



Radar level measurement for the wastewater industry

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Presentation Overview

My goals for the next 1,200 seconds...

- Keep you awake
 - - not bore you with 60 years of company history
 - - not discuss things that don't help you solve problems
 - - We're here to solve problems...



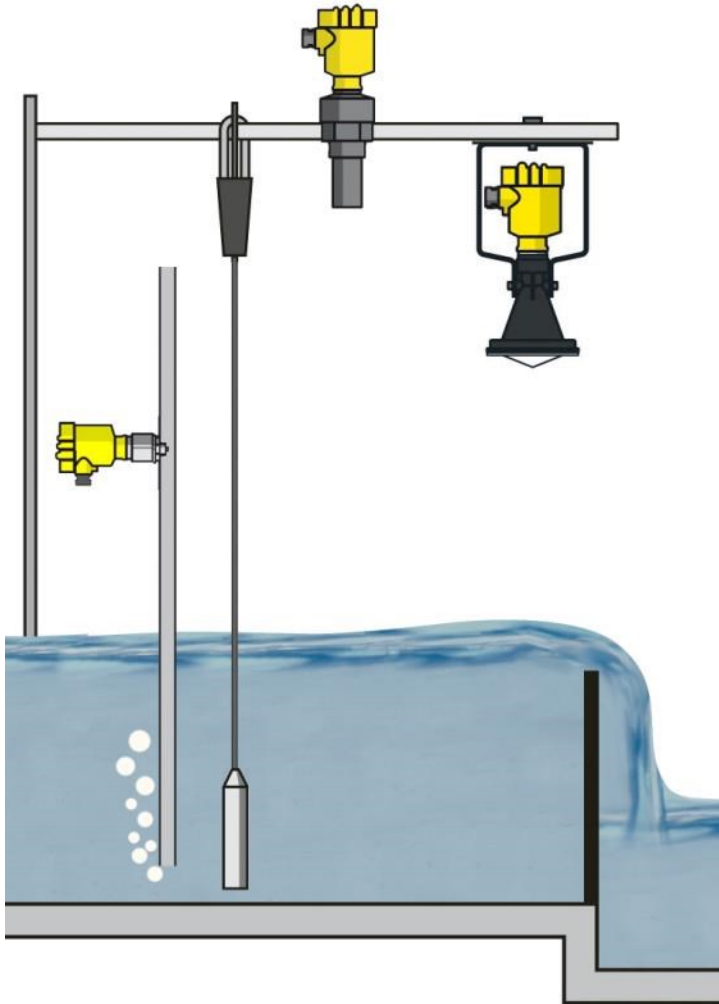
Presentation Overview

We'll talk about...

- Lift stations/Wet wells
 - Open channel flow
 - Chemical storage tanks
 - Bar screens / plant headworks
 - ...and the problems people relate to those applications.



Level Measurement Technologies For Wastewater



- Bubbler
- Hydrostatic Pressure
- Ultrasonic
- Radar

Solar Influence

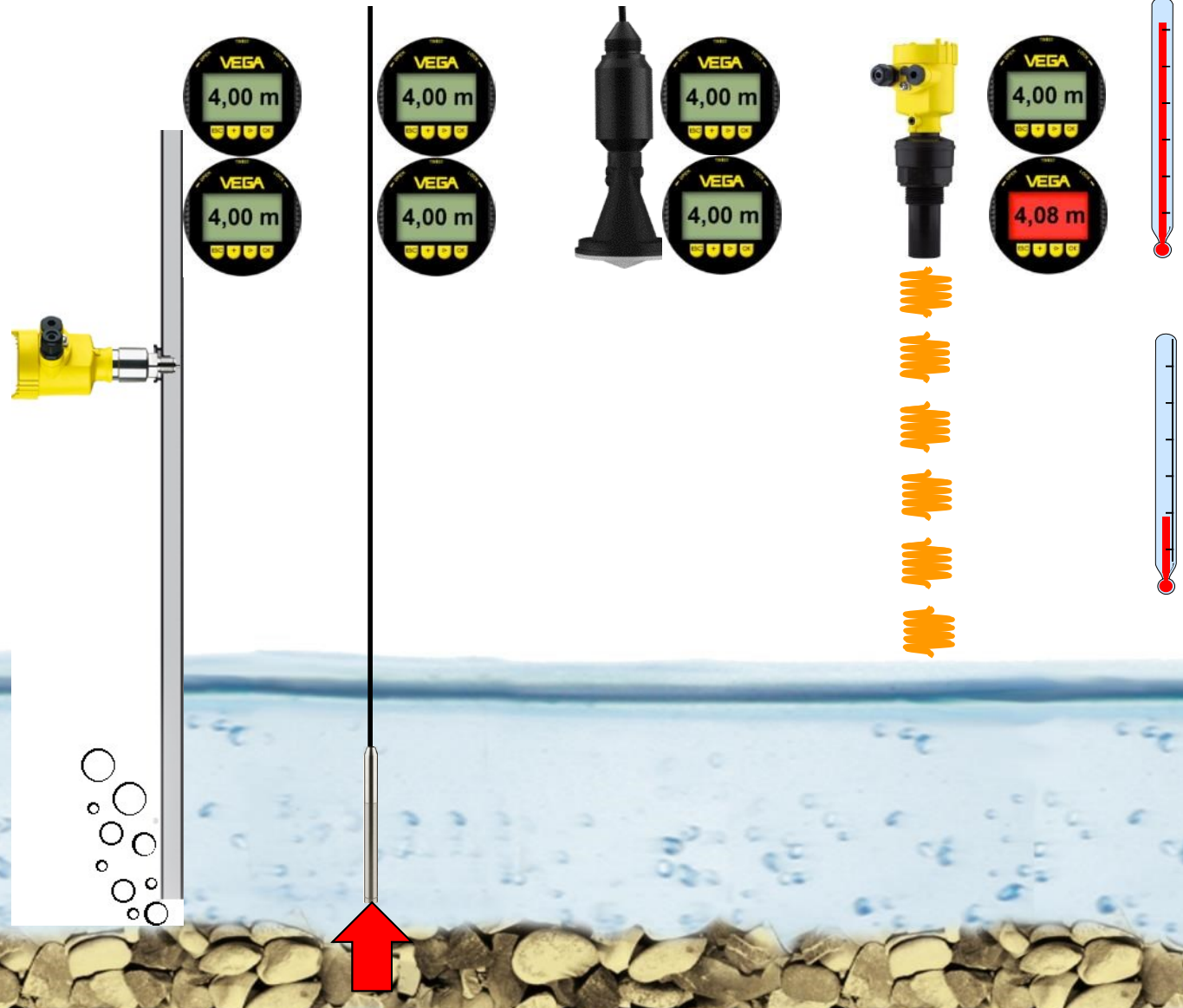


Bubbler sensor

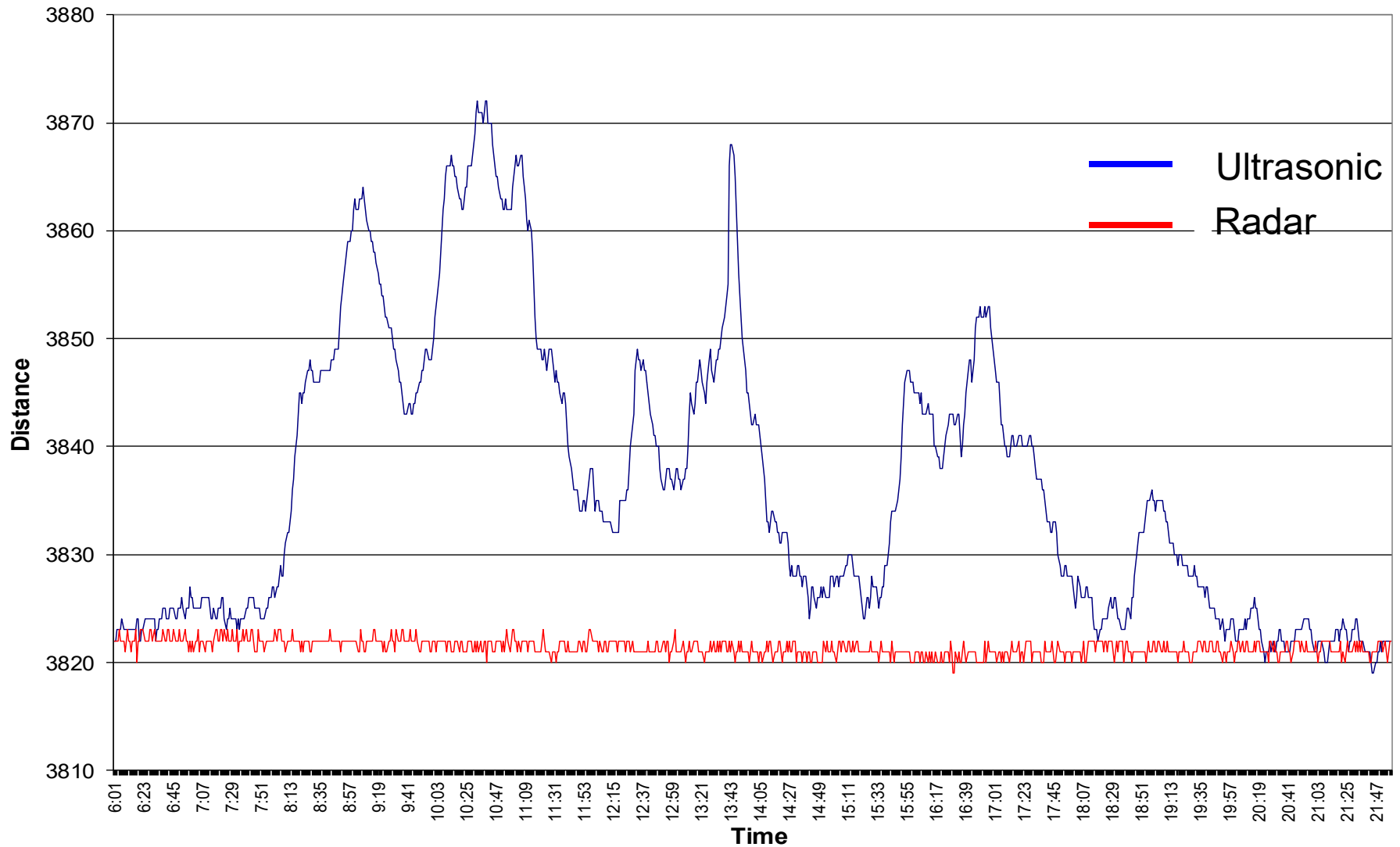
Hydrostatic

Radar

Ultrasonic



Side By Side Comparison



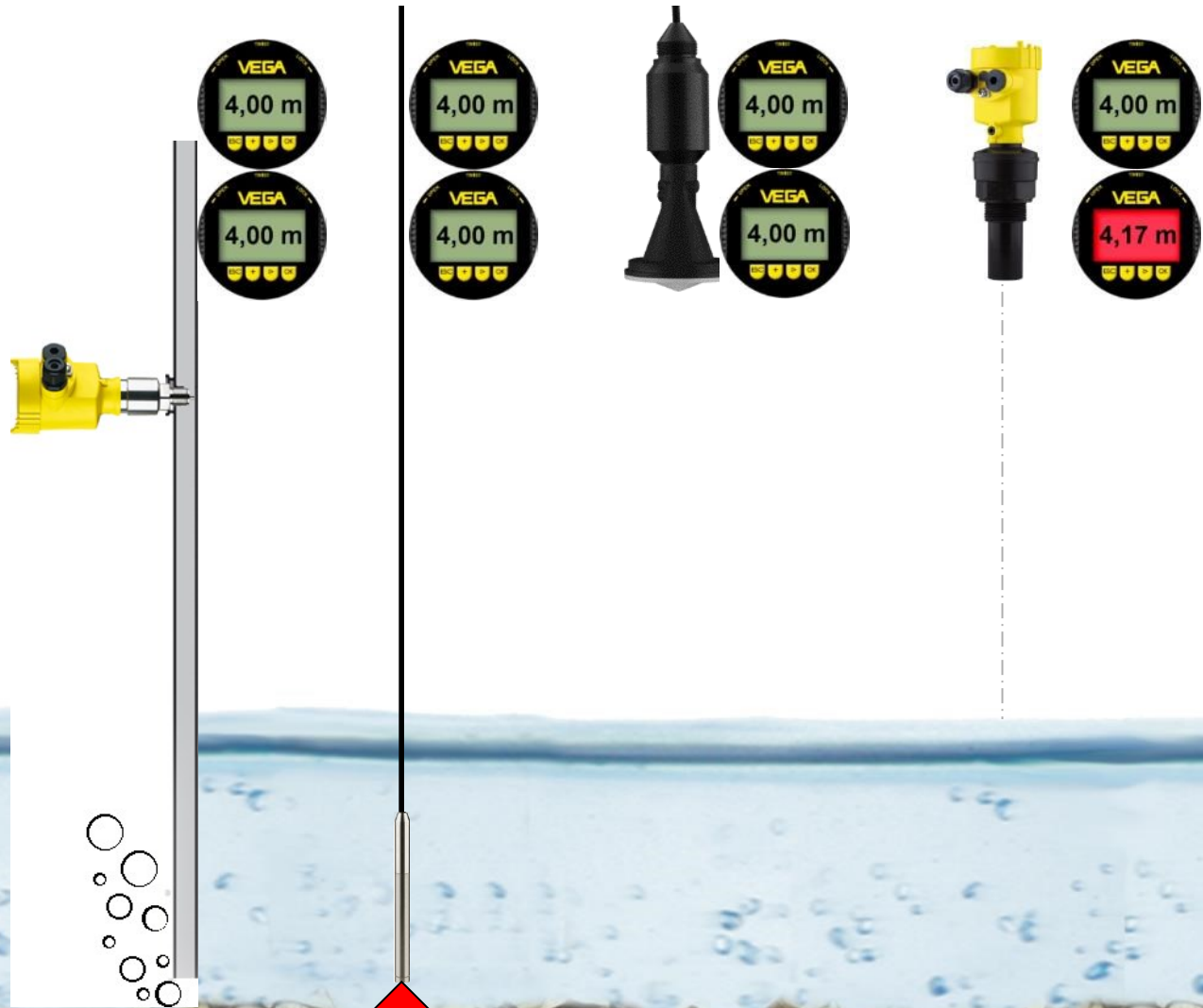
Wind Influence

Bubbler sensor

Hydrostatic

Radar

Ultrasonic



Sediment Build-Up

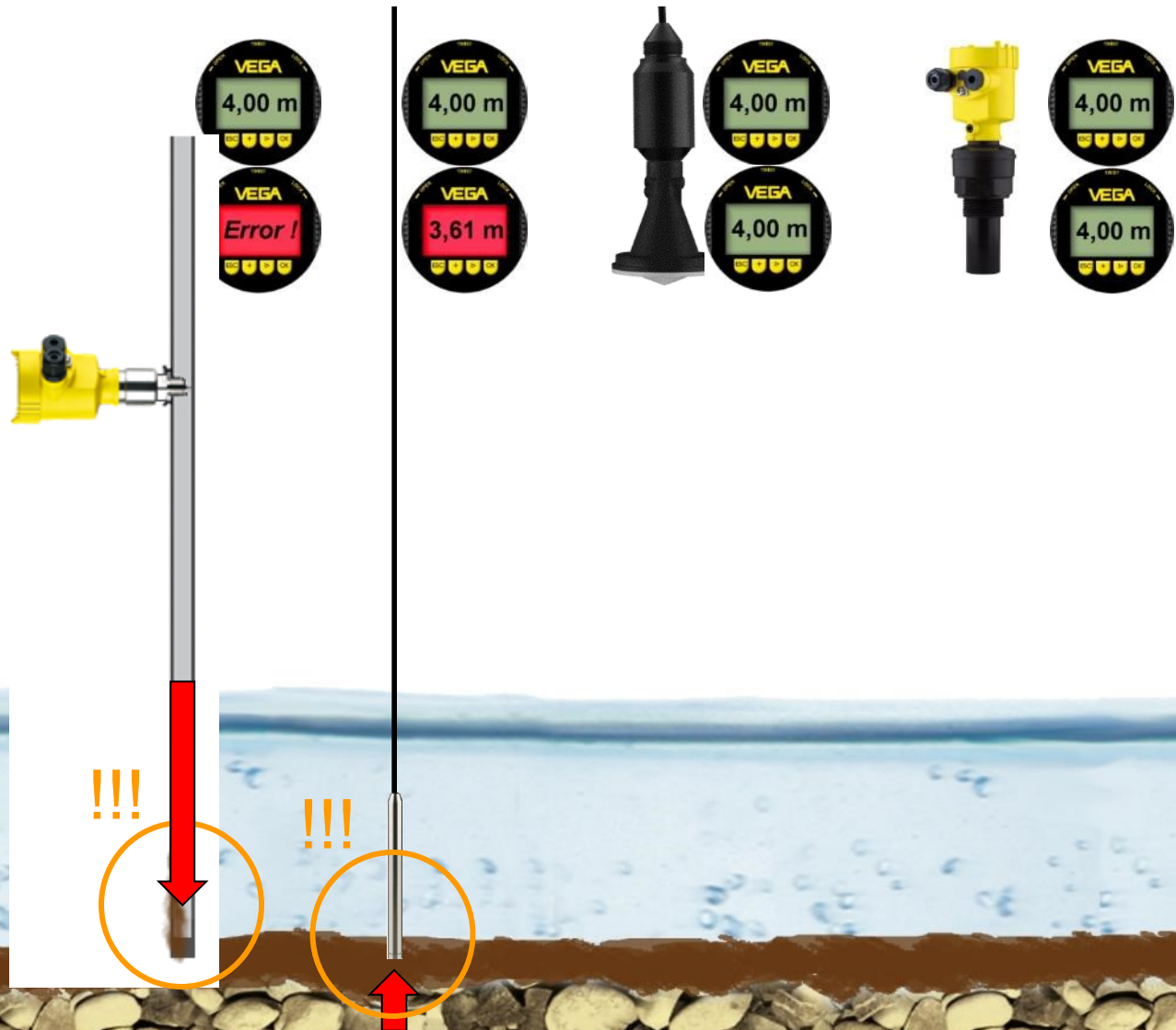


Bubbler sensor

Hydrostatic

Radar

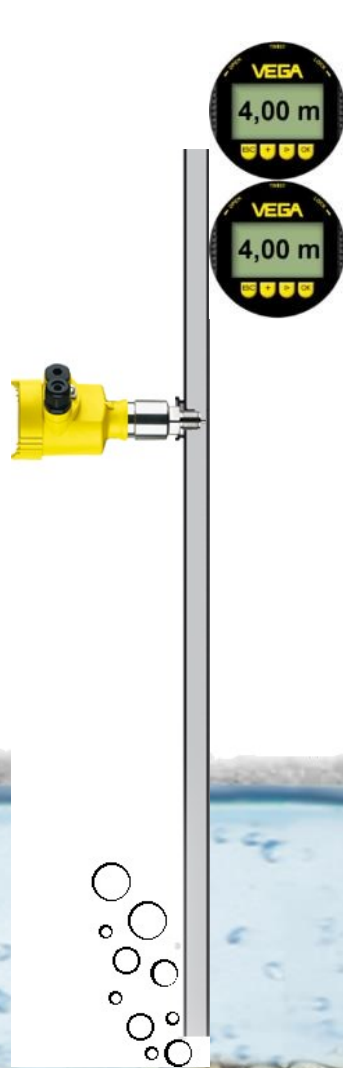
Ultrasonic



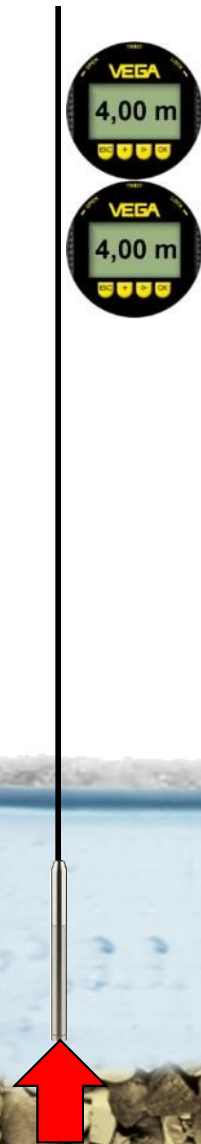
Foam Influence



Bubbler sensor



Hydrostatic



Radar



Ultrasonic



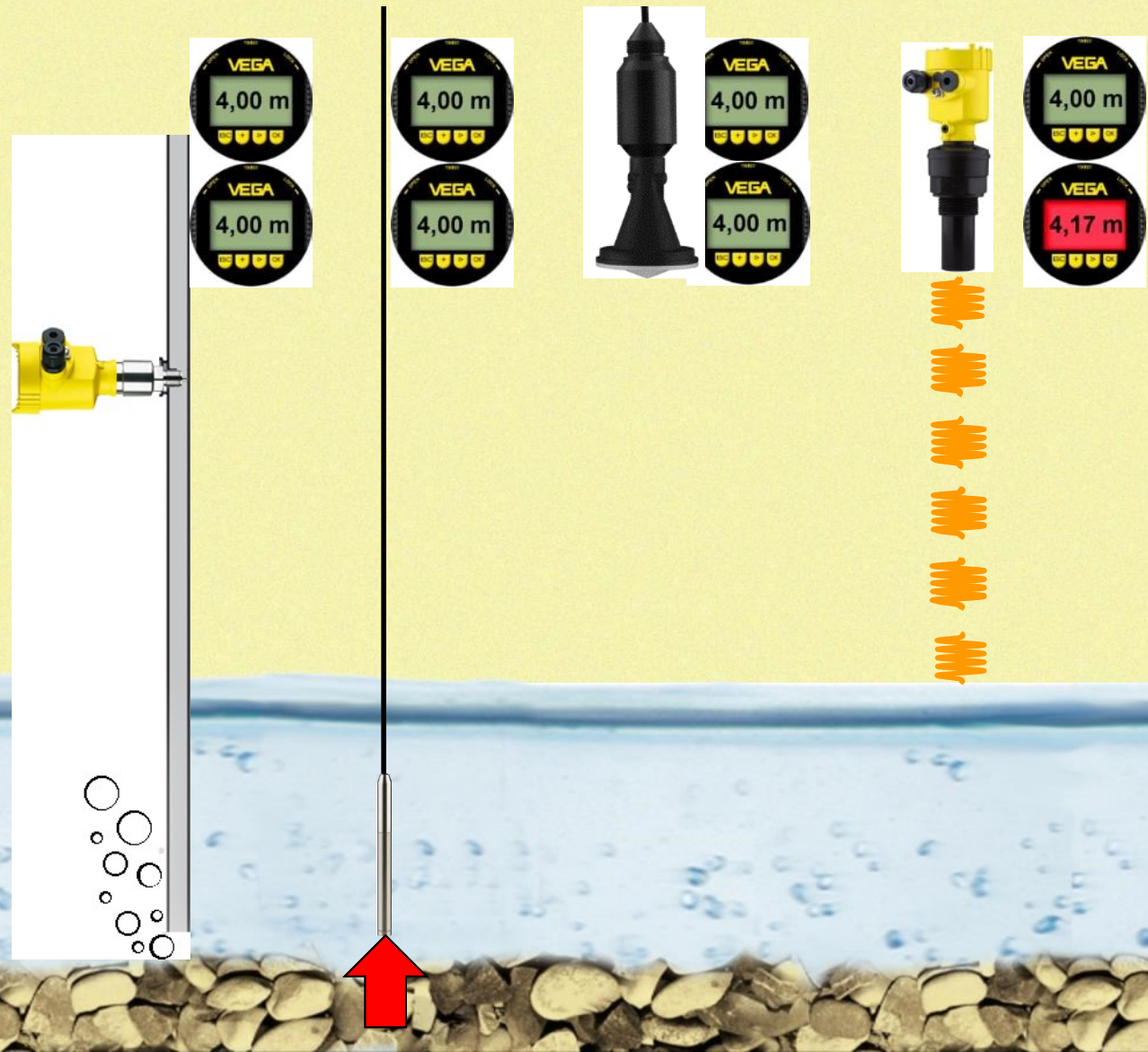
Gas Layer Influence

Bubbler sensor

Hydrostatic

Radar

Ultrasonic



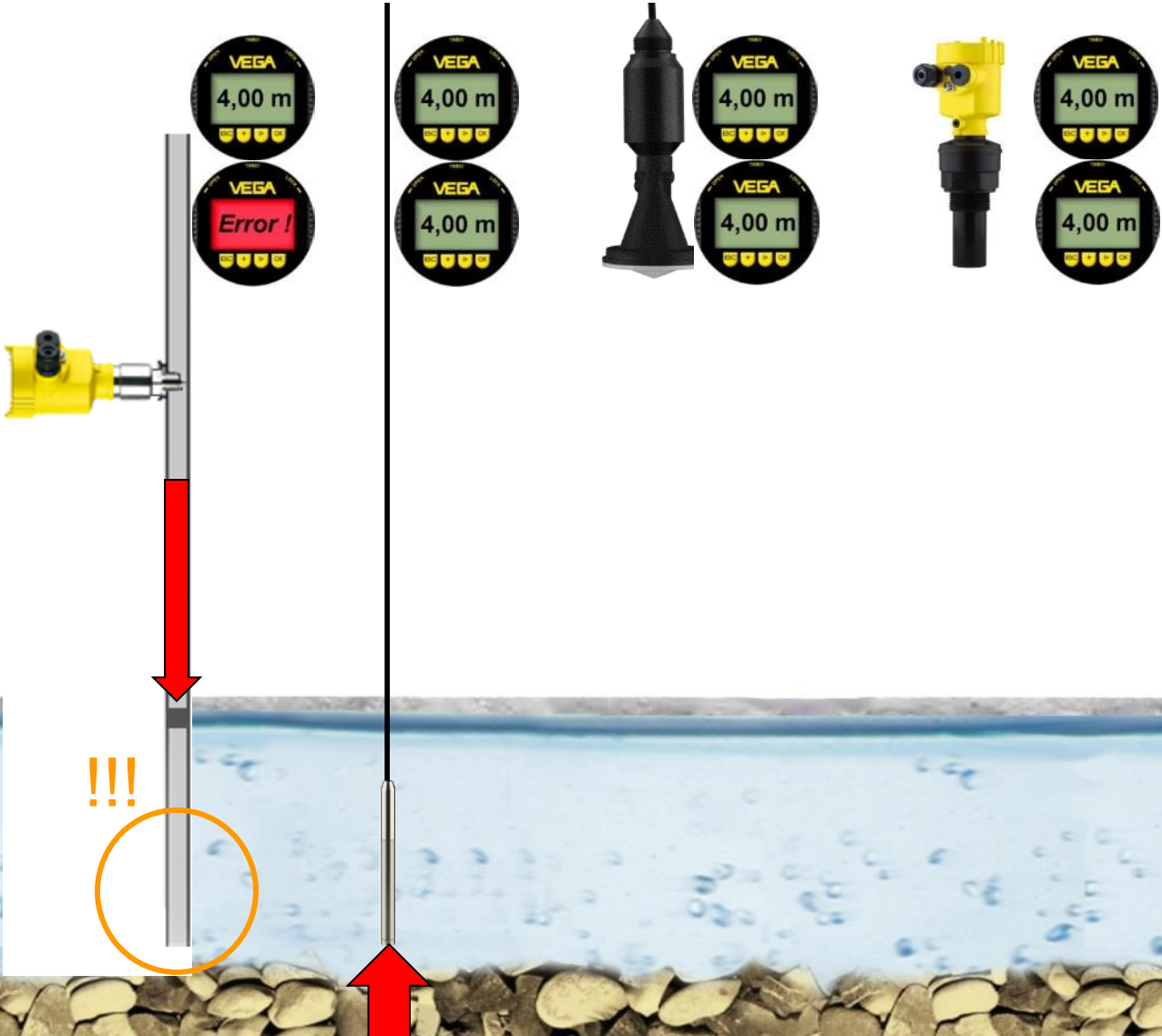
Ice Influence

Bubbler sensor

Hydrostatic

Radar

Ultrasonic



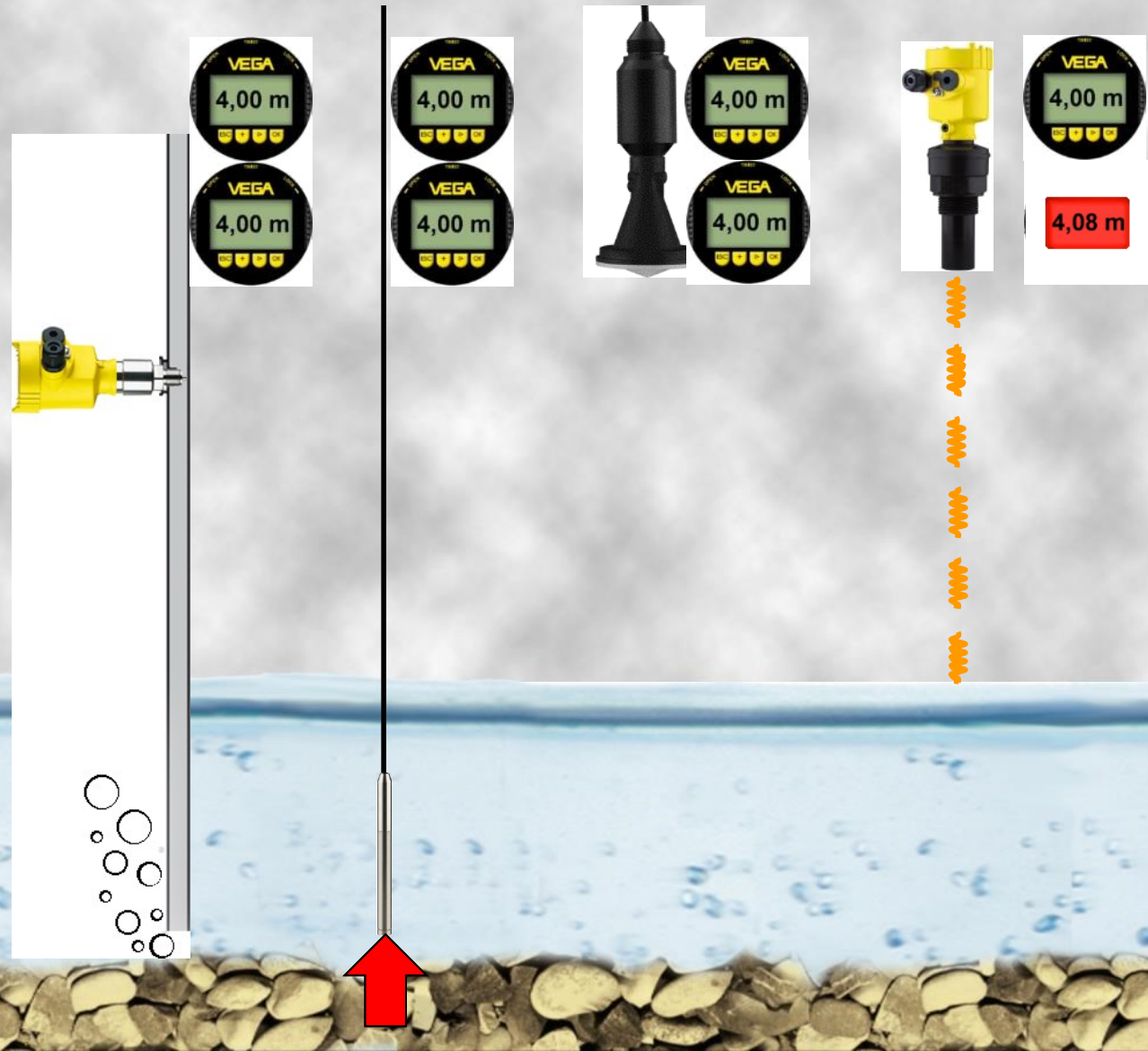
Fog Influence

Bubbler sensor

Hydrostatic

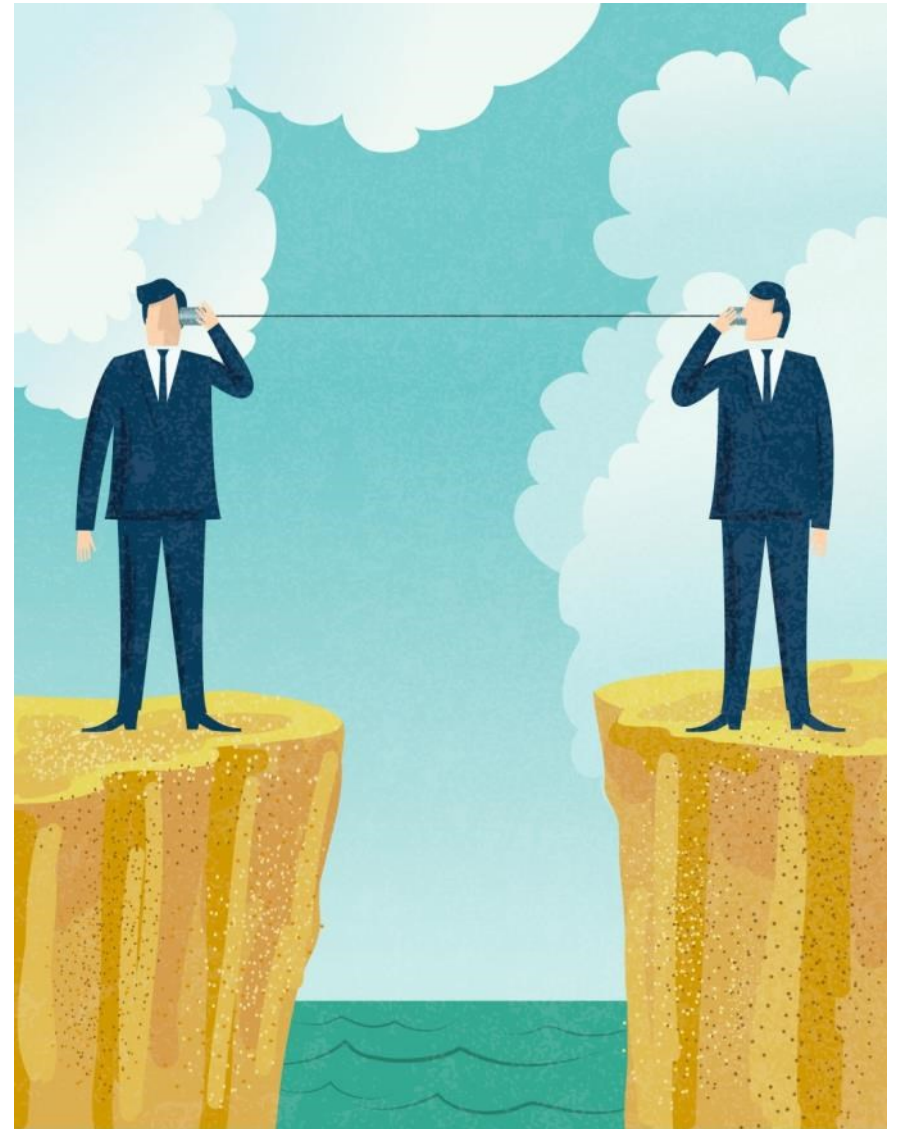
Radar

Ultrasonic

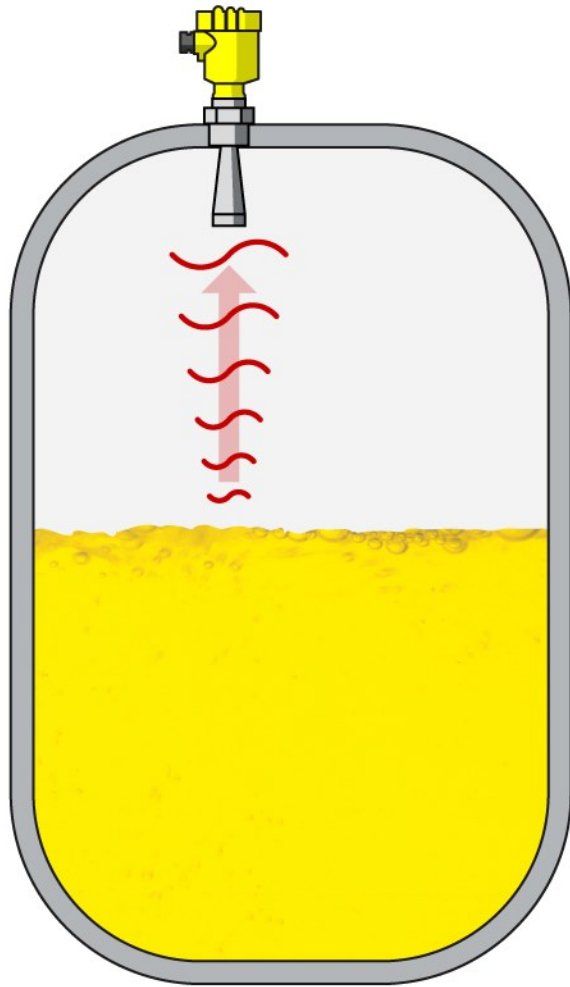


Ultrasonic vs Radar

- Ultrasonic
 - Sound wave
 - Needs a carrier to propagate



Radar Principle of Operation



- A microwave pulse is emitted, reflected off the product and received
 - Each pulse has a length of 0.5 nanoseconds
 - A new pulse is emitted every 280 nanoseconds (3.6 million pulses per second)
- Time of Flight Measurement
 - $\text{Distance} = \text{Rate} \times \text{Time}$

Ultrasonic vs Radar

■ Radar

- Beam angle:
 - 4 – 22 deg
- Accuracy: +/- 2mm
- Temperature change from 0 to 2,000 deg C: 0.026% error
- Change from Air to Methane: 0.0122% error



Lift Station/Wet Wells – Hydrostatic Pressure



Pros

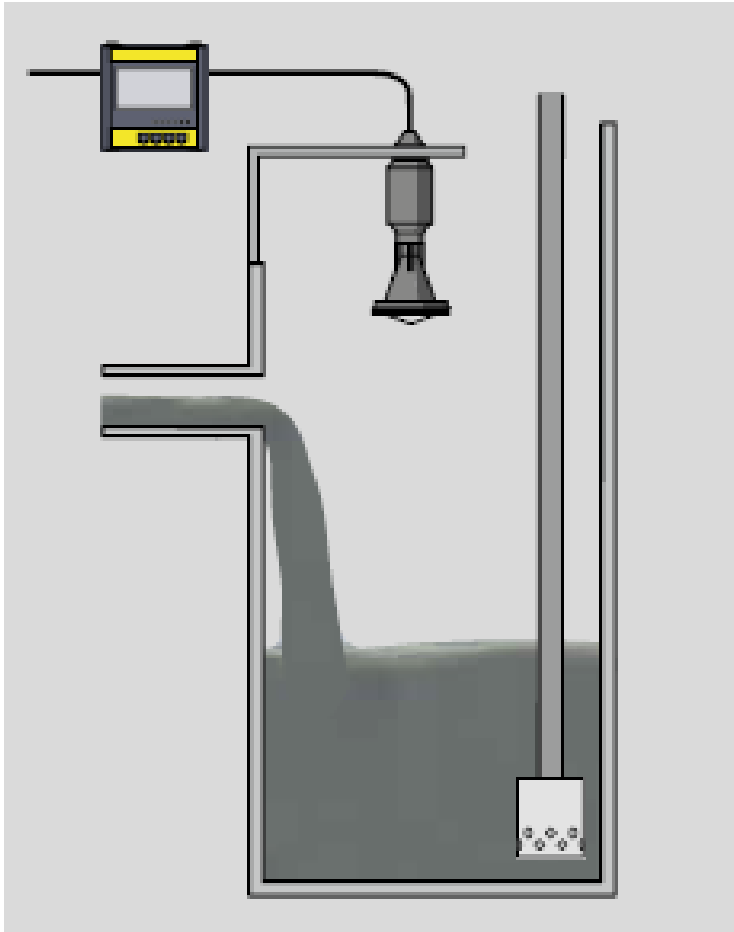
- Lower cost
- High degree of repeatability
- Not susceptible to plugging as other hydrostatic sensors
- Long life
- Birdcage design for protection not needed

Cons

- Contact measurement – maintenance required
- Overall level error if FOG present
- Possible error if submerged in sediment/grit

Lift Station/Wet Wells – Radar

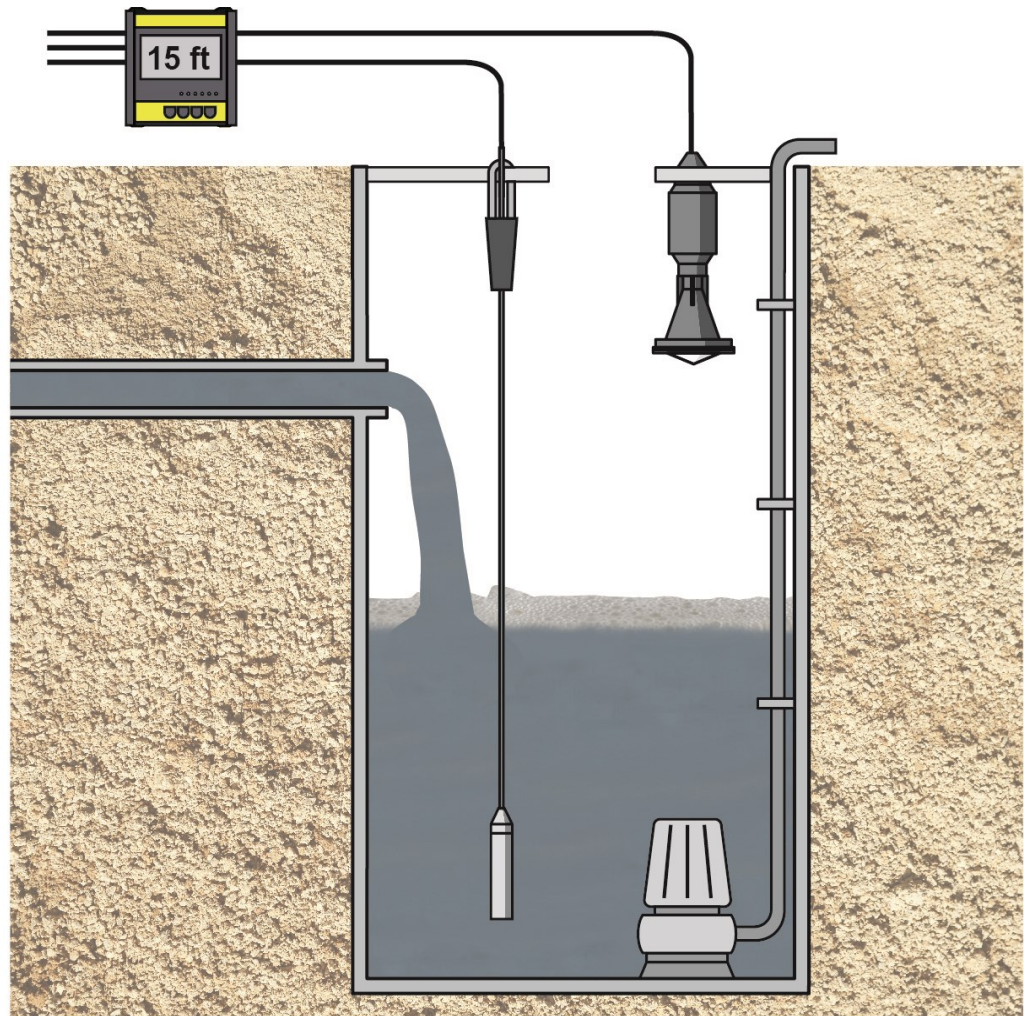
- Non-contact
- Not susceptible to ‘in-air’ interferences such as foam and fog (condensed water vapor)



Lift Stations / Wet Wells

FOG Package

- High degree of reliability
- FOG layer information
- Measurement redundancy



Lift Stations / Wet Wells



Lift Stations / Wet Wells



Open Chanel Flow



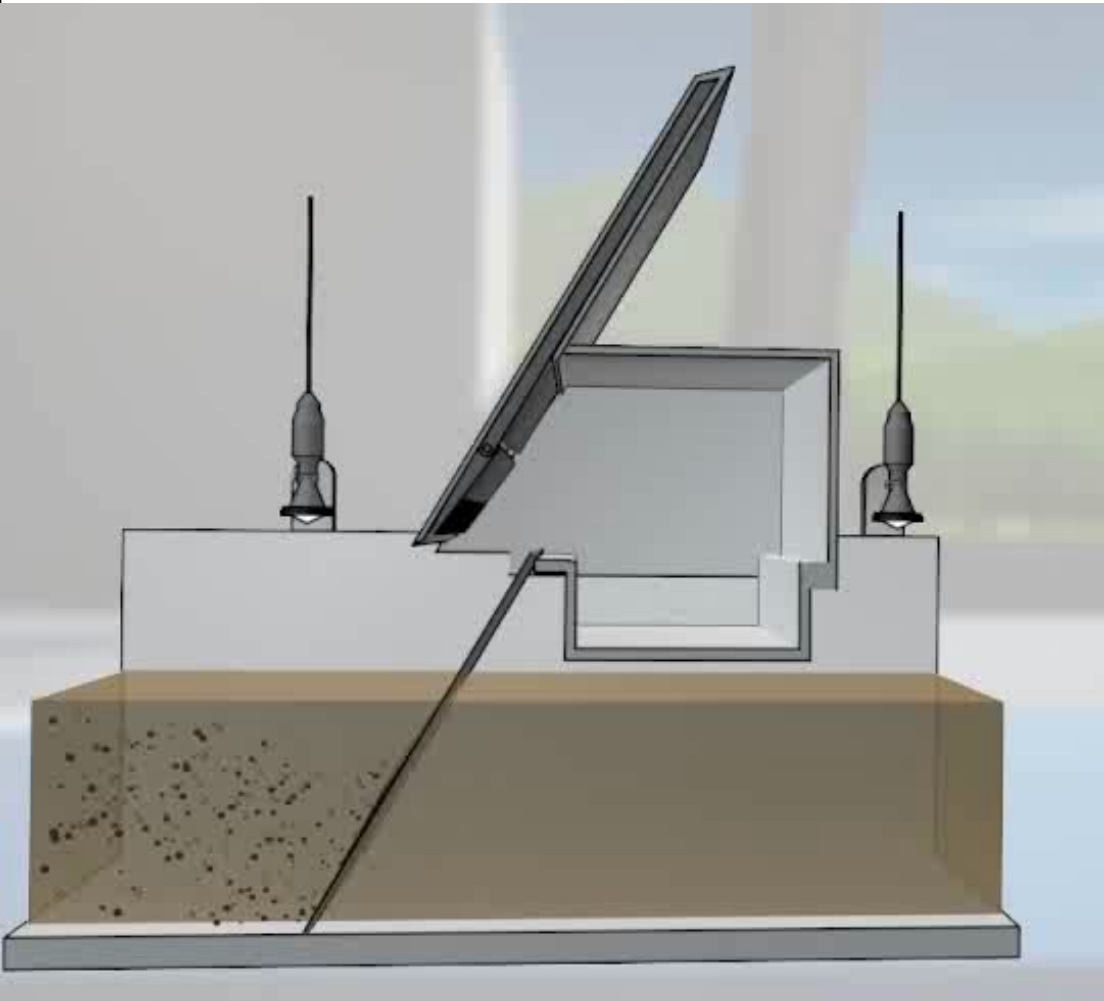
- Unaffected by temperature, wind, and weather
- Common flow algorithms built into sensor, making controller/display optional

Open Chanel Flow



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Bar Screens



- Small measuring ranges
- Unaffected by condensation
- Reliable measurement even with foam generation



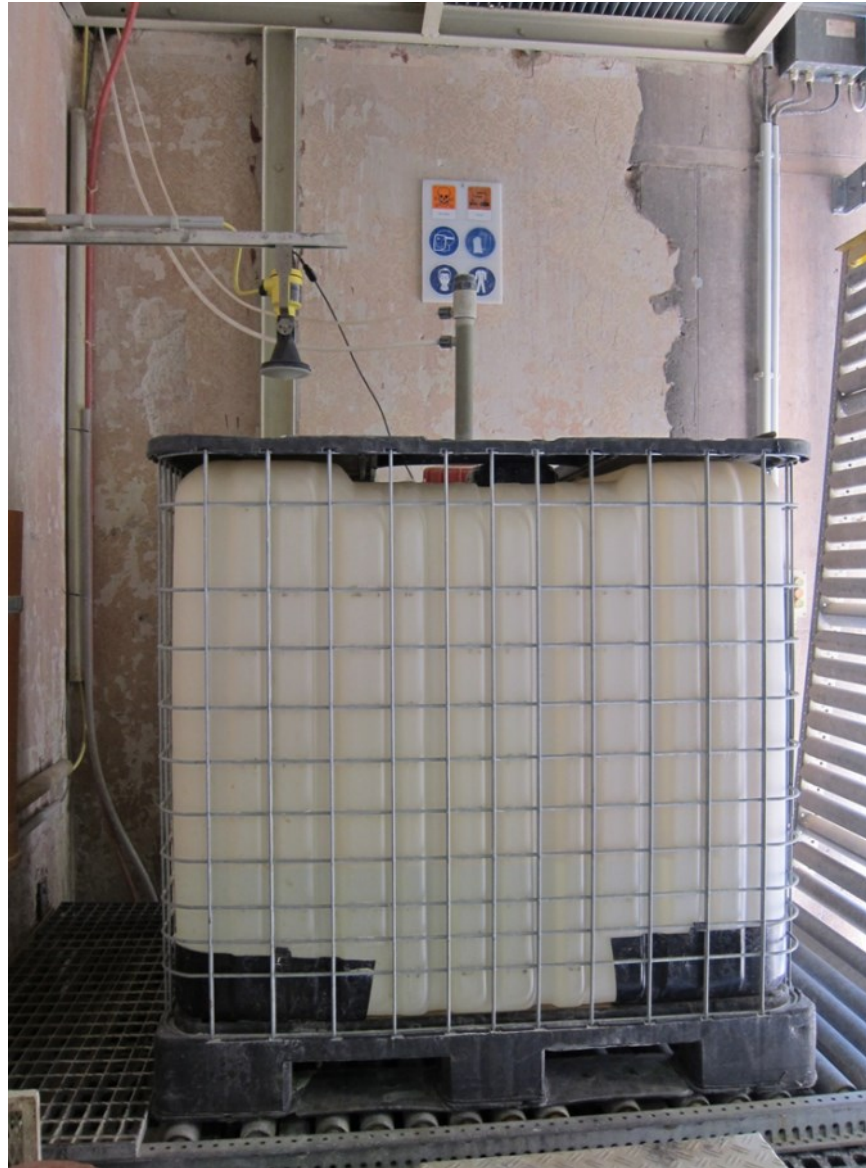
Chemical Storage Tanks



- Non-intrusive measurement for plastic tanks
- Radar signal cuts through condensation and foam within tank



Chemical Storage Tanks



Other Key Applications

- **EQ Tanks**
- Sludge Tanks
- Clarifier Scum Pits
- Splitter Box Weirs



Any Questions?

