February, 2009

Pigging Industry News
the newsletter of the Pigging Products & Services Association

President's letter

THE PPSA held its 10th annual pigging seminar in Aberdeen on 28th November, 2008, which once again proved a great success (*see photos, right*). Some very interesting papers were presented by PPSA members and the number of exhibitors was up on previous years as were the delegates – 127 people from 16 different countries. The next seminar takes place on 18th November, 2009, at the Marcliffe Hotel in Aberdeen, UK.

PPSA members will be back together again at the Houston pigging conference on 11th - 12th February. The annual golf tournament is planned for Monday 9th February with the AGM on the 10th at the Marriott Westchase Hotel Houston at 3.30. The meeting is open to all – members and non-members alike – and provides the opportunity for open discussion as to how PPSA should proceed in the coming year. An election for two USA directors will be held at the meeting. Only full members are entitled to vote and can do so, either at the meeting, or in advance by e-mail, fax, or post. The directors elected will take over from Brent Cross of N-Spec, retired President, and Kevin Scott who left Baker Hughes last year, thus creating a second vacancy on the Board. Our thanks go to Brent for his great contribution to PPSA over the past few years.

Anyone wishing to play at the golf tournament should visit the PPSA web site www.ppsa-online.com and follow the links through from the home page, top left hand corner.

John Lambley
President

New Members

Full

Pipeway International Inc, USA

Optimess Engineering GmbH, Germany

PNS – Pipeline Nitrogen Services bv, Netherlands

Individual

Stephen Mayo, Pipelines 2 Data (PLD) Ltd, UK

Pigging Products & Services Association is at:
PO Box 2, Stroud, Glos GL6 8YB, UK
tel: (+44) (0) 1285 760597 fax: (+44) (0) 1285 760470
e-mail: ppsa@ppsa-online.com
web: http://www.ppsa-online.com

Industry news

BJ Services opens in Houston

BJ Services Co has expanded its US-based pipeline inspection services by opening a new facility in Houston, Texas. The 20,000-sqft facility, which is dedicated to providing pipeline inspection services, represents an expansion of the operations and data analysis services in the United States, and will further complement the services supplied by the pipeline inspection services operation centre in Calgary for the past 20 years. The new location will enhance support for continued growth in the US market, providing strategic operations and data analysis for all of the company's pipeline inspection operations throughout the region.

"The new base in Houston demonstrates the company's growth and commitment to providing unparalleled service to all of our highly valued pipeline inspection services customers in North America, while acting as a central hub from which continued business development efforts will be carried out in the United States," Dave Latto, BJ Services' technical sales manager, said. "The expansion of our operation in the US allows us to bolster support for the North American market from two full operations bases."

The facility features offices for administrative support, sales and marketing, data analysis, and operations personnel, as well as a large maintenance workshop and warehouse that house a comprehensive suite of specialist pipeline inspection equipment. A full complement of state-of-the-art pipeline inspection equipment will be based permanently on-site, including the new fleet of combo tools featuring the high-resolution capabilities of BJ Services' industry-leading magnetic flux leakage and *GEOPIG* tools.●

Tips for better tracking

JACK Rankin, manager of engineered solutions and new products with **T.D. Williamson's** Pigging Products Division, provides guidelines for success in tracking and locating pipeline pigs.

Tracking and/or locating a pig stuck in a pipeline can present a challenge. A little preparation and proper tracking techniques, however, help ensure success. There are many applications in which it is important to track the progress of a pig as it travels through a pipeline, including:

Commissioning

- running a smart pig
- conducting a nitrogen purge with pigs
- running a pig with a transmitter to locate a stuck pig

There are also several situations that can result in a pig getting stuck in the line, such as:

- excessive by-pass when the pig is in a bend
- excessive debris build-up in front of the pig
- an obstruction such as a buckle in the pipe or a partially-closed valve

Manpower

First, plan to have an adequate number of two-man crews with each crew consisting of a pipeline operator who knows, and has access to, the pipeline right-of-way (ROW), as well as a contractor who is experienced in tracking equipment and procedures. The number of crews needed depends upon a variety of factors, including:

- is the ROW accessible by vehicles?
- how long is the run from launcher to receiver?
- what is the velocity of the pig under expected conditions?
- is the pig propelled with gas or liquids?
- is there a contingency plan if the pig gets stuck and can, or can't be located?

Job preparation and training

The pipeline operator should provide suitable maps and alignment sheets, and be thoroughly familiar with the pipeline ROW and access to various tracking locations. The contractor should possess an operating manual and be thoroughly familiar with the operation and maintenance of the tracking equipment. Crews should practice with the equipment so the signal can be observed, recorded, and interrogated before ever launching the pig. For practice purposes, the transmitter should be positioned a few meters away from the electronic receivers and moved parallel to the receivers at various velocities to demonstrate what the signal will sound and look like. For training, the transmitter should be placed out of sight. The trainee, following the instructions in the operator's manual, should walk along a line that is parallel, but about 3m from, the transmitter at its closest point. This exercise should be conducted in a field with overgrown vegetation where conditions are less favourable.

Pig tracking in progress.

Equipment

Electronic tracking systems use an electromagnetic-pulse transmitter (mounted on the pig) and an electronic receiver system. The transmitter should be selected based on the specific application, considering size and wall thickness of the pipeline, and the amount of time that it may take to locate the pig should it get stuck. Lithium batteries will provide extended life (though there may be some restrictions on the use of lithium batteries in some areas). The tracking equipment should provide audible, visual, and recorded indication of the pig passage. In addition to the electronic receiver, a geophone is recommended as it amplifies the sound being made by the cups, discs, and brushes as the pig travels through the line, allowing the crew to hear the pig coming well in advance of its scheduled arrival time at the tracking location.

Once the crew or crews are in place, confirm that all mainline valves are fully opened and that flow is going through the receiver barrel. Each crew should have spare batteries as needed, and a laptop computer with variable project inputs and a spreadsheet for recording data and notes. When positioning the tracking system receiving antenna and geophone probe, each crew should have a pipe locator to confirm it is over the pipeline. A spare receiving system should be carried by one of the tracking crews. If the pipeline goes through a casing, the receiver antenna should be positioned a bit upstream or downstream of the casing pipe so that the signal doesn't have to travel through two pipes. Where possible, pigs should be tracked at approx. 2-km (1.5-mile) intervals. Avoid areas with a lot of traffic, railroad crossings, and high-voltage power lines as these may induce 'noise' in the tracking system receivers.

Communication

Communication is critical. Everyone involved in the tracking process must have accurate information at all times to know when the pig is expected to arrive at a particular location.

Should a pig pass a given tracking station (station 73, for example) but not arrive in a timely manner at the next station (station 74), the crew at station 74 should wait for the late-arriving pig. Perhaps the pig was damaged and is still moving but is by-passing flow, or one of the units (compressor or pump) may have shut down, causing it to be late. The crew should proceed as though nothing has changed, assuming that the signal was simply missed for some reason.

If, after diligent tracking efforts all the way to the receiver, the crew has not heard/recorded pig passage at any location, including the receiver barrel and associated valves and fittings, it would be assumed that the pig is stuck somewhere between station 73 and 74. At this point, one person equipped with an antenna and receiver would start at each station walking toward each other until the stuck pig is found. If the ROW can be cleared in this area it will make the job easier and success more likely. If there are any fittings, valves, etc., between the two stations, they should be searched first. The receiver and associated valves and fittings should be checked on a regular basis (every few hours is recommended) until the pig is located.●

IMS to help operators manage pipelines

GE Oil & Gas' PII Pipeline Solutions has introduced an integrity-management system (IMS), said to be a first-of-its-kind pipeline integrity management software system, to help pipeline operators more effectively manage the integrity of their pipelines. The company has launched its IMS as part of *PipeView Integrity*, its rapidly-expanding portfolio of integrated pipeline integrity management and engineering solutions and services to help the oil and gas industry comply with increasingly stringent integrity reporting and maintenance regulations.

By using the new system, GE says that operators can manage all aspects of their pipeline-integrity process, from setting integrity goals and assessing pipeline conditions and risks to planning and tracking mitigation, assessment and maintenance activities. Encompassing both

data analysis and practical integrity management, IMS includes modules that can assess a pipeline's condition, determine risks, and evaluate, create and manage integrity plans. This includes determining appropriate mitigation activities and assigning mitigation and maintenance activities to the appropriate personnel, complete with notification and approval mechanisms.

The system offers the required functionality to support the operator during internal and regulatory audits, including the ability to link procedural instructions and document the completion of activities. "The IMS is the pipeline industry's first software solution that truly integrates integrity management and integrity engineering into a single, seamless environment," said John Bucci, general manager. "It offers all the enhanced support tools needed to drive asset availability and empower the operator's staff to dramatically improve the way they manage their pipeline assets."●

"Next-generation" inspection tools

GE Oil & Gas' PII Pipeline Solutions has launched its new, enhanced *EmatScan CD*, which it describes as a 'next-generation' inspection tool. The tool's technology is designed specifically to provide pipeline operators the necessary levels of tool performance and confidence in stress-corrosion crack (SCC) and individual crack detection analysis and mitigation management in gas pipelines.

The new tool applies electro-magnetic acoustic transducer (EMAT) technology to the demands of in-line inspection runs in gas pipelines by detecting and measuring what the company says is a greater range of defects compared to existing technologies. The system can detect cracks down to 1.97in (50-mm) length and as shallow as 0.079in (2mm) while utilizing PII's software capabilities and reporting techniques.

The company says that thanks to its new sensor technology, developed by project partner **GE Inspection Technologies**, this third-generation EMAT tool also offers operators greater discrimination of serious and non-serious flaws in a given pipeline. Unlike conventional ultrasonic inspection methods, the new tool does not require a liquid medium for its signals to reach a pipe's wall. As a result, operators no longer need to invest in costly pre-inspection preparation or subject their lines to contamination by liquids, in order to obtain the required inspection medium to support conventional ultrasonic data collection. The tool has been designed to offer operators other critical technical and economic benefits, including the ability to detect even sub-critical SCC colonies, and enhanced data accuracy.

The company is also introducing its new *MagneScan* 'next-generation' magnetic-flux leakage (MFL) pipeline inspection technology. The new tool incorporates an improved magnetizer design and advanced sensor technology; using the 6-in tool as an example, the new sensor design includes 216 low-noise Hall-effect sensors, and readings are taken on the axial, radial, and transverse vectors every 2 mm. This new three-dimensional sensor configuration has been designed to provide 100% coverage of a line and to optimize the accuracy of defect sizing for width, length and depth.

With its comprehensive sensor array, the new *MagneScan* combines several types of inspections in a single run. The tool is equipped with a fully integrated high-resolution caliper, EMAT sensors to measure wall thickness for more accurate defect sizing, and also offers GIS mapping technologies as a standard option for improved data alignment. The corrosion detection is now 5% of wall thickness at 90% POD, while the depth-sizing accuracy is 10% at 90% certainty. Offering multiple inspections in a single run greatly reduces any interruptions in pipeline service for the operator and overall inspection project costs.●

Integrity software customization contract

HOUSTON-based **Rosen USA** has been awarded a contract in customizing its asset integrity management software (*RoAIMS*) for **Equistar Chemicals**. The project includes customization of the software package to integrate the with Equistar's existing database structures, and to offer a collection of interoperable software tools to assist the operator in maintaining its pipelines in a safe, reliable, and cost-effective manner.

The primary objective of *RoAIMS* is to assist pipeline operators in applying their integrity-management strategy to the specific conditions of their assets. Rosen has projects in place for delivering and maintaining the customized software package for customers in South America, North America, and Eastern Europe.●

Fig.1. One of the 38-in SmartPlug trains on its way into the launcher.

Double-block pipeline isolation in Austria

TDW Offshore Services has successfully completed an onshore pipeline isolation operation for **OMV Gas GmbH** in Austria, in conjunction with the company's Trans-Austria gas pipeline (TAG) expansion programme. One of the key developments of the expansion programme is the newly-constructed compressor station in Eggendorf, Austria, to which OMV Gas needed to safely re-route the existing pipelines. To achieve this, TDW carried out pipeline isolation services on the 38-in import pipeline that runs approx. 70km from Baumgarten to Eggendorf, and on the export pipeline that runs approx. 70km from Eggendorf to Grafendorf.

TDW isolated these pipelines by using its remote-controlled 38-in *SmartPlug* trains to create double-block isolations against the gas pressure. Both plugging trains were launched and pigged with production gas into excavated sections of the pipelines, travelling approximately 100m from the launchers to the work positions. Using its wireless through-wall communication system, TDW manoeuvred each plug train into place, and set them in the excavated area of the pipeline. While the plug trains were in place and isolated pipeline

Fig.2. The SmartPlug train is situated just below the custom-made tension belts. The pipeline contains gas with a pressure of 50bar held back by the plug train while work continues safely to connect to the new pipeline.

sections, OMV Gas carried out the necessary modifications and re-routed the two pipelines to the new compressor station. Once this was completed, TDW released the *SmartPlug* trains and pigged them back to the launcher and receiver using gas pressure from the pipelines. The pipeline pressures for both pipelines were 50bar during the isolation operations. While each SmartPlug train isolated the pipeline sections for three days, the entire isolation operation took 10 days from TDW's arrival on site in Austria through to demobilization.

In order to help the two pipeline sections cope more effectively with the additional internal pressure exerted by the plug trains, TDW developed eight custom-made tension belts specifically for the operation. Although traditional belts can be cumbersome and time-consuming to attach to the pipelines during onshore isolation operations, TDW designed the tension belts in such a way that they were quickly and easily mounted. As a result, the contractor was able to reduce the time and effort required to attach the belts and progress more rapidly to isolating the pipeline sections in order that the modifications could be made, and the pipelines safely re-routed. Throughout the operation, the plug trains were continuously monitored using TDW's *SmartTrack* system that interacts with the transceiver systems that are featured as standard in all *SmartPlug* trains.

"As a result of our ability to effectively isolate the pressure in the two pipelines so efficiently, OMV Gas was able to initiate modifications to the system sooner than anticipated which was highly beneficial, reducing the overall pipeline re-routing programme schedule," said Rune Haddeland, general manager for TDW Offshore Services. "Coupled with the fact that the pipelines were isolated with minimal venting of product in accordance with OMV Gas' environmental policy, we consider it a real testament to the dedication and innovative spirit of the TDW team," he added.

Fig.3. Mounting the tension belts onto the pipeline.

Movement of black powder in pipelines - Part 2

by Dr John Smart

BLACK POWDER, or sediment in pipelines, can move from fluid drag in pipelines, or can be swept clean by pigging. Knowing the velocity required to move loose powder can help plan the cleaning of a pipeline, helping to prevent sticking of pigs by solids accumulation in front of a pig. This paper presents some design information on movement of black powder in oil, water and gas in pipelines, and gives a velocity criterion to indicate when progressive pigging, jetting devices or gel pigs are required to allow safe passage of pigs through a pipeline in oil, water or gas pipelines.

In the first part of this paper, published in the November, 2008, issue, Dr Smart discussed pipeline cleaning and some aspects of modelling the transport of particulate solids by pipeline.

Case 3: iron compounds in 20°API oil

The calculated velocity to move iron compounds in 20°API oil by velocity alone is even higher than for 40° oil, as shown in Fig.4. Oil velocities from 10ft/sec to over 15ft/sec are required, plus the 10-15% safety margin for uphill flow.

However, for very small particles, in the range of 1-5 mils, the oil velocity only has to be 2-6ft/se respectively, as the velocity required to move the particles increases more slowly with particle size. Thus, if a pipeline contains fine powder, it should be able to be safely cleaned by pigging even at these lower velocities. Use of heavier, more-viscous, oils will result in much longer particle settling times to the pipe bottom, if stirred up by turbulence in front of the pig.

Case 4: iron compounds in No 2 diesel

Diesel is sometimes used for cleaning pipelines as the compound is relatively-inexpensive and available, and much of it can be recovered or sold. The velocity for entrainment of the same iron compounds is shown in Fig.5.

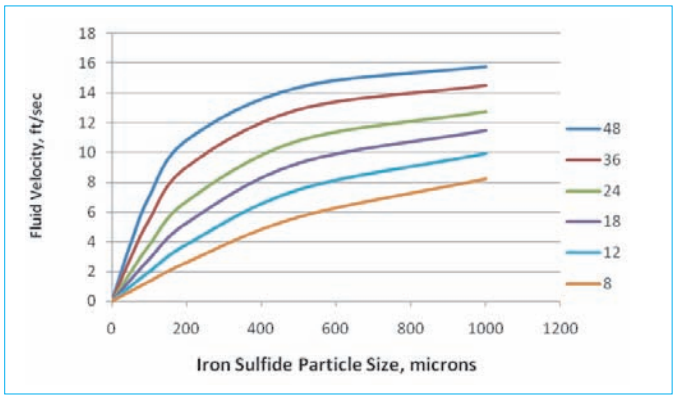

Fig.4. Velocity to move iron compounds in 20°API oil.

Lines using No 2 diesel should also be treated with caution, as larger particles will collect in front of the pig and will need to be pushed by it. This means that diesel is not a particularly good fluid to use when cleaning very dirty pipelines. Also, with the safety margin added in for uphill flow, these numbers may be a bit optimistic. Therefore, by-pass pigs with jetting nozzles, progressive pigging, or gel pigging are more conservative for lines with iron oxides, sulphides, etc. in them.

Case 5: black powder in natural gas pipelines

Figure 6 shows the effect of pipeline operating pressure on the velocity required to move 1-mil diameter and finer black powder particles in an 8-in pipeline as a function of pipe diameter and pressure. The term black powder is used as a catch-all phrase to include iron oxides, sulphide and carbonate particulates in pipelines, and can also include sand, clay, mineral scale, weld spatter and flex, and iron shavings.

Gas velocity is 9ft/sec in 8-in lines, up to 13.6ft/sec in 48-in lines at 1000psi, plus 10-15%. Natural gas pipelines can very in their flow velocity depending on the season, and may cycle above and below this number. If the pipeline were operated in a corrosive condition, even just enough to cause millscale to flake off the inside wall, large amounts of black powder could result that could possibly be delivered to customers or, at the least, require substantial filtering before delivery.

These results explain why gas pipeline compressor stations need to have filters installed in front of compressors to catch black powder coming down the pipeline. Pipeline operators report that as black powder is transported down a pipeline, it fractures and becomes very fine, with a size in the range of 1 micron; extremely fine powder like this can pass through normal pipeline filters. They also report that extremely fine powder such as 1 micron can be tolerated by reciprocating compressors, but can damage turbine compressors, even with filters in place.

These velocities also illustrate the cleaning requirements when crude oil pipelines are converted to natural gas service. One technique to keep the amount of black powder flowing down a pipeline is to treat the line with corrosion inhibitor which puts a tacky film on the wall of the pipe to which the black powder sticks, making it immobile.

Figure 7 shows the effect of pipeline operating pressure on the flow rate required to move 1-mil diameter and finer black powder particles in natural gas pipelines.

Discussion

Conversations with pipeline operators reveal that when pipelines are cleaned for such purposes as ILI inspections, using chemical cleaning initially results in a clean line. However, after some time, black powder is usually found coming down the line again when the lines are dry. Further, many gas pipelines are not dry, however, but contain compressor lubricating oil and possibly other liquids such as glycol which can adhere solids to the wall of the pipe and keep them from moving. One common technique to keep black powder from moving is to treat the line with a corrosion inhibitor: inhibitors are tacky compounds and can "glue" powder in place.

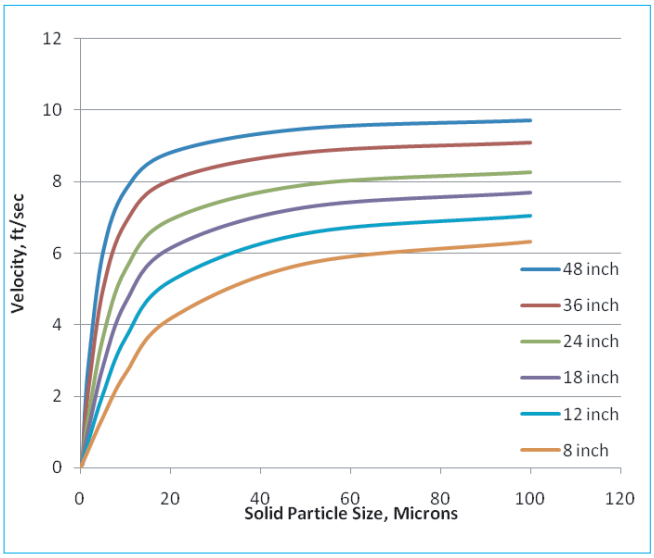

Fig.5. Iron compounds in No 2 diesel: the properties of the diesel used for calculations were 32°API diesel at 60°F, with a viscosity of 200cp.

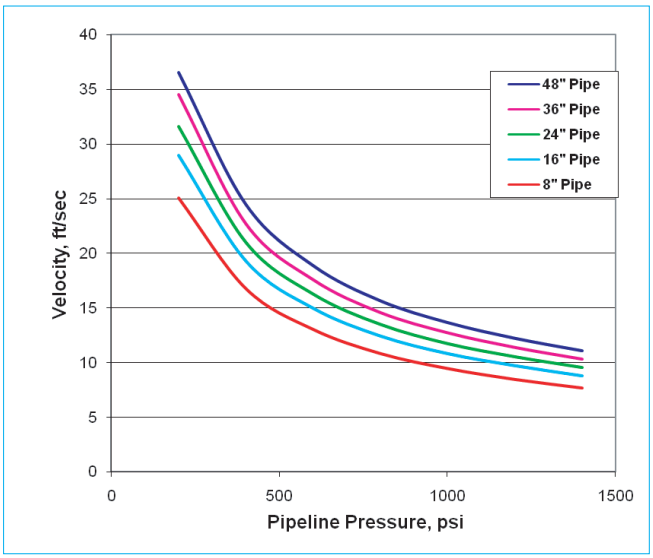

Fig.6. Black powder in natural gas pipelines.

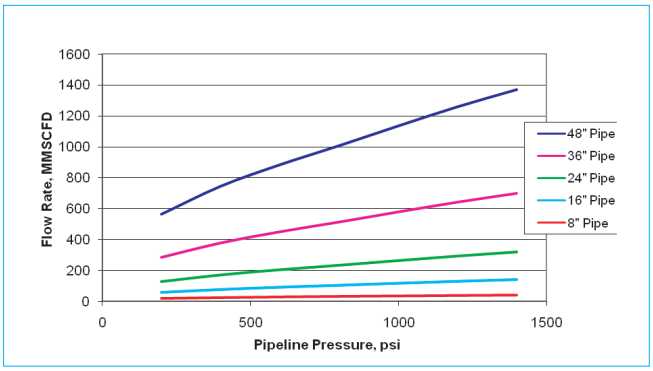

Fig.7. Velocity to move black powder particles in an 8-in pipeline as a function of line operating pressure.

Operators also report that when black powder solids move down a pipeline, they tend to fracture and become very fine, in the range of 1

micron, and these particles are more easily moved down a line. One advantage for fine powder in pig cleaning is that it settles much more slowly than coarse powder, and can be kept fluidized more easily by turbulence.

Another problem reported by operators is that moving powder causes problems with ultrasonic flowmeters.

Conclusions and recommendations

1. Solids can move through a pipeline either by velocity alone or during pigging operations.

2. Pigging can dislodge sediment from the bottom of a pipeline and the upper walls of the pipe, which can accumulate as large plugs in front of the pig.

3. If the velocity required to move the solids in front of a pig is higher than the pig velocity, solids can accumulate in front of the pig and it can become stuck.

4. Knowledge of the velocity required to move solids in a pipeline is an important design parameter in a pigging programme.

5. If the velocity of a pipeline is less than the velocity to move particulates, the steady-state bed height of black powder can be estimated which can be an indicator of the amount of solids in a pipeline.

6. When the velocity to move solids is greater than the pig speed, the pigging programme should be designed to accommodate the presence of these solids by progressive pigging, by-pass pigs, and jetting nozzles in front of the pig, or the use of gel pigs.

References

1. Iraj Zandi, Ed., 1971. Transport of solids at low concentration in horizontal pipelines. In: Advances in solid-liquid flow in pipelines and its applications. Pergammon Press, New York, pp101-124.