Pigging the unpiggable

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The attendees at the first annual Unpiggable Forum in 2011 were exposed to a number of commercially available solutions. That initial two-day workshop determined that the needs were for: tools that work in smaller diameters less than 6 inches, more choice of tractor- or robotic-based equipment, and more successful examples.

The second bi–annual Unpiggable Pipeline Solutions Forum, to be held from 15–16 May 2013, will present additional solutions to solving difficult operator problems. Some of the prototypes discussed in the earlier meeting have reached the commercial stage.

Perceptions of unpiggable

There are several perceptions that label pipelines as unpiggable. The simplest just considers any barrier:

- A free–swimming tool can’t be introduced or removed;
- There is insufficient flow to drive a pig;
- There is too much friction making high velocity excursions and the accompanying loss of data normal;
- The tool can’t navigate past internal obstacles or barriers, or
- The customers can’t tolerate any reduced product flow.

Perceptions of unpiggable

A better use recognises that most gas pipelines were never built with in–line inspection (ILI) in mind and planning will be required to address the impediments or capital required to remove the built–in barriers. The most realistic definition recognises that there might also be a range of objections due to preconceived perceptions, and these objections need to be addressed inside the operating company with a realistic plan. Technologists agree there is no such thing as unpiggable – it just takes ingenuity and money to conduct integrity assessments when either the safety or operational risks warrant it.

One paper the 2012 mini–session at the Pipeline Pigging and Integrity Management (PPIM) conference in Houston offered two ideas that could definitely...
help operators:
- Pre-planning for access; and,
- Modular almost off-the-shelf pig configurations.

Pre-planning

The cost of running a tool and the analysis of the inspection results are essentially the same whether in a piggable or unpiggable pipeline. However the cost of inspecting an unpiggable line is usually more than double that of a piggable line. Why?

The key to success and extra cost is due to the need for additional pre-planning, such as working out an inspection strategy, considering tool development, and investigating the need for pipeline preparation. Pre-planning considers not only the access, but the interval needed for each inspection, as well as consideration of special tool configuration.

Gas control can help analyse the product flow over time to recognise an opportunity to gain the necessary short inspection window. If the flow is controlled externally, such as that coming from overseas by a CNG tanker, then negotiations will be needed to extend the interval between deliveries also it may be that additional onshore storage must be arranged to ensure deliveries continue to the customer while the line is out of service for a sufficient interval while time is extended between two successive ocean CNG tanker deliveries.

Sometimes a slight design modification of the existing pipeline system is all that is needed to prepare the system for quicker tool insertion and withdrawal.

One paper at The Pipeline Pigging and Integrity Management Conference 2012 discussed pre-planning and identified a need to reconfigure the pig train so that it could do several things in one insertion rather than requiring separate ILI pig runs. The gas line girth welds were ultrasonically inspected by designing the pig train to handle multiple liquids.

The operator first inserted a slug of glycol between two sealing pigs followed by an ultrasonic testing (UT) pig in a water slug. The water was used to slowly push the pig train into the section to stop at the known obstruction. On insertion, the tool pre-located all the girth welds. The gas pressure was then used to push the train back to the launcher while the hydraulic pressure control allowed the pig to stop at each girth and rotary inspect over all 360 degrees and then validate the inspection. Once the extended pig train exited, the gas line – which had already been dried by the glycol – was immediately available for service. As a result of thorough pre-planning, it was slick and easily done.

Modular pigs

Pigs used to be custom-made for each particular inspection run. Today, with the greater number of ILI inspections, operators can consider them to be made up of the components. Almost, but not quite, like building your custom tool train from Lego. There are bodies designed to work in various ranges of pipe diameters, and each body can be fitted with a different sensor types such as axial, spiral, or transverse MFL, caliper or geometry ‘fingers’, guidance, UT, EMAT, etc.

Power is needed to drive sensors, store data, and power tractor drives for tool mobility. This can come from battery packs with or without the addition of a regenerative turbine-generator. Mobility, real-time communications and power can come through cable systems, or rods and cables. Communication and controls can also be through a radio frequency (RF) link.

All these technologies are currently available, but not everywhere, or with every ILI service provider. Research and development

Since the San Bruno incident, the public and regulators have come to question the completeness, comprehensiveness, and validation of some of the original
mill and construction records, especially in high-consequence areas (HCAs). In some cases where records are incomplete, the only choice was to do a number of sampling excavations and inspect the exposed pipe in the bell hole.

However, today ILI is looked upon to help validate and/or restore many of these information gaps. The mill and construction records are needed to determine where residual threats exist and if there is a possibility of interactive threats if deterioration mechanisms may be active.

In addition, the validity of the original construction hydrotest records that established the maximum allowable operating pressure (MAOP) for pipelines in HCAs came into question. ILI is looked upon as a technical solution to validate questionable pressure-test documentation. The industry has started a research and development (R&D) programme to show that off-the-shelf tools will be able to complete or validate these record gaps.

A magnetic-flux leakage (MFL) inspection could be sufficient to find those extra-large mill defects that would be expected to fail a pressure test at 125 per cent MAOP. The alternative is to conduct a hydrotest to 125 per cent MAOP when any of the original records are found to be questionable.

This R&D programme will use free-swimming tools and is expected to be validated by in-the-ditch inspections followed by some hydrotests. Note that these successes translate directly to unpiggable segments to be used wherever mill and construction records are in question.

**Bringing information to the Forum**

The 2011 Unpiggable Pipeline Solutions Forum showed that operators are open to exploring unpiggable tool capabilities but are hesitant to use untried technology. Presentations and conversation throughout the programme helps foster the transfer of information.

The breakout session at the 2011 Forum was a successful innovation, and allowed the attendees to discuss ideas in a much smaller group and bring these back to the full meeting. The second 2013 Unpiggable Solutions Forum will repeat these breakout conversations to help exchange ideas in smaller groups and suggest needed solutions.

The accompanying trade show is a great place to discuss needs, ask questions, and talk prior solutions.

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