Revolutionary long-distance CCTV inspections

by Kobus Prinsloo, SSISS

SSIS Sahara recently performed the first long-distance CCTV inspections under live operating conditions in South Africa on the Vaal Gamagara Water Scheme in the Northern Cape.

The inspection was performed with the innovative Sahara® live CCTV video inspection system.

The Vaal Gamagara Water Scheme (VGWS) is owned and operated by Sedibeng Water. Water is abstracted from the Vaal River and treated near the town of Delportshoop (approximately 60 km west of Kimberley) before being piped as far as Hotazel and Black Rock in the north. The scheme, consisting of more than 300 km of bulk steel water pipelines ranging in size from 250 mm to 700 mm in diameter, fulfils an important strategic role in supplying potable water to a number of towns, settlements and mines in the Northern Cape.

Sedibeng Water commissioned a master planning study for the scheme to assess future upgrading and expansion requirements. Assessing the condition of the existing pipeline infrastructure, much of which has been in service for more than 30 years, formed an important part of this investigation.

Apart from assessing the corrosion potential and external coating integrity, there was also a need to perform internal visual inspections on the pipelines. Owing to the high water demand of the scheme, Sedibeng Water could not take the pipelines out of service for any prolonged periods to perform conventional drained visual inspections. Inspections under live operating conditions were required and SSIS Sahara (SSISS) was appointed as a subcontractor to Isinyithi Cathodic Protection (ICP) to carry out the task using the revolutionary Sahara live CCTV video inspection technology.

THE TECHNOLOGY

The Sahara CCTV platform was developed specifically for applications in which inspections need to be performed under live operating conditions, and was therefore ideally suited for use on the VGWS.

The system is inserted into a live pipeline through a standard 50 mm diameter or larger tap or opening, usually at air valve installations. Tethered to the surface, the camera is pulled by the flow of the water, transmitting real-time video data from inside the pipeline. It can be used for a number of applications, including:

- assessing the internal condition of potable water pipelines and joints
- locating lost line valves
- investigating unexplained flow conditions
- locating debris or other partial blockages
- searching for illegal connections

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- locating and assessing tuberculation of all types
- locating and assessing the extent and behaviour of entrapped air in the pipeline
- examining the condition of suspect line valves
- screening for obstacles or laterals before using other inspection tools
- viewing pipes near a known leak to help plan repairs.

The system setup and components are illustrated in figure 1.

Since Sahara is an in-line inspection system, access into the pipeline is obtained at existing air valves or specially prepared connection stubs. The under-pressure insertion is achieved by removing the air valve and fitting a specially fabricated flange and an insertion tube on top of the gate valve. The camera

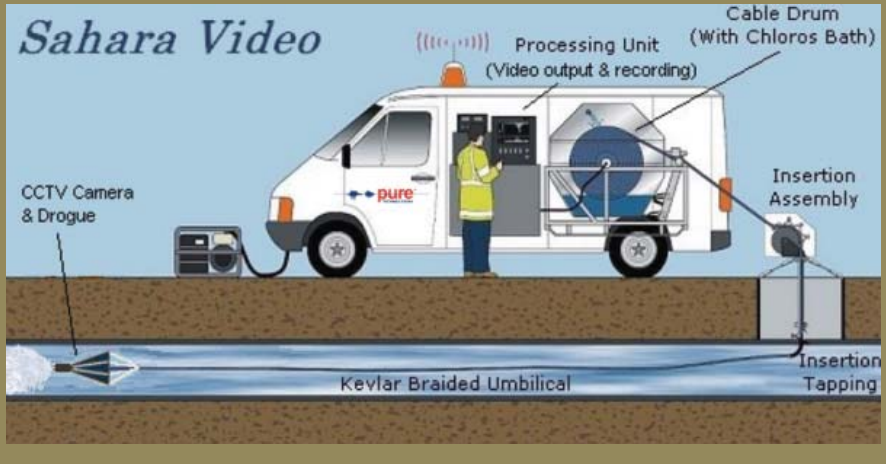

FIGURE 1: Sahara CCTV system setup and components

FIGURE 2 (ABOVE): Typical site arrangement showing inspection vehicle, insertion tube and winch assembly

FIGURE 3 (RIGHT): Sahara CCTV camera head and parachute assembly

head, inspection cable and parachute are then deployed under pressure through the insertion tube into the pipeline while the pipeline remains in service. The flow of water opens the parachute and provides the necessary drag to pull the camera and cable along the pipeline (refer to figures 2 and 3).

The speed and direction of the camera are controlled by a hydraulically operated cable drum and winch, which are fitted on top of the insertion tube and controlled from inside the inspection vehicle, allowing the operator to scan backwards and forwards while recording the images to a hard drive and DVD. The camera head is tracked on the surface to locate any anomalies detected accurately.

INSPECTION FINDINGS

The purpose of the Vaal Gamagara inspections was to determine the internal condition of a number of selected pipe sections to inform the decision-making process as part of the master planning for the scheme. Fourteen inspection positions that would provide a representative indication of the internal condition of the pipelines throughout the scheme were identified in collaboration with Sedibeng Water.

Twelve of the sites, totalling 4.2 km of pipeline, were successfully inspected. The remaining two sites could not be inspected as a result of excessive internal operating pressures. A standard visual classification procedure was developed to classify all possible inspection features consistently, such as cracked lining, peeled lining, corrosion deposits, etc. In addition, a basic steel pipe corrosion classification model was developed as a first step in assessing and prioritising pipe wall corrosion. All visual observations were classified and recorded on DVD.

The live CCTV inspections on certain sections of the VGWS provided a good indication of the internal condition of the selected pipe sections (refer to figure 4). Apart from observations of normal bio-film growth inside the pipelines, the following findings were documented:

- gate valve condition, riser stub corrosion and tuberculoses
- damaged and defective lining, including cracked lining, damaged or missing lining, visible signs of corrosion product build-up, blistered lining and physical obstructions inside the pipelines

Project details:

Client: Isinyithi Cathodic Protection (ICP) on behalf of Sedibeng Water
Project: Sahara® CCTV inspection of selected pipeline sections on the Vaal Gamagara Regional Water Scheme
Region: Northern Cape
Water Board: Sedibeng Water
Inspection Distance: 4.2 km
Project Duration: August to November 2010
Pipeline Description: Various steel pipelines of 300 mm to 900 mm in diameter
Number of Sahara® CCTV inspections performed: 12
Average inspection distance per insertion: 350 m

Key project outcomes and features:

- This was the first live long-distance CCTV inspection in South Africa using the Sahara® inspection technology.
- All the inspections were performed while the pipelines remained fully operational, without the need for prolonged shutdowns and draining.
- Notable observations included: lining cracks, internal corrosion, tuberculation on the internal surface of the main pipe barrel and air valve riser stubs, damaged and missing lining, severe blistering of the internal lining and severe joint corrosion.
- The system used is a very effective visual inspection platform that provides valuable management and decision-making information, without the need to decommission a pipeline.

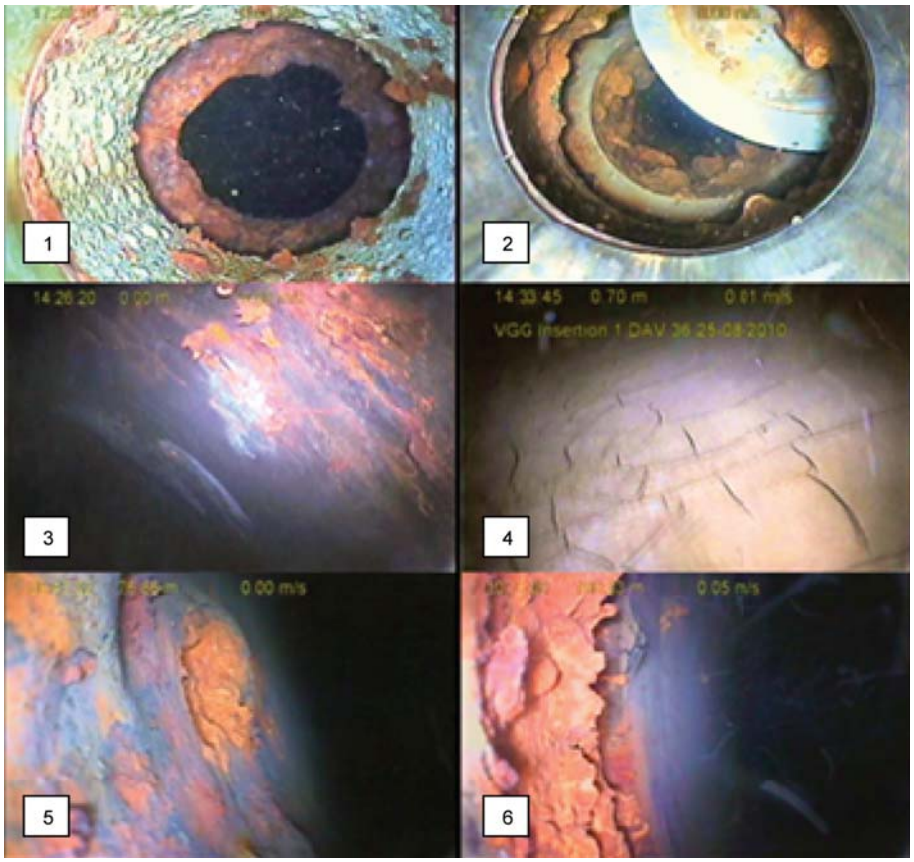

FIGURE 4: Selection of images captured inside the pipelines, showing: (1) early stages of riser stub corrosion (2) riser stub tuberculoses and condition of the gate valve disc (3) corrosion product build-up on the pipe wall (4) cracked lining (5) severe blistering of the pipe lining and (6) pipe joint corrosion

- condition of pipe joints
- pipe barrel corrosion.

CONCLUSION

The first live CCTV inspection in South Africa using the revolutionary new Sahara live CCTV video system was successfully performed on the VGWS. The visual inspections provided clues to the presence and possible types and modes of corrosion taking place inside the pipelines, enabling a more accurate assessment of the pipe condition and refurbishment requirements. All the inspections were performed while the pipelines remained operational, which significantly reduced the impact of the inspections on operations.

Water utilities now have the ability to assess the internal condition of their bulk water pipelines visually, without the need for costly shutdowns. 3S