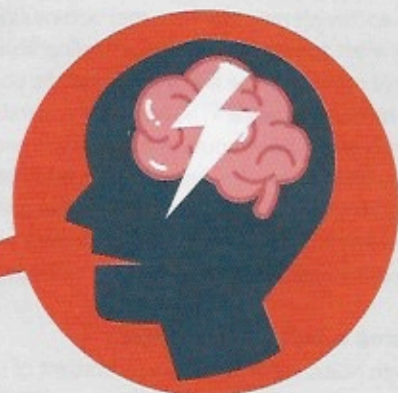


# Handling NGL headaches



**David Wint, Director of Pipeline Integrity, Audubon Field Solutions, USA,** discusses how NGL issues build urgency for automated pigging in shale gas pipelines.

**I**n recent years, producers have reaped the benefits of shale gas extraction. Yet, many still fail to fully capitalise on all that liquid-rich gas streams have to offer.

In some ways, the industry values natural gas liquid (NGL) wealth tremendously. However, many natural gas pipeline operators consider natural gas to simply be a by-product of liquids production. With the price of gas where it currently is, and given the revenue available from NGLs, that view is understandable.

However, despite their efforts, many pipeline operators fail to execute key steps that allow them to maximise NGL recovery from their lines. They often mismanage the inherent risks associated with liquids production from shale formations as well.

NGLs can be particularly problematic in large diameter pipelines that gather gas from feeder lines and carry product to gas plants where liquids are removed. Because of their high volume, flow restrictions in these lines can have a significant impact on both profitability and safety. They also carry an increased threat of spills and emissions to the atmosphere.

As shale gas extraction continues to mature and spread to other regions of the world, this problem will likely become more acute.

## What problems do NGLs cause in gas pipelines?

When improperly managed, NGLs and other liquids can cause a number of costly issues in gas pipelines, including the following:

### Pipeline flow restrictions

Like any liquid, NGLs flow towards the lowest point in a pipeline, typically to low elevations, where they accumulate and cause partial or even complete blockage of the line. This increases the differential pressure in the line and forces the compressor system to work harder – resulting in higher energy operating expenses, increased horsepower outputs of compressors and reduced service life of equipment. Take, for example, a situation on a pipeline with a 400 ft elevation change, where an operator was seeing approximately 170 psi differential pressure from one end to the other (approximately 2 miles), due solely to liquid loading issues.

### Corrosive effects from water

Along with NGLs, water is often a constituent of shale gas. With a higher specific gravity than the NGLs, it tends to gather at the bottom of the lowest quadrant of the line and causes internal corrosion. Corrosive conditions are created when water combines with carbon dioxide and/or hydrogen sulfide – two gases that can



Figure 1. Pigs in an automated insertion system are lined up to be inserted on a schedule or as required. Photo courtesy of WeldFit Energy Group.



Figure 2. Designing pipelines for easy insertion and removal of pigs helps facilitate removal of liquids in the line. Photo courtesy of WeldFit Energy Group.

be naturally produced at the wellhead. Produced water is also the source for corrosive microbes (i.e. sulfate reducing bacteria, acid producing bacteria) that can cause microbiologic induced corrosion if not treated. Gathering pipelines are particularly vulnerable to this condition because the gas they transport is untreated. The Pipeline and Hazardous Material Safety Administration (PHMSA) estimates that 42% of incidents in gathering lines are caused by internal corrosion.

### Unpredictable fluid production

Accurately determining how much liquid is in a gas stream is difficult to do, particularly in hydraulic fracturing operations. Liquid volume is dependent on a number of factors, including the stage of the producing well's life and the specific area of the formation that the gas is produced. This, unpredictability, can make liquid loading difficult due to unexpected pressure differentials, variable throughput and flooding of gas processing equipment downstream. It's especially an issue for operators who follow the increasingly popular trend of dehydrating gas at a central location downstream of the wellhead.

### Recommended responses to issues of NGLs in pipelines

There are measures that operators can take to deal with these issues and effectively mitigate the risks that they present. These include:

#### Liquid dispersion modelling

Differential pressure and internal corrosion attack, coupled with unpredictable fluid formation, can result in an increase in leaks and catastrophic failure in pipelines. While most pipeline operators do account for gases in their dispersion modelling and emergency planning, they often do not account for the dispersion of liquids in the event of an unintentional release. As a result, they may have little or no knowledge about how liquids will flow over land, or if they will enter water bodies and watercourses if a leak is to occur.

Operators should be cognizant of where, along their pipeline routes, liquids might flow in the event of a breach in the line – paying close attention to low elevations, watercourse crossings and high consequence areas, as these are among the most vulnerable points.

It's important to note that the need to account for liquid dispersion modelling is particularly important in cold climates due to the fact that as temperature decreases, more liquids are condensed out of the gas stream.

#### More inspections of upstream pipelines

In some jurisdictions, such as the US, pipeline integrity regulations of pipelines upstream of processing plants are virtually non-existent. These lines are not required to meet certain standards with regards to internal and external corrosion as they would on regulated pipeline systems. It does appear, however, that this regulatory loophole will be closed relatively soon, as new accounts of pipeline explosions and leaks continue to proliferate on these non-regulated pipeline systems.

One problem for the operators, as well as regulators, is that there have been very few (if any) construction records kept for these gathering lines. This means that as regulation of upstream lines develops, operators will have to work quickly to generate

records that demonstrate their operating and maintenance compliance with newly implemented frameworks.

In preparation, pipeline operators should strongly consider gathering information on construction, pipeline integrity, operational and maintenance issues for their gathering lines whenever it is practical. In addition to aiding in compliance, this information provides the added benefit of helping to identify areas where maintenance and repair work is required, so as to better inform the maintenance and budgetary planning processes.

Ultimately, this can help reduce the threat risks for a pipeline rupture or leak to occur, thus minimising the risk of fines and other regulatory sanctions. It can also help to avoid a breach of trust with local residents and political leaders, which has become increasingly important as regulatory authorities pay closer attention to whether or not resource companies are maintaining their 'social license to operate'.

### More frequent pigging to remove NGLs from the line

One of the most effective activities that pipeline operators can perform to resolve the issues posed by NGLs and other liquids in their lines is pigging. In general, the more frequent that pigging occurs, the better. Some operators pig their lines once every hour in order to ensure that all liquids are removed.

Because pigging promotes more effective recovery of high BTU NGLs, its return on investment (ROI) is often substantial. More frequent pigging operations can also reduce the risk associated with leaks, catastrophic failures, and explosions. Other financial benefits are provided through improved flow efficiency in lines, which allows for more gas to be delivered to the processing plant and increased service life of the pipeline system and other equipment.

### Better design of pigs

Traditional liquid recovery pigging operations have been done through spherical pigs that are inflated to the internal diameter of the pipeline, and carried by the flow of the pipeline. These lack efficiency because they only have one point of contact with the pipeline internal pipe wall. Other problems encountered with spherical pigs include the fact that they easily stall at pipe fittings or in low flow operating conditions.

Many operators desire to utilise pigs equipped with discs, cups or brushes to provide improved liquid recovery efficiencies. Cleaning pigs also assist in the removal of debris that reduces the flow efficiency and throughput of the pipeline. Additionally, cleaning of the internal pipe wall is required for corrosion inhibitors to be effective to retard against internal corrosion attack.

### More automated pigging to reduce costs, worker exposure risks

There has been a trend towards automated pigging systems throughout the industry using devices that can stage several pigs, to launch a single pig through means of automation. For instance, with an automated device that stages seven pigs, pigging can be performed on a daily frequency. The devices allow for release of pigs on a regular schedule and typically only have to be serviced once a week.

These devices have several benefits, perhaps the most prominent of which is fewer manpower requirements to insert


and retrieve each pig. As the pigging frequency increases, the economic benefit becomes more significant.

With manual systems, each time a pig is inserted or recovered, pressure in the line must be released to atmospheric pressure to launch or retrieve a pig. In addition to being financially wasteful, this results in a harmful emissions release to the atmosphere.

With automated pigging, pigs can be inserted and/or removed without a need to depressurise the launch and receiver system.

This has benefits for worker safety, as was voiced in a conversation with an operator in Iraq, whose line contained a high amount of sour gas ( $H_2S$ ). He expressed appreciation for automated pigging because it eliminated the need for his crews to use personal protection equipment to protect from  $H_2S$  exposure each time they have to insert or retrieve a pig.

### The bottom line

With a growing share of gas production coming from shale formations, managing liquids will be a key area of competitive advantage. Effectively addressing issues associated with liquids production can help pipeline operators increase profitability, reduce costs and risks, and improve safety. Frequent pigging using automated systems has proved to be a reliable method for achieving this, and as more and more operators look to take advantage of high-value NGLs, the use of these systems will become increasingly prominent. 

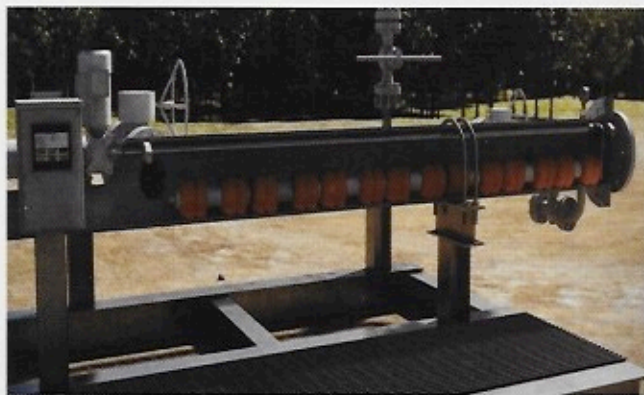


Figure 3. SureLaunch™ automated pigging system (patent pending) manufactured by WeldFit Energy Group. Photo courtesy of WeldFit Energy Group.



Figure 4. Pigging can help manage risks and operational costs that come from liquids blocking pipelines. Photo courtesy of WeldFit Energy Group.