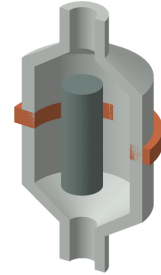


FLOW AND TRANSPORT

Sampling chamber

Reduce the old sample left behind when the incoming liquid changes.



CONCEPT ILLUSTRATION

Transport brief; probe geometry to define

THE PROBLEM

An inline sensor sits in a small chamber. When the incoming liquid changes, regions with little flow can retain the previous sample and delay the measured response. This study examines the chamber around a defined probe envelope.

SCOPE

- Design a fully flooded, rotationally symmetric chamber with a fixed probe envelope.
- Solve slow internal flow and track a tracer representing the previous sample.
- Compare chamber volume, pressure drop, and time to 99% tracer replacement.

PLANNED DELIVERABLES

- Chamber CAD and section drawings
- Tracer animations, response curves, and pressure-drop comparisons
- Reproducible model and a physical flushing-test plan

CONSTRAINTS**Arrangement**

Fully flooded, axisymmetric chamber

Probe

Fixed sensor envelope

Comparison metric

Time and liquid volume to replace 99% of the simulated old sample

Model scope

Flow and tracer transport with specified fluid properties

VERIFICATION PLAN**Transport balance**

Account for tracer entering, leaving, and remaining in the chamber.

Spatial and time refinement

Check that the response curve is stable as the mesh and time step are refined.

Physical comparison

Define a flushing experiment that measures the same sample-replacement response as the model.

NEXT STEP

Fix the probe geometry, fluid properties, flow range, and tracer behavior.

The study will evaluate fluid replacement. Sensor chemistry, adsorption, and bubbles are outside this defined model.