INSPECTION OF NON PIGGABLE PIPELINES

By Peter van Beugen, Pipesurvey International CV, Zwijndrecht, The Netherlands

ABSTRACT

Around 40-50% of all oil and gas pipelines around the world are non-piggable for one reason or another. There is growing tendency in the market to look into the integrity of these pipelines.

Pipesurvey International has developed a tool that can cover at least a bulk part of these pipelines. The XHR MFL tool incorporates all features of any up-to-date MFL ILI tool. The surplus value of the tool is that it is of complete bidirectional design, multidimensional and it has short bend-radius capability. The tool can be launched into a single-entry pipeline, be retrieved back at the same point and in the mean time inspect any length of pipeline. The tool is autonomous but can be operated with an umbilical as well. It is possible to combine the tool with a self propelling pipe robot, which takes the inspection range even one step further.

NON-PIGGABLE PIPELINES

Of all the pipelines that are in operation around the world, about 40 – 50% are non-piggable, based on a generalization of what some operators estimate about their own network.

Development and deployment of pipeline inspection tools so far has largely focused on piggable pipelines over the past decades, leading to the so-called ILI (in-line inspection) tools. Existing techniques like ultrasonic inspection (UT) and measurements based on Magnetic Flux Leakage (MFL) have matured to deliver accurate and reliable inspection data. Pipesurvey International has focused specifically on transferring this technology to so called nonpiggable pipelines.

Pipelines may be called non-piggable for a variety of reasons, ranging from construction features to operating conditions. To name a few examples:

● A pipeline of ‘regular’ design may not have pig traps on either side. Installing pig traps can be a costly operation, especially if these have to be built new. Moreover the operation can be cumbersome since it may impact the direct working environment existing installations and pipe work and the operations. If one can work with an inspection tool that does not require the installation of a pig trap on either side of the pipeline, and operate the tool in normal and reverse flow, this clearly offers cost savings.

● Some pipelines end in Tee connections; sub sea manifolds or other configurations, where a pig receiver is not present and cannot even be installed. Having a tool that can be launched down to a predetermined location and then pushed or pulled back to the launching point offers a solution to these pipelines. The same goes for pipelines on loading terminals, jetty lines and tank farms.

● Some pipelines operate at such pressures or flow rates that running a regular ILI tool is not viable. Low pressure in a pipeline, especially if it is associated with low flow rates, will result in a very irregular velocity profile of the tool which has adverse effects on the inspection results. The friction of the ILI tool is the major factor in this equation. Having a tool that runs at lower □p opens perspective for inspecting these pipelines.

Existing techniques for inspecting non-piggable pipelines are:
● Pressure testing. This method tells you whether or not a pipeline is safe to operate at a certain pressure. However the method does not give any information about sub critical

corrosion features and corrosion growth phenomena. A major drawback of the method is that the pipeline must be taken out of operation for a certain period of time.

● Direct Assessment. Integrating data from various methods of inspection such as Direct Current Voltage Gradient (DCVG) and Close Internal Potential Survey (CIPS) provides valuable information about the structural integrity of the pipeline and much work has been done to improve the uncertainties associated with these techniques. The method however focuses mainly on defects which are associated with coating failures. The method further requires sufficient access to the pipeline, which is not always available.

● Umbilical tools which are operated with an umbilical clearly overcome most of the issues discussed in the previous techniques. A limitation these tools is the length and the number of bends in the pipeline.

A NEW MFL TOOL

Pipesurvey International has developed an MFL inspection tool with a unique combination of features:

● Bidirectional operation. The MFL measuring system has been designed from grass roots to be completely bidirectional. Operating the tool in a reverse flow condition is exactly equal to operating it in forward flow because the tool is completely symmetrical. This goes for magnetic contact, sensor pads, and the suspension of all parts. Special attention has been paid to the design of the discs and the bypass facilities on the tool. One always wants to create the differential pressure on the front end of the tool so that the vehicle is being pulled through the pipeline rather than pushed. This has been ascertained in the mechanical design of the tool, so it will be pulled through the line in both ways!

● Multi-diameter design. Each tool can deal with a diameter reduction of 25%. In this way adjacent diameters of pipeline can be inspected with the tool without a problem, and even bigger gaps can be bridged with the same tool. Using extra High Resolution Tri-Axial sensors; with sensors packed back-to back on the sensor pads, the highest possible density of Hall sensors has been achieved. Measurement of the Flux Leakage field is done with a tri-axial arrangement of the sensors for an accurate determination of the metal loss volume. All three components are used in reference to the defect library in order to match the defect on the right sizing curve;

● Low friction design. All the measuring parts are wheel-supported, which reduces the friction of the tool in the pipeline by a factor 4 – 10, depending on the pipeline diameter. This results in a smoother pig run, thus collecting more reliable data.

● Gap less sensor arrangement. The sensor pads have been shaped in such a way that they will make a complete measurement over the circumference of the largest pipe diameter, while they will overlap in the smaller pipe diameters.

● Double measurements. The tool will make measurements as it travels down the line and also on its way back. This way one gets two complete sets of data which of course can be compared with each other.
● Short Radius bends. All tools are designed to deal with 1.5 Radius bends, also in a back-to-back configuration.

LATEST TECHNOLOGY MFL INSPECTION

Apart from the above characteristics, the MFL tool complies with all that may be required from a modern MFL ILI tool. All data are stored on board and are collected after the run for

data analysis and report generation. Defect assessment and fitness-for-purpose evaluation is done in accordance with ASME B 31G, DNV RP-F101, R-streng or any other method. The tool, company and data reporting further comply with the P.O.F. Specifications and requirements for intelligent inspection of pipelines (version 3.2 2005), NACE international publication 35100 (XHR specifications), NACE standard RP0102-2002, API standard 1163 and ANSI/ASNT ILI-PQ-2005.