

SONAR flow meter for Cavern Storage services

Underground natural gas storage

Summary

Expro's non-intrusive SONAR meters are widely used in the natural gas storage brine circuit. The PassiveSONAR™ flow meter capability of measuring volumetric flow rate and gas volume fraction is ideally suited for the operational and regulatory requirements of the brine transfer application.



Background

Natural gas liquids (NGL) including ethane, propane, butane, isobutene and pentane are important and widely used fuels and feedstock for petrochemical plants. NGL are most commonly held in inventory underground under pressure in three types of facilities: depleted oil and/or gas reservoirs; aquifers; and salt cavern formations.¹ In salt cavern storage, NGL is transported into and out of the storage cavern by injecting or withdrawing brine. The brine is stored in ponds to ensure availability of brine for product transfer.

Industry challenge

When brine is moved into and out of the cavern, safety devices are required to detect hydrocarbon leaking into the brine. Hydrocarbons leaking into the brine circuit pose an environmental threat and an explosion or ignition hazard. In some cases, government

¹ <http://www.eia.gov>

Key deliverables

- Gas detection
- Real time volumetric flow measurement
- Non-intrusive design
- No process shut down
- No modification of the surface lines
- Available in virtually all standard pipe sizes
- Accurate

Technology Used

- PassiveSONAR™ flow and GVF meter

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regulations drive the type and the number of hydrocarbon breach detection devices needed on each cavern. For example, the Texas Railroad Commission Rule 95 states that each NGL storage cavern must have two forms of detection. In addition, measurement of the volumetric flow into and out of the cavern is an important process control measurement. Due to the corrosive nature of brine, inline meters require frequent and costly replacement and create potential leak paths. Traditional flow metering accuracy is also challenged by the presence of gas in the brine. Additionally, when solution mining to create the storage dome, it is important to measure the flow rate of liquids and salt, and this too is a challenging measurement for traditional flow meters.

Expro's solution

Expro's PassiveSONAR™ flow meter has the unique ability to measure both the volumetric flow rate of liquids and the gas void fraction (GVF) of well-mixed bubbly liquid flows. To measure the flow rate, the PassiveSONAR™ flow meter employs an array of passive strain-based sensors to track the velocity of turbulent eddies in the fluid flow. To measure GVF, the PassiveSONAR™ flow meter detects sound waves in the fluid as they pass through the sensor array. The Speed of Sound (SoS) of the mixture is then computed and the GVF is derived from the SoS.

This ability to measure both flow rate and GVF non-intrusively make PassiveSONAR™ meter the ideal instrument for the brine circuit application. PassiveSONAR™ flow meters are widely used by cavern operators to monitor hydrocarbon leaking into the brine circuit. When NGLs are present in the brine circuit, the liquids instantly flash to gas if present in the brine. The PassiveSONAR™ flow meter will measure the GVF. This GVF measurement is then sent via the meter's digital or analog outputs to the client's safety system, which is programmed to alert when elevated levels of gas are detected in the brine.

The clamp-on design of the PassiveSONAR™ flow meter allows for installation on existing pipework without modifications. There are no parts that are in contact with the flow, which contributes to a long, maintenance free equipment life.

Expro Meters have over 20 meters installed globally for metering and gas detection of salt brine flow.

