
# Kuwait 4th Flow Measurement Technology Conference

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الراعـي الرسمـي

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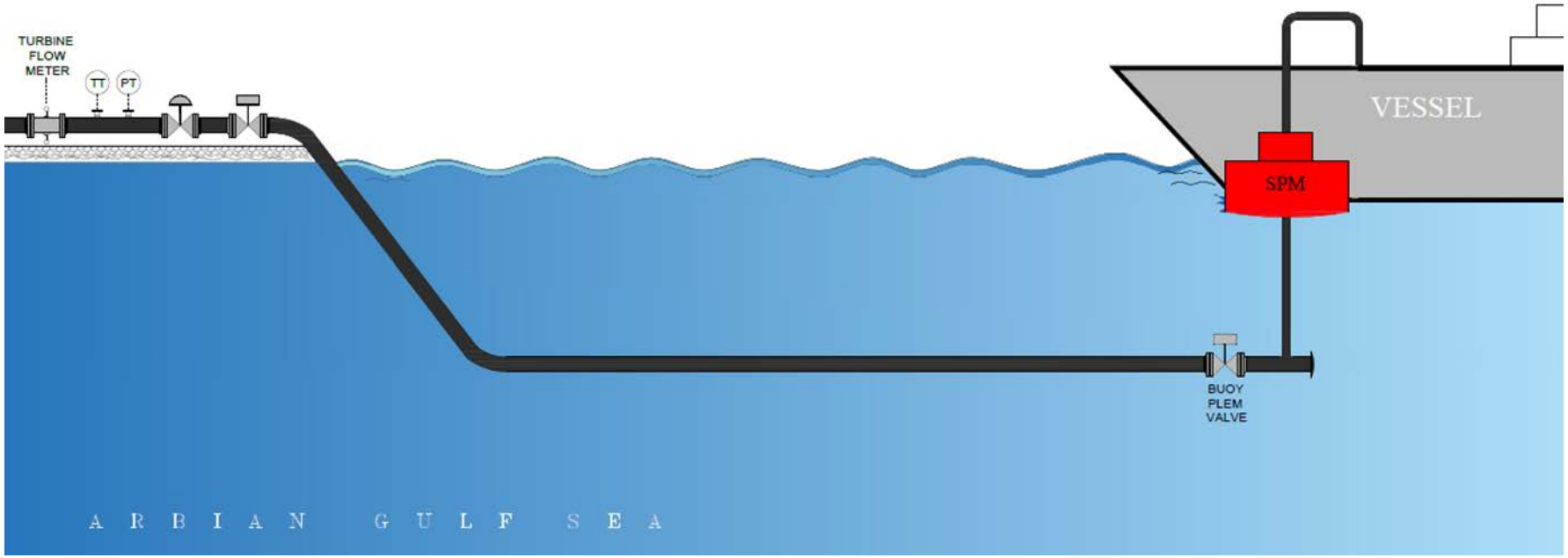
## SHRINKED QUANTITY MEASUREMENT DURING SHIP LOADING

# Outline

1. The Liquid Shrinkage Phenomena
2. The Issue
3. Existing Metering Skid Layout
4. Existing Loading Process
5. Metering Skid Upgrade Implemented
6. Upgraded Loading Process
7. Benefit
8. Profit

# Liquid Shrinkage Phenomena

In between two consecutives vessels loadings, the submarine pipeline is subject to colder seawater, which will cool down the pipe (steel) which indeed cools down the content as well creating **a shrinkage effect.**



# What is the issue?

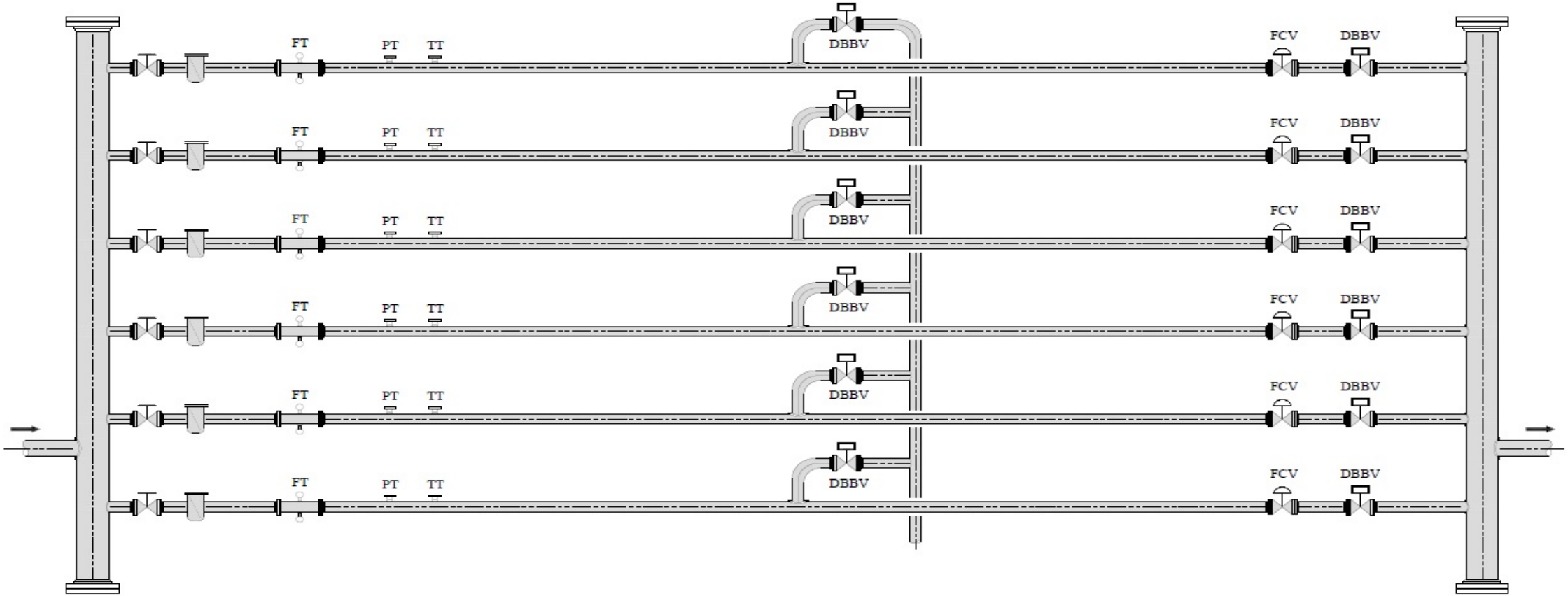
- At the start of the batch, the shrinkage volume is being compensated by filling the empty space in the submarine pipeline. Measurements at shore with line fill has resulted in observed fill volumes between 200 – 800 BBLs, depending on the time elapsed (days) between two consecutive loadings, the temperature of the crude oil and the season (temperature of the seawater).

- Existing Metering Skid does not have a dedicated line fill meter, and this is done with the existing duty 16” turbine flow meter, which has a range of 2,700 to 27,000 BBL/hr.

- Auto Mode will Open Three meters at the same time and without any flow control limit.

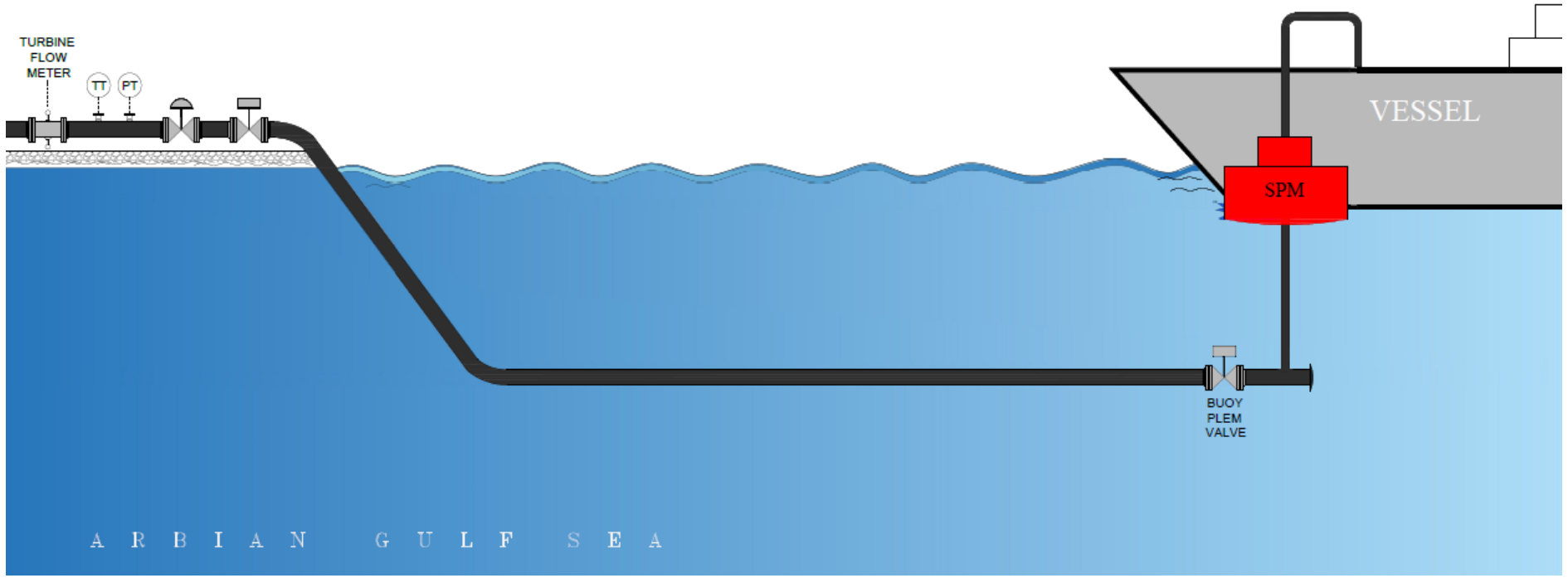
- Difficulty using manual mode to fill the line due to valve operating challenge (Flow Proportional)

# Existing Metering Skid Layout



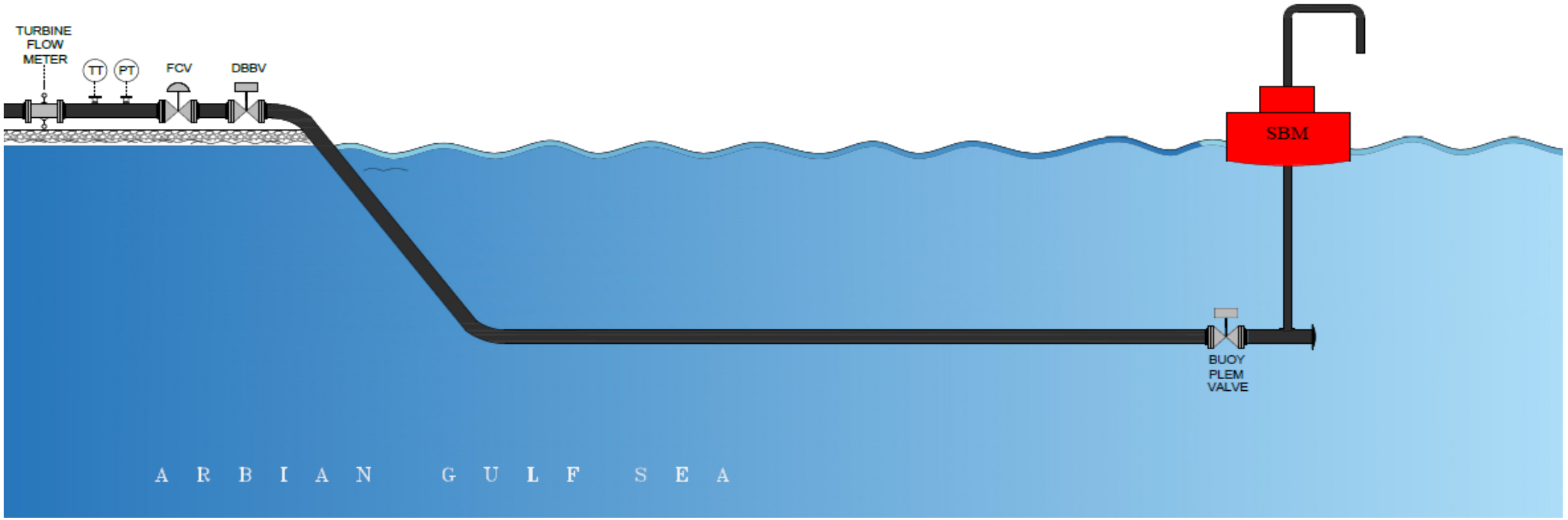
# Existing Loading process

Situation of loading facilities after completing loading
"Vessel 1"



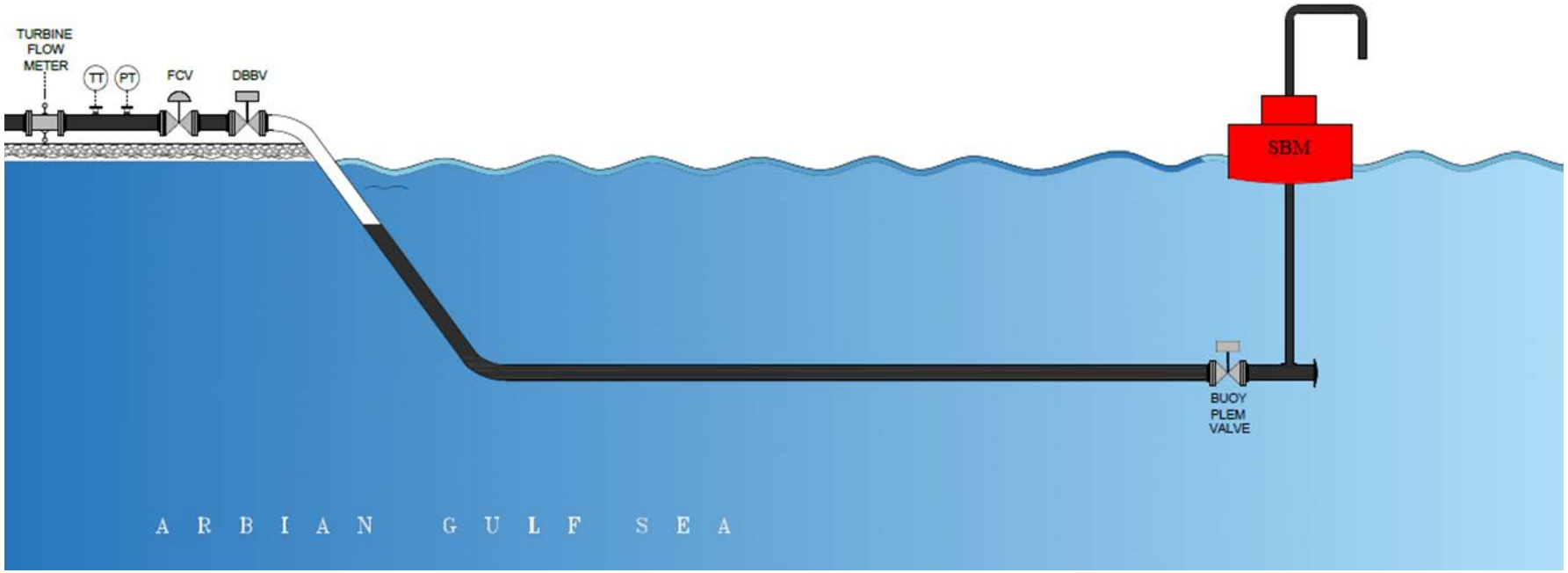
# Existing Loading process

Loading Facilities Stand-by waiting for next vessel to be loaded



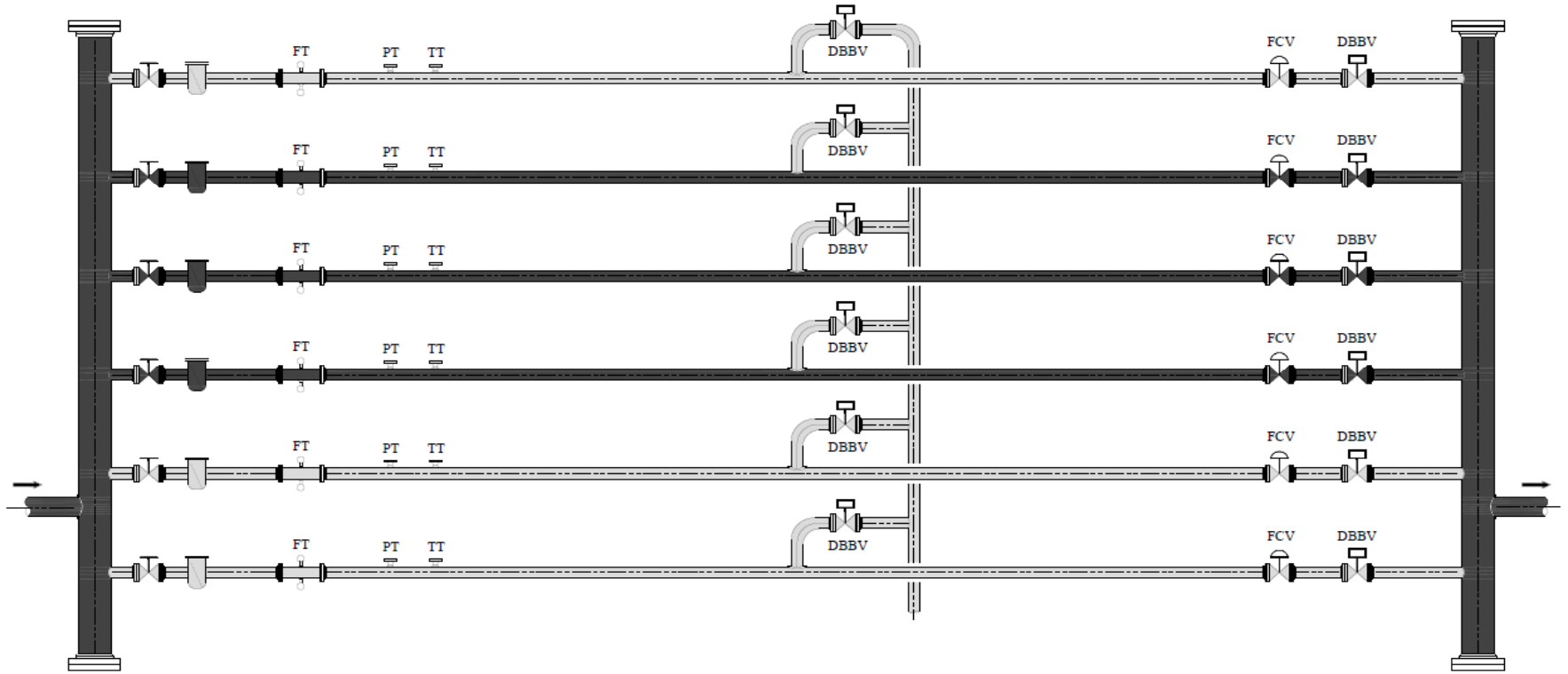
# Existing Loading process

Shrinkage (empty space) created in the loading pipeline



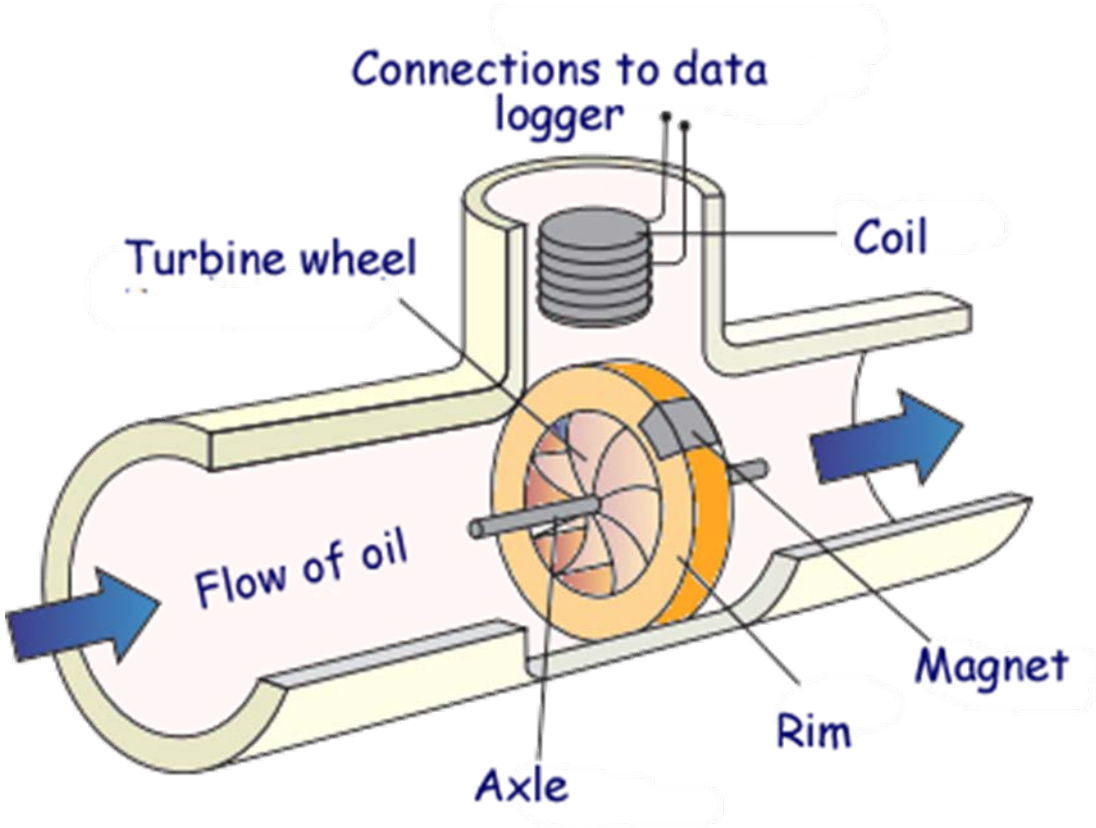
# Existing Loading process

## Selection of streams at the beginning of loading



# Turbine Meter

Slippage effect thru turbine meter during Line Fill process



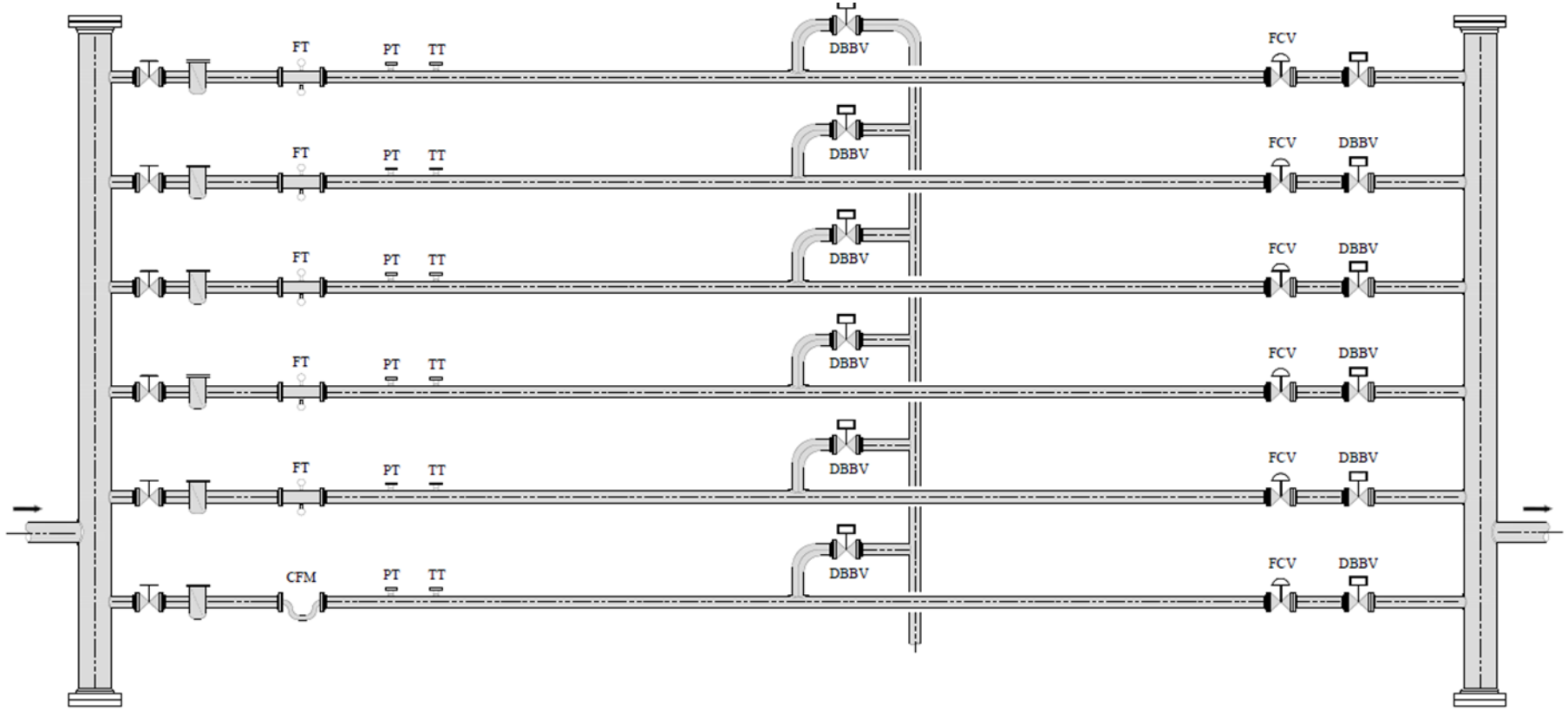
# Metering Skid Upgrade Implemented

- Replacing one 16” turbine meter in one of the available stream by a 4”Coriolis meter which has the ability to read low flow rates starting from 50 bbls/hr instead of 5,500 bbls/hr for the turbine.

- The Skid will contain five Turbine Meters and one Coriolis for line fill after modification.

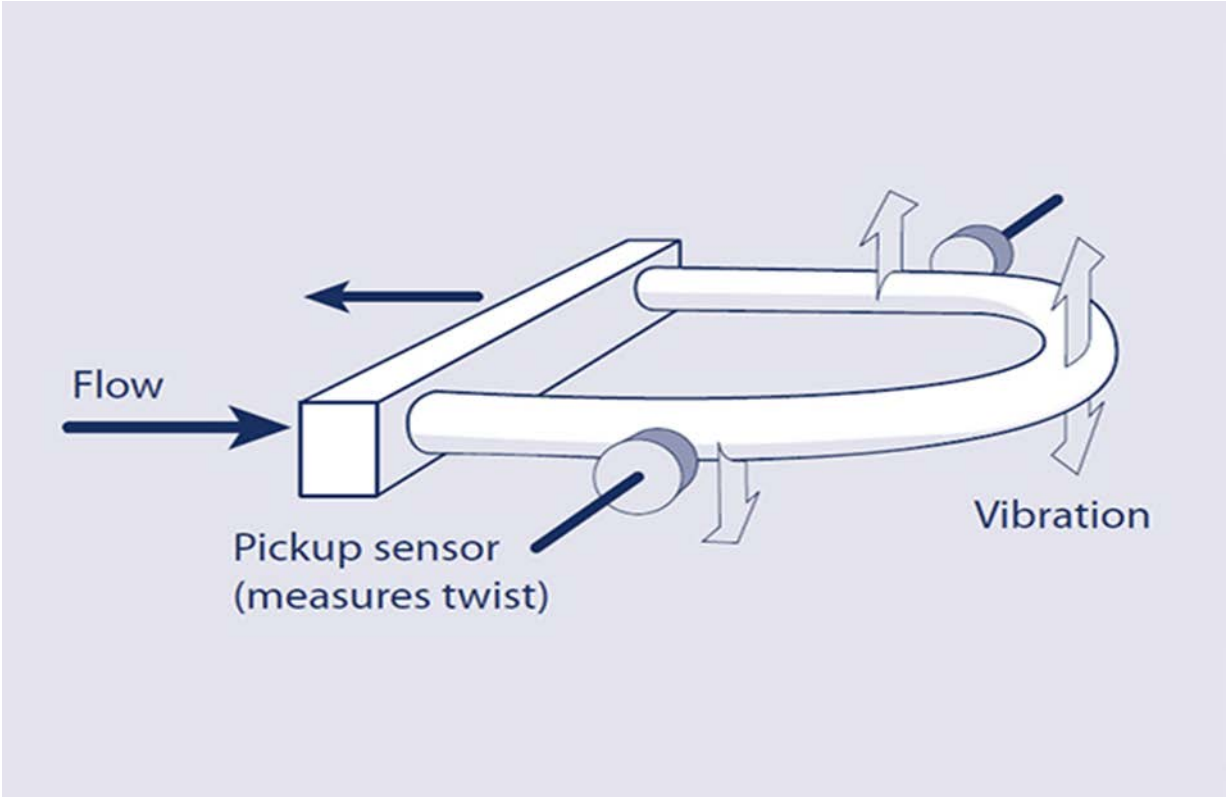
# Metering Skid Upgrade Implemented

## Upgraded layout



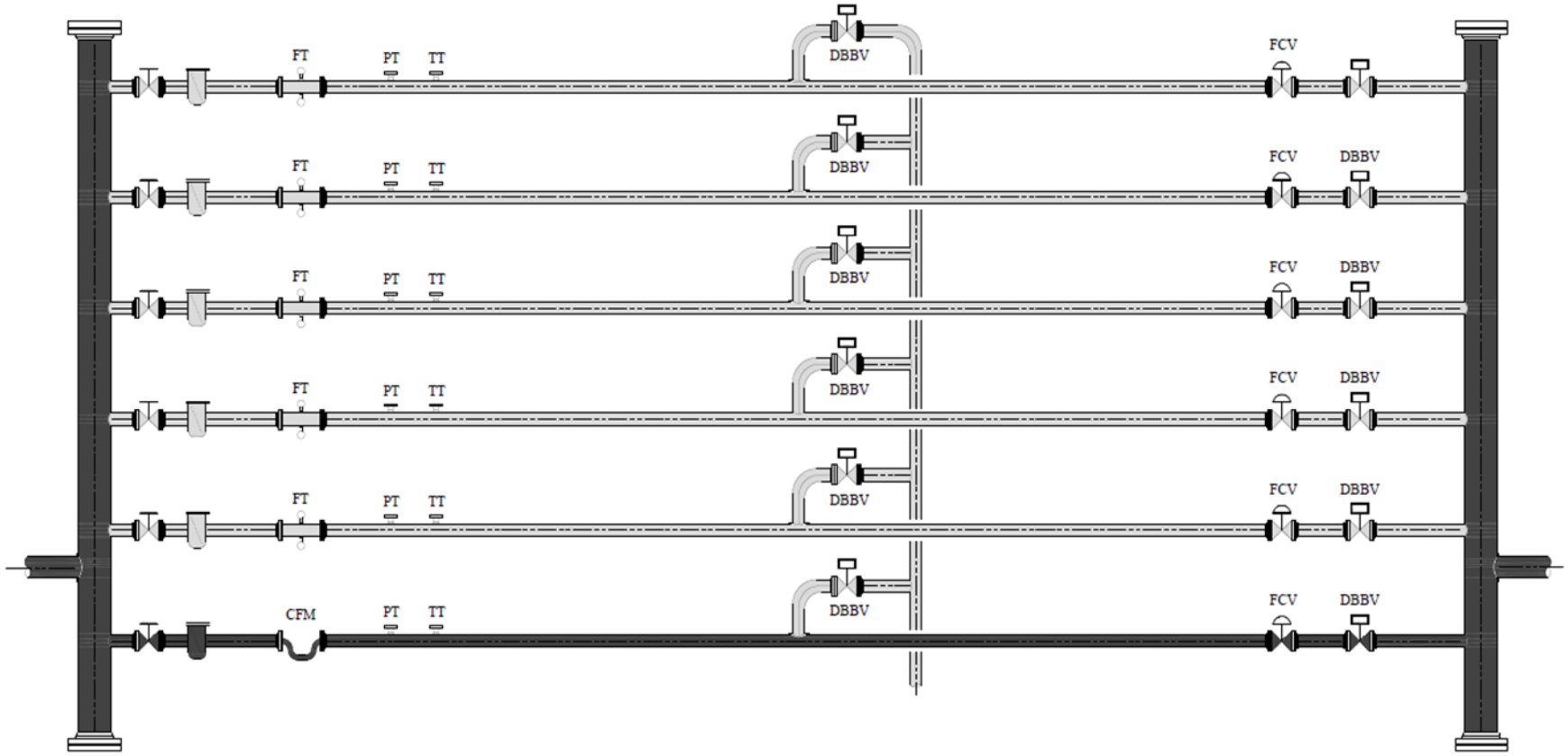
# Coriolis Flow Meter

Determination of mass-flow based on the vibration of an oscillating tube



# Upgraded Loading Process

Commencement of Line Fill Process Using Coriolis Meter



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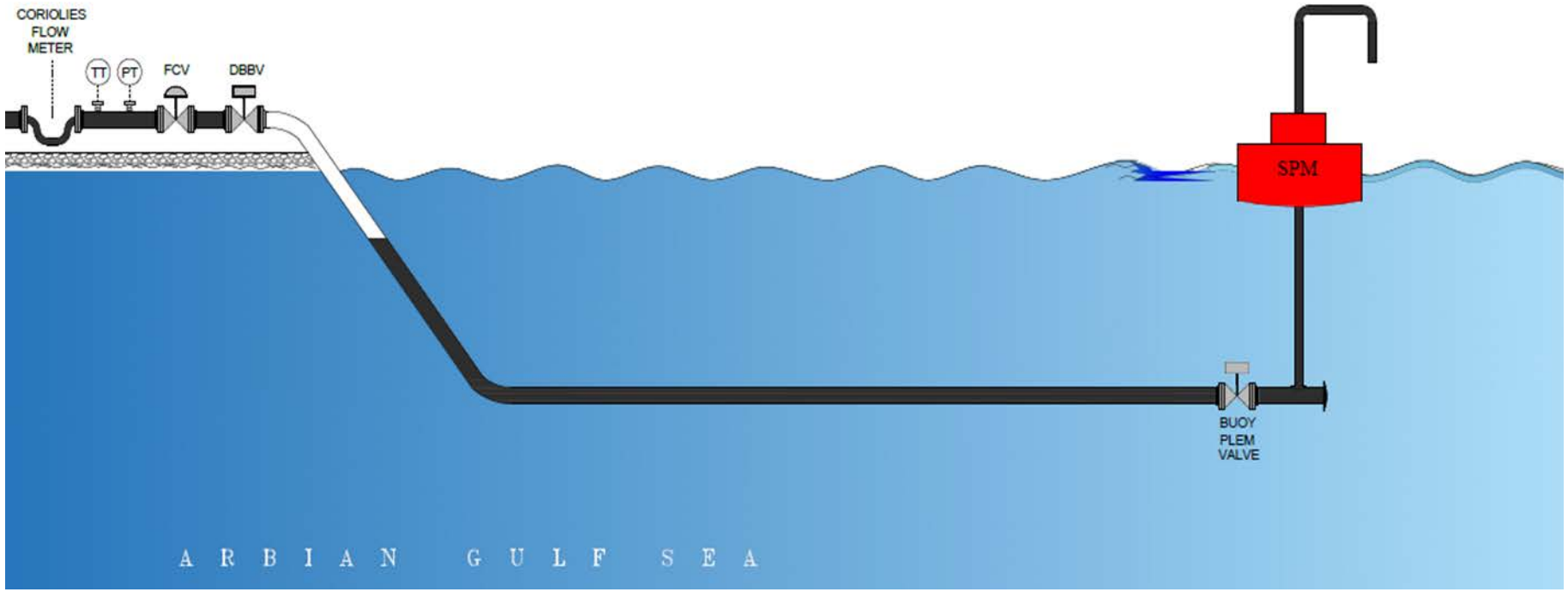

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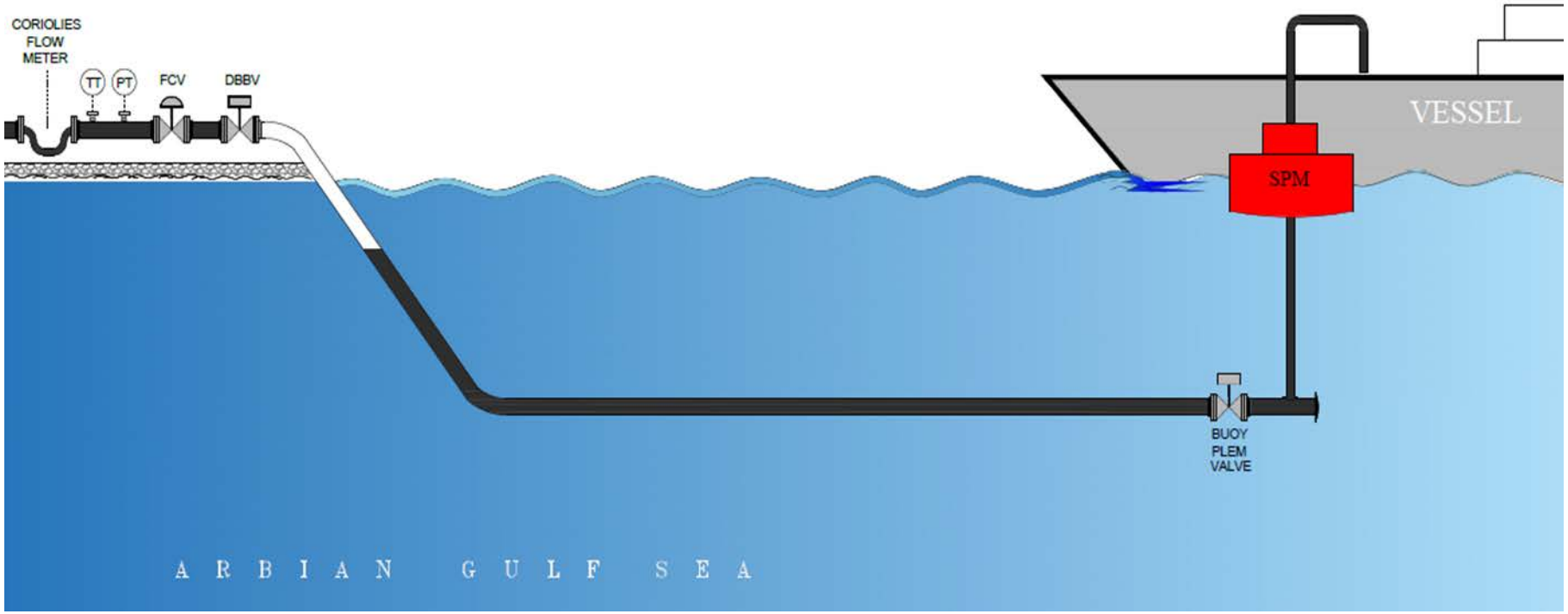
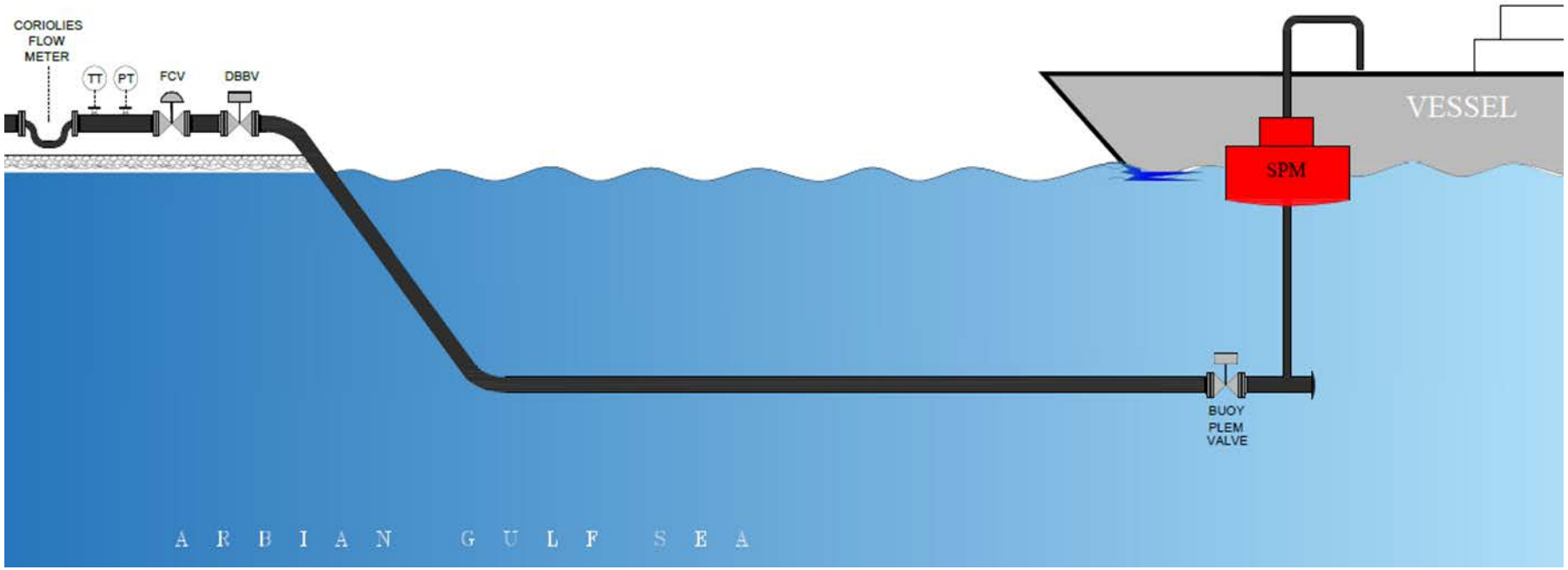


# Upgraded Loading Process

Line Fill completed and measured with Coriolis Meter



# DCS Layout during vessel loading

# Benefit

Filling the Submarine line for any shrinkage using a separate smaller diameter and different type of flow meter prior to opening the SPM (Single Point Mooring) and PLEM (Pipeline End Manifold) valves will lead to measure and account the crude used to compensate the shrinkage quantity accurately and gain an additional profit.

# Profit Calculation

**Commissioning Date = 29th November 2018**

**Loading Dispatch = x37 Vessels**

**Ave. KEC Price per Bbl. = 60 $**

**Total Barrels Dispatched using Coriolis meter = 39,802 Bbls**

## Total Additional Profit in Dollar = 2,388,120 $

**Installation included all equipment, material & fabrication = 150,000 $**

# THANK YOU