



Pall Corporation

PIPELINE CONTAMINATION CONTROL

for the Oil & Gas Industry

Filtration. Separation. Solution.SM

Introduction



Pipelines used for transport of natural gas, LPG and hydrocarbon condensates will often contain liquid and solid contaminants that can create a number of maintenance and process issues. Black Powder is a generic term for corrosion products that are made up of iron sulfide and/or iron oxides and is a major concern in both dry and wet pipeline systems. Liquid contaminants in gas streams can include water, glycols, hydrocarbon condensates as well as compressor oils. For liquid hydrocarbon streams, water is the main liquid contaminant.

Pipelines are typically classified by the function that they perform:

1. **Gathering pipelines** - group of smaller diameter, interconnected pipelines that ‘gather’ into a complex network. Gathering pipelines are normally used to bring gas from many well heads in a gas field to a nearby gas processing plant.
2. **Transportation pipelines** - long pipes with large diameters used to ‘transport’ products such as oil, gas, and other liquids. Transportation pipelines can be used for shorter distances or for long distances across countries from gas processing plants to industrial users or cities.
3. **Distribution pipelines** - many interconnected pipelines with small diameters, much like gathering pipelines, used to ‘distribute’ the product to the final consumer.

Where problems occur



Leaks in pipelines and major accidents can occur, but are extremely rare. However, it is the less publicized problems that go undetected and can cause larger problems for processors and their final end-users from the petrochemical, refining and power generation industries. For example, contamination that is very small in physical size can lead to much bigger problems. Solid and liquid contaminants are commonly found in natural gas, LPG, and condensate pipelines. Contamination is known to block compressors, leave deposits inside pipelines and pipeline components, create corrosion, cause erosion, and negatively impact operations, costing

companies millions of dollars each year in maintenance and reduced productivity.

The good news is that the majority of the common, reoccurring problems that appear as a result of contamination can be identified, fixed, and prevented. Pall will put its three decades of experience in the Oil & Gas industry to work for you. Our experts will properly diagnose the problem and develop a custom filtration solution. The result – customers can save millions of dollars each year by keeping their systems running more efficiently and by reducing the amount of money they spend on costly repairs.

Typical contaminant related problems:

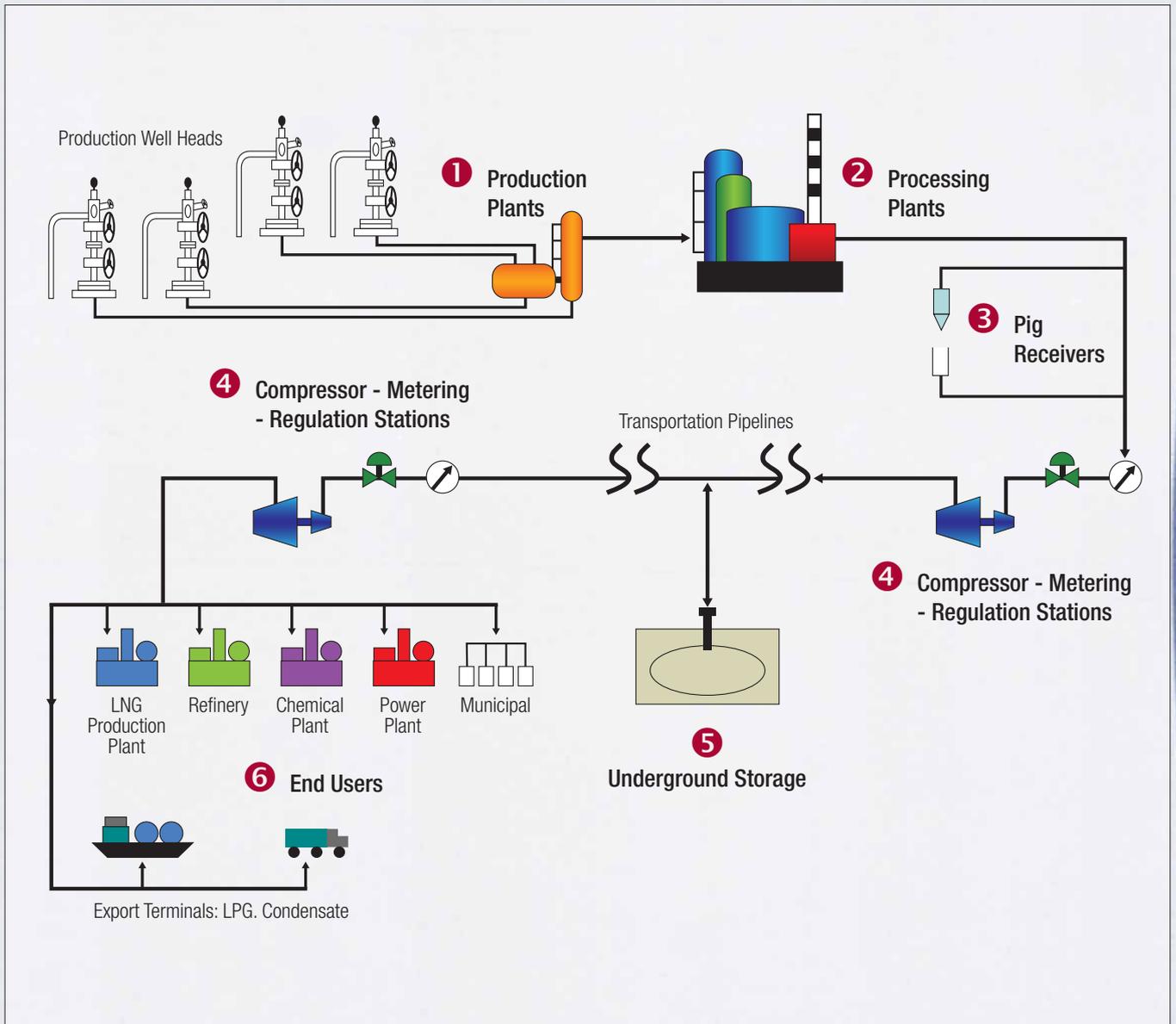


- ✘ Excessive corrosion
- ✘ Erosion of pipeline and its components
- ✘ Risk of pipeline integrity loss
- ✘ Creation of internal deposits restricting pipeline flow
- ✘ Blocking of compressors
- ✘ Blocking of orifice meters
- ✘ Contamination of instrumentation and control valves
- ✘ Blocking of furnace nozzles
- ✘ Plugging of filter systems
- ✘ Ingression in treating units (see Pall's Amine Systems Reliability Program brochure, part # FCAS06)
- ✘ Formation of deposits in storage tanks and spheres
- ✘ Operating problems at end-users
- ✘ Disposal issues with **Black Powder** (see Pall's Technical Report, part# FCBLACKPEN)
- ✘ Repeated pigging of pipeline

Applications

	Contamination Issues	Pall Technology/Solutions
1 Production Plants	Prevent liquid and solid contaminants from causing corrosion and deposits in the pipeline network leading up to the processing stage	Gas particle filters, cyclo-filters, liquid/gas coalescers, liquid/liquid coalescers
2 Processing Plants	Protect gas processing plant from contaminants that can lead to sulfur plant excursions, regenerator upsets, contactor foaming, excessive corrosion, deposits in condensate stabilizer, and deposits in condensate and LPG storage tanks	Gas particle filters, cyclo-filters, liquid/gas coalescers, liquid/liquid coalescers
3 Pig Receivers	Collect solids removed by pigging operation	Gas and liquid particle filters
4 Compressor - Metering – Regulation Stations	Remove solids and liquids that can lead to damage of the compressors, the orifice meters and control valves	Gas particle filters, cyclo-filters, liquid/gas coalescers
5 Underground Storage	On removal of stored gas, salt contaminant can be ingressed into the gas pipeline leading to corrosion and fouling of compressor - metering - regulation stations	Gas particle filters, cyclo-filters, liquid/gas coalescers, liquid/liquid coalescers
6 End Users	Reduce contamination that can lead to process and quality problems in end users including refineries, power plants, chemical plants, LNG production plants, export terminals, and municipal gas distribution systems	Gas particle filters, cyclo-filters, liquid/gas coalescers, liquid/liquid coalescers

Process diagram



Solutions

Pall offers a variety of customizable solutions to reduce pipeline contamination and optimize operations. We'll develop a solution that's right for you. Give us a call to find out more about our capabilities in the Oil & Gas industry.

Particle filters



Small solid aerosols from gas streams, including **Black Powder** (iron oxides, iron sulfides), and other particles (sand, debris), can foul instruments, valves, compressors, heat exchangers, and other critical system components. Pall's gas and liquid particle filters are used to remove these particles, eliminating a primary source of the contamination that causes system failures. Ultipleat® High Flow filters remove solids from liquid streams including LPG and hydrocarbon condensates. For pipelines that are not piggable, filtration is even more critical to maintain pipeline integrity as there is a higher risk of leakage due to corrosion and erosion due to limited information available.

Pall products:
Coreless Profile® filters,
Epoce® filters,
Nexis® High Flow filters,
Ultipleat High Flow filters,
Ultipor® filters,
Claris® filters

Cyclo-filters



A new filter design that combines the advantages of a cyclone and an absolute-rated filter. A two-stage separator consisting of a low velocity cyclonic section to separate the coarsest particles down to 5-10 microns, and an absolute-rated cartridge filter section to remove the finest particles down to the requested specification. The cyclonic section operates at low velocities in order to generate a low pressure drop, typically a few psi. The cyclo-filter is a high-performance and high-capacity separator, which is capable of handling high solid contents including solid slugs during pipeline scraping operations.

Pall products:
Coreless Profile filters,
Pall Cyclonic separators

Liquid/gas coalescers



Performing with maximum removal efficiency and economy, Pall's liquid/gas coalescers reduce equipment downtime and decrease labor and maintenance costs. They have a unique fiber medium matrix that contains increasing pore sizes. This design allows small droplets in the incoming gas to merge (coalesce) into larger drops that are easier to separate. The medium enables single-stage coalescing to separate difficult liquid aerosols. Our liquid/gas coalescers are specially treated with a fluoropolymer coating to improve the drainage of liquids through the coalescer. As a result, smaller assemblies can be used, and up-front capital costs are minimized. The fluoropolymer treatment also lowers operating costs by allowing the coalescer to operate at a lower liquid saturated pressure drop and recover quickly from process upsets.

Pall products:
SeptraSol™ liquid/gas coalescers,
SeptraSol Plus liquid/gas coalescers

Liquid/liquid coalescers



Pall's liquid/liquid coalescers are designed to efficiently separate liquid/liquid emulsions. They are constructed of a variety of polymers and fluoropolymers, offering a wide range of compatibility. These high-efficiency coalescers are effective in systems with low interfacial tension without disarming or being compromised by the presence of surfactants. A patented vertical stack design is used with a coalescer/separator configuration, allowing an even flow distribution. This permits a high flow rate in a smaller assembly. With long service life, the coalescer cartridges require fewer change-outs, thereby reducing maintenance and disposal costs. A horizontal design is also available for use with very low interfacial emulsions.

Pall products:
AquaSep® Plus liquid/liquid coalescers,
PhaseSep® liquid/liquid coalescers

Technical capabilities

With offices in more than 30 countries, Pall is well-positioned to provide assistance to customers on the local level, as well as offer broad-based, worldwide support when needed. At the core of our support network is our Scientific and Laboratory Services (SLS) department, an extensive global network of scientists and engineers who are experts in their field.

Pall is much more than a filter company. We are Total Fluid ManagementSM specialists. We're committed to advancing technologies that make our customers'

operations more successful. Our expertise has enabled us to build a large library of proprietary core materials, which we can modify to separate, remove, or selectively capture the most elusive contaminants.

Our customized system services include:

- ✓ Process audits/consultancy
- ✓ Lab testing
- ✓ Customized product development
- ✓ Training seminars
- ✓ Testing/piloting
- ✓ System maintenance/service contracts

Pall Corporation – a leader in filtration technologies

For more than 60 years, Pall Corporation has been solving complex filtration, separation, purification, and contamination control problems for diverse customers around the world. In the Oil & Gas industry, Pall has developed separation solutions that reduce contamination, increase product yields, and improve product quality.

Worldwide, 88% of Pall's manufacturing facilities have achieved ISO 14001 certification (international standard for environmental management systems) to date. The program has helped Pall minimize environmental impact, improve compliance, and reduce costs. Pall's manufacturing facilities are also ISO 9001 certified and follow a strict world-class manufacturing philosophy with a never-ending focus on continuous improvement.

We invite you to learn more about Pall's wide array of products and services. For more information, contact your local Pall representative or visit us on the web at: www.pall.com.



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