# FROM TANKS TO TANKERS

**Harry Smith, Atmos International, UK,** discusses how to improve storage operations with pipeline technology.

Whether they are for short or long-term storage, tanks and tankers are integral to the downstream phase of a gas or liquid's transportation.

While tank farms and terminals temporarily store commodities ranging from water, oil, and petrochemical products before they are transported to customers or another tank farm, tankers are mobile and combine the storage and bulk transportation of commodities.[1] Both tanks and tankers are crucial in the fulfilment of most of the world's energy needs, with pipelines also playing a pivotal role.

From the complex networks connecting tanks at tank farms to a tanker's product transfer, pipelines facilitate downstream storage operations.[2] While it is the safest mode of transportation, there are many pipeline challenges that can threaten tank and tanker operations.

## Challenges in store

### Corrosion

Corrosion is inevitable on any pipeline and is caused by external factors like the air, soil, and water. Corrosion is the leading cause of pipeline incidents.[3] In the context of tank farm pipelines, corrosion could be accelerated by the repeated transportation of hydrocarbons and chemicals in and out of storage tanks. For tanker loading and unloading pipelines, corrosion could manifest in the form of seawater properties depending on its salinity, pH and oxygen levels.[4]

### Short pipelines

Short pipelines are commonly used in tank and tanker storage operations. While not impossible, it is typically harder to install instrumentation on short pipelines due to the lack of opportunities and space for metering.

### Anchor strikes

Even with its anchor dropped, a ship tanker can still move back and forth and its anchor can snag a connecting pipeline, causing product to leak into the surrounding area.[5]

### Passing ships can block data communications

Communication can be a challenge on a monobuoy if line-of-sight communication is used. Once connected to the buoy, a ship can break this sight as it rotates in the water. This is another factor contributing to the difficulty of installing instrumentation and communication on the offshore part of the pipeline.

### Multiple ended leak detection system offshore presents many challenges

Offshore pipelines have monobuoy used to connect the ship to the pipelines for the loading and unloading of fuel. It can be a challenge to install instrumentation on this type of buoy due to spacing issues, power requirements, and communication needs. This can make installing a standard leak detection system (LDS) difficult as it is not always possible to have instrumentation at each end of the pipeline.

Atmos has developed a method of providing leak detection utilising instrumentation at only one end of the pipeline.

### Environmental impact

Tanks and tankers can contain commodities ranging from chemicals to oil and gas, all of which can have catastrophic environmental impacts in the event of a pipeline leak and long-term effects on climate change.

For a pipeline loading and unloading a tanker, a leak in any capacity can impact the marine environment and there have been incidents across the world where biodiversity in protected aquatic areas has been affected by tanker leaks and spills.[6,7]

For tank farms where fuel storage can involve gases, pipeline leaks can be difficult to identify unless the gas has a colour, odour or if there is an effective leak detection solution in place.[8] Gas leaks that remain unnoticed can cause greenhouse gas emissions as well as being a fire hazard, posing a risk to health and impacting surrounding air quality.[9]

### Fines

In addition to environmental damage and the offending tank or tanker company's reputation, financial damage can follow a leak event to account for harm caused to the surrounding area and clean up costs.

## Summary of challenges

These factors are not an exhaustive list of challenges associated with tank and tanker pipelines. Pipeline systems can be complex, every pipeline behaves differently and no single technology is the best, but the following two

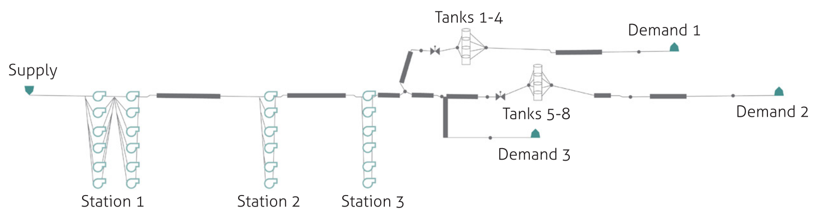


**Figure 1.** The pipeline used for the pump and tank optimiser.

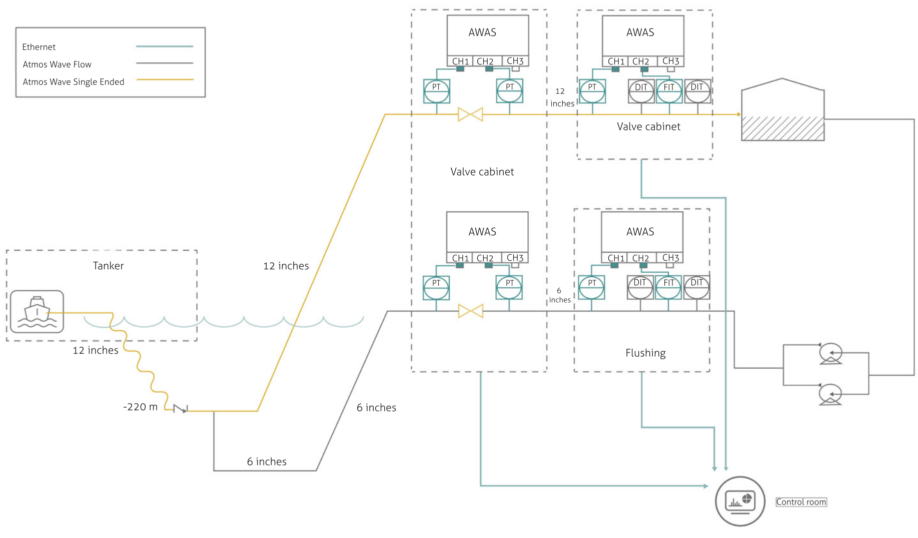


**Figure 2.** Atmos Wave's single ended solution on the diesel pipeline transporting fuel from tanker ships offshore to tanks onshore and Atmos Wave Flow on the flushing pipeline.

**Figure 3.** Atmos Eclipse installed at a tank farm with wind and solar power.

case studies outline solutions to some particular tank and tanker storage operations.

## Case study 1 – dynamic pump and tank optimiser for water networks

With demand for fresh water increasing every year, desalination increasingly grows in popularity as a means of producing more water. This requires the transportation of water from desalination plants to the areas where water is needed, and it depends on the use of large water tanks and pipeline networks.

While desalination operations follow a routine cycle, an optimiser presents opportunities for planning maintenance, dealing with equipment failure or supply interruptions and in planning extensions to the pipeline network. This was the case with a long-range water transmission network where inventory control is done in the tank farms.

Solving pipeline capacity, flow rates, and tank levels can achieve an optimal solution for pumping schedules, which can then be validated by running a transient simulator using the resulting pressure and flow setpoints, and pump line-ups. It can be used to answer design questions related to:

- If a pipeline can meet its delivery schedule without depleting the tanks.
- Whether a delivery schedule can be met if the pipe's minimum allowable operating pressure needs to be reduced.
- If the pipeline operation can be run on tank pressure for the day in the event of failure in multiple pumps.

For complex tank operations, using simulation software is vital to overcoming obstacles such as potential supply interruptions, pipeline sections being out of service for maintenance and other operational problems.[10]

## Case study 2 – leak detection for offshore-onshore tanker unloading pipeline

For a subsea to onshore diesel pipeline in Latin America, the customer required a leak detection solution that both improved operations and complied with their regional regulations.

A 1 km pipeline unloads fuel from tankers offshore to tanks onshore and involves three distinct operations: unloading of fuel from the ships, flushing, and static.

Using wave flow technology, the customer's flushing and static operations were improved, but the customer had an additional goal of performing leak detection each time a ship is being unloaded by including one-sided instrumentation. Atmos Wave was selected because it can provide a single ended leak detection solution while being easy to retrofit to the pipeline.

## Summary of solutions

When it comes to tanks and tanker leak detection, single ended leak detection is the solution because it is an easier installation and can utilise existing instrumentation while providing increased data acquisition and resolution.

Short pipelines are typically used in a tank or tanker operation (much like in case study 2) which can sometimes make it harder to install the appropriate instrumentation. Non-intrusive hardware is available in some ATEX packages and can be designed for rapid deployment. The company has already installed Atmos Eclipse units on tank farms across the globe, some using vertical fixings and within tight spaces.

For tank and tanker networks that have an opportunity to improve operations, Atmos' Simulation Suite can help operators respond quickly to ongoing changes in supply and demand, forecast future pipeline operations and more, as seen in case study 1. T&T

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