Cleaning pig technology for removal of black powder

Combining magnetic inspection experience and a specifically designed bypass system, a new tool provides an effective solution for removing black powder from gas lines. Dr Hubert Lindner explains.

A growing number of pipeline operators are now turning their attention to the relatively new phenomenon of black powder in gas lines, because of the substantial effects it has on their pipeline systems. Consisting mainly of iron and sulphur as well as iron oxide in different chemical combinations, black powder can be found in both dry and wet gas lines and in conjunction with any other contaminants such as water, liquid hydrocarbons, and sand, etc.

Black powder not only influences the flow performance of the pipeline, but it can also impair the function of installations such as valves and pipeline measurement systems. Since the performance and efficiency of pipeline inspections can be significantly reduced due to the particular characteristics of the powder, the development of specific cleaning methods for black powder posed an urgent challenge.[1] Fig. 1. shows the 48-in black powder cleaning tool just before launching in a 170 km natural gas pipeline in which the common problem of heavy black powder contamination is present.

Even in relatively short pipelines containing dry black powder, conventional cleaning tools show both low efficiency and heavy wear on the polyurethane of the cleaning equipment used (Fig. 2). The combination of heavy wear and low cleaning efficiency means that a large number of cleaning runs are required, thereby causing both heavy operating efforts and high spare part costs.

Fig. 2. Cleaning tool after a 50-km run through black powder.

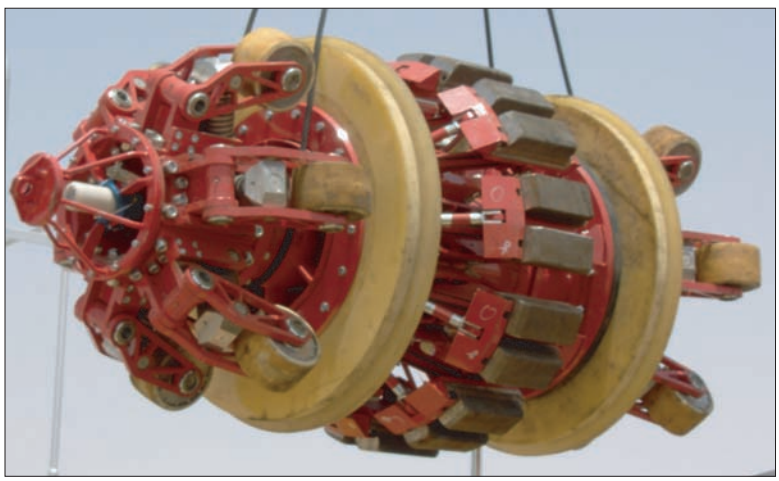

Fig. 1. Rosen 48-in Black Powder Cleaning Tool before launching.

Due to the urgency of the problem, a range of methods have been developed. For example, the use of magnetic inspection tools provides better cleaning efficiency, but it is marked by heavy wear on the tool components. Similarly, other cleaning procedures such as batch washing and gel pigging are more effective than standard cleaning. However, since up to eight single cleaning tools are usually required to separate the different fluids, solvents and chemicals, this method is both laborious and expensive. The problem is further exacerbated by the fact that all the fluids and chemicals inserted as part of such methods must subsequently be removed from the pipeline by means of a complex procedure. Combining the advantages of regular cleaning tools with those of magnetic inspection tools, Rosen's new technological approach also incorporates a specifically developed bypass system. All these different components make a specific contribution to the cleaning process as a whole. Carried by support wheels to prevent wear of wall-touching components, the tool is sealed with polyurethane guiding and sealing discs. At the same time, spring-supported magnetic brushes improve cleaning capability. Since all these mechanical components can be adapted to any pipeline properties, optimal cleaning efficiency is achieved under a wide range of different conditions.

The central feature of the new concept is a

Fig. 3. Receiver filled with black powder.

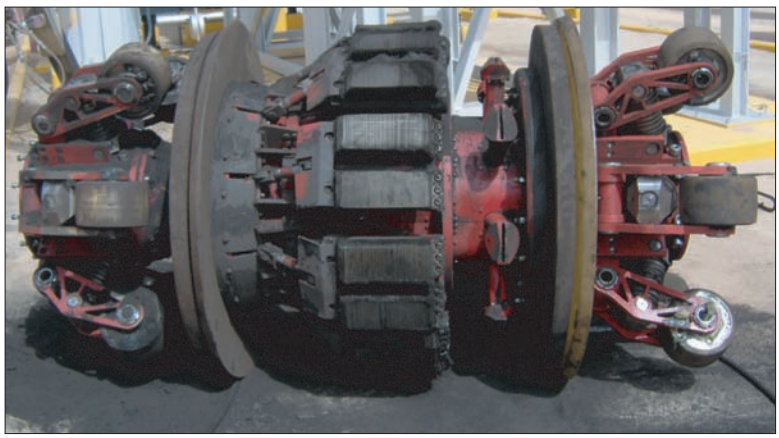

Fig. 4. Cleaning tool after more than 170 km in a gas line containing dry black powder.

calculated bypass flow running through the middle of the tool. The negative pressure created as a result of the acceleration of the medium permits flow into the bypass from where it is transported to the downstream area of the tool by means of purpose-built channels. The specific dynamic of the tool's flow means that an optimised value of powder particles can be removed from the pipeline wall. Moreover, the bypass flow through the middle of the tool transports additional powder particles.

The overall characteristics and performance of such complex interlinked processes must be calculated with extended methods of computational fluid dynamics. Thus the brush/magnet system not only ensures surface cleaning but also the required differential pressure. Furthermore, the actual pressure and flow in the line is taken into account to optimise cleaning performance and to prevent run problems due to excessive bypass. To monitor overall performance and function, each tool is equipped with a data acquisition system which measures temperature, absolute and differential pressure, and acceleration in three orthogonal directions with one data triple per second (minimum, maximum, average).

The efficiency of the new cleaning technology was proven during extensive in-house tests conducted for the two tool sizes of 48-in and a 56-in. Thus the 48-in tool collected 39 barrels of black powder in its receiver during a run in more than 170 km of dry black powder (Fig. 3). The condition of the tool after the run was such that it could be launched again without the need to replace any parts (Fig. 4). The tests thus indicate low operating costs and high cleaning efficiency even in heavily contaminated pipelines. ❑

REFERENCE:
1. Baldwin, Richard, The characteristics of black powder in gas pipelines, and how to combat the problem (www.blackpowderforum.org)

Enter 25 or ✔ at www.engineerlive.com/iog

Dr Hubert Lindner, ILI Tool Expert, Technology & Research Center Germany, ROSEN Group, Stans, Switzerland. www.RosenInspection.net

SURVEY HIGHLIGHTS INFRASTRUCTURE GAP

The fifth Aberdeen and Grampian Chamber oil and gas survey, produced with Deloitte, highlights that specialist equipment and infrastructure such as drilling rig and survey ships are at a premium and in short supply.

Findings also indicate that planned activity by contractors is stronger in international markets than in the UK Continental Shelf (UKCS).

"The potential equipment flight that may result due to capital expenditure necessary to increase UKCS capacity must be seriously considered," warns Geoff Runcie, chamber chief executive. "Oil producers and contractors, employing over 200 000 in the UK and international oil sector expressed unease about resourcing their businesses with the right equipment, infrastructure and people. This disquiet is compounded by the fiscal instability created by the UK Government's decision to increase supplementary North Sea oil charge from 10 per cent to 20 per cent. Concerns about the additional tax burden are much more evident in this survey.

Conducted by the Fraser of Allander Institute, the survey also shows that business confidence continues to rise but less so than in previous surveys. The majority of producers reported increased UKCS-based exploration, development and appraisal activity through the period (December 2005 – March 2006) and these rising trends are set to continue over the next 12 months. ❑

For more information, visit www.agcc.co.uk