  - New monitors need to be quickly integrated into operator and technicians work programmes, not left until they fail
  - Or use the supplier/ICA contractor to look after the equipment