

## HOW WELL DO YOU KNOW YOUR PIPELINE?

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### Outline

The importance of looking after pipeline design, construction and as-laid records is sometimes underestimated by operators. Having access to a comprehensive set of pipeline technical data can be invaluable to those responsible for preparing for pigging campaigns and managing pipeline integrity. Good records allow more reliable and often less conservative judgements over issues such as piggability or the response to reported features. Greater certainty results in reduced costs, less disruption to operations, and improved safety

An insight into, and some examples of, how design, construction and as-built records can help manage the risks associated with pigging and integrity management, how poor records create difficulties and uncertainties, and how ILI can tell you more about pipeline construction.

### Background

Penspen Integrity has been providing pigging support to pipeline operators for many years. With a focus on pipeline integrity the efforts of our pigging team have been centred on providing independent advice to operators to help them decide when to inspect their pipelines, which inspection technologies to choose and then providing technical advice and support during the preparation and execution phases of the actual operations.

A significant part of our work has always involved assessing the piggability of pipelines to ensure that ILI pigging is feasible, and to help in defining the scope of the preparatory pigging (pipeline proving and cleaning). This has generally been done in conjunction with the operator based on his existing records and a nominated ILI contractor based on their particular requirements.

In recent times within Penspen, our efforts have been concentrated on helping pipeline operators to inspect pipelines with little or no pigging history. This paper describes some of the challenges faced and procedures adopted to ensure that safe and successful pigging campaigns are developed and executed.

### Pigging of Onshore Gas Supply Pipelines Serving Power Stations

Together with our colleagues GreyStar UK, who provide O&M Services to the UK's gas and liquids pipeline industry, the Penspen Integrity pigging team have recently been working with a number of electricity generators who operate gas fired power stations with associated high pressure pipelines connecting them to the NTS system.

The majority of these pipelines are aged between 5 and 15 years old, and have not been pigged at all since commissioning. Furthermore, the power station operator's personnel often have little or no experience in carrying out pigging or any of the associated pipeline operations necessary. In general the main aspects of pipeline operations are not considered a core activity by them, with their main pipeline O&M services being contracted out.

Common features for these pipelines usually include:

- Owned by power station operator
- Connected to NTS (with or without PRS)
- Continuous operation
- Often no alternative source of gas supply
- Significant revenue streams dependant on pipeline
- No operational pigging
- No permanent pigging facilities
- Limited operator knowledge (not core business O&M contracted out)
- Doubts about the dependability of pipeline as-built records?

Despite having many common features however these pipelines are all different and have their own unique set of challenges and issues.

Currently industry practice (IGEM/TD/1-5) advocates that the frequency of internal inspection of high pressure transmission pipelines can be set using a risk-based approach where appropriate data and records are available and where not, the maximum interval between internal condition monitoring should not exceed 10 years. Against this background, many reluctant pipeline operators are now contemplating their first inspection operations.

### **The 'Piggability Study'**

The traditional approach within Penspen Integrity in providing pigging support has been to act as a consultant to the pipeline operator, carry out pigging feasibility studies and providing subsequent support in executing an ILI operation. Increasingly however through our closer O&M ties with many of these customers, Penspen are being asked to deliver turnkey solutions covering all aspects of the pigging operations, including providing temporary pig traps and taking on the necessary operations of the pipeline to load, launch, run, receive and recover all preparatory and ILI pigs.

This has brought into sharp focus the importance of the initial feasibility assessment and the important role it plays in identifying all the project requirements, highlighting the key challenges and developing workable solutions. In the majority of cases for power station operators, the continued operation of their generating equipment is entirely dependant on supply through a single pipeline. While there may be some limited flexibility in operating conditions, any interruptions in gas delivery and the resultant loss in generation can be measured in excess of £1.0M per day in revenue terms. Furthermore, when temporary pig trap facilities, a dedicated team of operators and specialist subcontract services (e.g. ILI pigging) are all being provided for the execution of the site works, it is critical that the planned pigging operations are well thought out and that all the appropriate tools and equipment are on hand so that the all works can be completed in an efficient and controlled manner.

To ensure that a robust assessment is made and the pigging operations are properly planned it is essential that all available pipeline data is gathered and then properly assessed. In many cases, a good deal of the pipeline data that is required can often be found quite easily and/or verified through site survey and in principal the proposed operations might appear straight forward. However for the buried part of the pipeline system it can often be surprisingly difficult to verify that the available data and as-laid pipeline records are a true reflection of reality.

In recognition of this challenge, Penspen's approach is to carry out a comprehensive 'Piggability Study' from the outset, through conducting a thorough analysis of all available pipeline data to ensure that we (or others taking on the responsibility of pigging operations) get to know the pipeline intimately. In order to ensure all aspects of the pipeline and proposed pigging operations are properly considered, our approach is to carry out an initial site visit to gather pipeline data and conduct a site survey of the launch and receive facilities. This is subsequently followed by a second visit to fill in any unknowns following an initial assessment and to verify preliminary findings where appropriate. Experience has taught us that it is important to challenge the pipeline operator in order to get as much reliable data as possible to eliminate doubts and clarify uncertainties where feasible.

The principle sources of pipeline information and as-built data that might generally be expected to be available includes:

As-built data:

- Route maps/drawings
- Site / AGI plans
- P&IDs
- Isometric Drawings (usually of AGI plant)
- Pipebook / weld records or charts
- Construction POs and procurement documentation

Other useful document sources include:

- Commissioning records (including pigging reports)
- Construction reports
- Third party incidents
- Repair and maintenance records

#### Operational data

- Current operating conditions
- Historical operating conditions
- Suspected or known issues (e.g. evidence of dusts / sludge in filters)

Any available as-built data needs to be carefully considered. Operators often retain huge volumes of records including numerous revisions of the same documentation. It is important to pay attention to each documents revision history to identify the latest as-laid version.

Additional information contained in construction reports can often help dispel worries regarding unusual pipeline geometry, especially at tie-in locations. Photographs from the time of construction in particular can prove to be an invaluable source of reference.

Commissioning data often includes records of pigging that may have been carried out to clean, de-water and dry the pipeline after hydro-test. This information can be invaluable in deciding what preparatory pigging may be required and in particular what level of initial pipeline proving may be considered necessary.

Operational data is usually relatively easy to obtain, with most operators recording the throughput routinely and on a frequent basis. Historical operating data and any records regarding the frequency of replacement of the plant inlet filters together with reports the condition of filter elements can help form judgements of the likelihood of, and potential quantities of debris or contaminants in the pipeline.

Suspected or known issues with a pipeline can however give rise to concern. Typical concerns expressed by operational personnel for power station pipelines centre on the potential for significant quantities of dust (including pyrophoric dust), construction debris and on occasions a possible build up of liquids. Anecdotal reports of potential or suspected problems are often difficult to ignore, can be hard to disprove and can lead to over conservatism in the approach to pigging.

The principal outputs of the piggability study are to:

- Confirm pigging feasibility
- Identify any areas of uncertainty for further investigation
- Identify any necessary pipeline adaptations and modifications
- Provide key technical data for pig selection and specification
- Recommend, appropriate preparatory pigging operations and related tasks
- Identify the key requirements for ILI pigging (and the ILI service requirements specification)
- Identify any supplementary services e.g. pig tracking)
- Provide key data for the development of reliable operational procedures
- Provide a basis for risk assessment and to develop mitigation measures and emergency response plans
- Provide relevant data to ILI pig vendors to facilitate data analysis

This more considered and thorough review approach in order to get to know a pipeline intimately ahead of embarking on a pigging campaign has been proven to yield many direct and indirect advantages. Examples of this can include:

- Confirming the adequacy of all launch and receive facilities – pig trap requirements, access issues, serviceability of valves
- Confirming the arrangement and serviceability of the AGI pipework – for preparation of comprehensive pigging procures
- Quantify the full range of pipe thickness and bores – for optimum sizing of pigs and sealing elements

- Identifying the location and configuration of all major infrastructure crossings locations – for risk management and emergency response planning
- Identification of significant geometrical features including known minimum bend radius – for correct pig selection, pig configuration and sequencing of pig runs
- Identification of potential debris sources and contaminants – for correct pig selection, evaluating risk to downstream plant and for preparedness at the receive end

### **In Summary**

When considered holistically, a comprehensive piggability study can be seen to provide significant benefits to both the operator and those taking on the responsibility for delivering pigging services.

Taking the time and effort to get to know your pipeline intimately makes it possible to significantly increase the effectiveness of a proposed pigging campaign while at the same time reducing both overall risk and eliminating any unnecessary conservatism.

The 'Piggability Study' therefore now forms a key part of Penspen's approach to delivering pigging services in this and other market sectors.