Companies move toward integrated sand monitoring

Detecting and reacting to sand in the well and flow stream have never been more crucial.

AUTHORS

Kjell Wold *and* ***Sean Hopkins,*** *Roxar; and* ***Øystein Brandal,*** *StatoilHydro*

As operators look to develop ever more sophisticated sand management strategies and contend with aging assets and increased gas production, sand monitoring remains critical. Sand monitoring technology is rising to the challenge with the integration of erosion- and acoustic-based sand and corrosion monitoring techniques and the development of innovative software to manage integration.

Acoustics/erosion-based monitoring

Sand monitoring devices can provide an "early warning system" — an immediate response when sand is present. Many sand monitoring techniques have tended to be based on either acoustic or erosion-based sand probes.

Acoustic sensors provide an immediate response to changes in sand production. Such meters use the acoustic energy generated by sand particles to calculate sand production in oil, gas, or multiphase pipeline flows. The passive acoustic technology is non-intrusive and can be mounted in fixed, pre-installed clamps on the outside of the pipe (Figure 1).

Simple installation is particularly valuable on older and more mature fields where there is a focus on extending the natural life through optimized production. With this goal in mind, sand monitoring can place a tighter rein on operating conditions and deliver improved economic returns.

Erosion-based sand monitoring provides direct measurement of sand erosion. Roxar's sand erosion solution is based on the electrical resistance (ER) principle, where metal loss on the element is measured as increased electrical resistance in a sensing element exposed to sand erosion. Sand production rates can be quantified by combining measured metal loss rates with average sand particle size and flow data.

Figure 1. Acoustic non-intrusive sand monitors are one type of system used in sand control and management. (Images courtesy of Roxar)

The probe provides robust, accurate measurements irrespective of flow patterns and noise created by flow conditions or other sources. It also does not require calibration through sand injection for the quantification of sand production.

The move toward integration

More and more of today's operators are seeing increased value by combining acoustic- and erosion-based sand probes into one integrated asset management system. The advantages of using two supporting technologies and integrated workflow and reporting capabilities are too compelling to ignore.

One benefit is the ability to derive the best from each technology. Whereas acoustic monitors provide an immediate response on sand production, they are complemented by the intrusive sand/erosion probes, which generate accumulated erosion data used to control sand production. The intrusive sand/erosion probes also can calculate erosion and sand production when combined with flow data and provided an average sand particle size.

Combining the two systems also ensures that no information is lost if one system fails or if conditions are unsuitable. The results from the two measurement technologies also can be used for internal data verification and correlation and setting more reliable alarm systems.

In addition, combining acoustic detectors with intrusive sand probes might cover measurements of a wider range of sand with respect to particle size and velocity since intrusive erosion probes only measure erosive sand. This could be beneficial for installations with limited sand handling capacity topside that are producing fine sand at low velocities.

Other benefits include flexible calibration where one system can be used to calibrate data from the other system using a single user interface for data comparisons. This leads to more effective comparisons and correlation of data from the field and a better understanding of the reservoir management process.

Tying the data together

Roxar and StatoilHydro are jointly developing new sand management software for increased data handling capacity, multi-user functionality, and new reporting facilities. This is being applied on the Heidrun license, which has been producing oil and gas since 1995. Production in 2008 was about 100,000 b/d of oil.

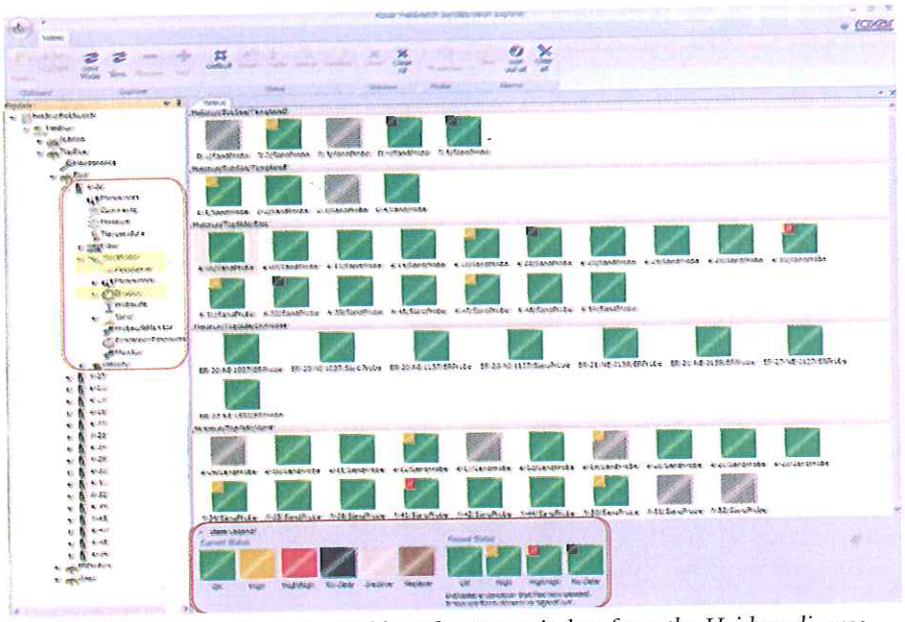

Figure 2. This figure shows the Fieldwatch status window from the Heidrun license.

There was a need to increase the field's sand monitoring capabilities to allow for the maximum amount of sand without affecting production and to meet the challenges of increased water content and more produced gas (more sand and higher velocities). The Heidrun license relies on erosion-based sand probes. Increased available data and analysis of the data provided made limitations of the earlier sand monitoring software tools obvious.

Consequently, Roxar and StatoilHydro agreed to develop new-generation sand monitoring software. The primary criteria included the need to handle more data; get real-time data; and improve reporting, trending, and data verification features.

Fieldwatch is a specialized Windows-based field monitoring system that allows data to be collected quickly from multiple locations and accessed through an intuitive user interface. The rapid retrieval and display capabilities of Fieldwatch also provide the user with the ability to quickly visualize data and identify trends and patterns or areas of interest for further analysis.

Real-time data can be accessed directly at the desktop via a graphical user interface and, if worthy of further analysis, transferred at regular intervals to Fieldmanager, which is based at the field's onshore control center and provides a suite of more detailed analysis and interpretation tools and local storage for the data.

Sand monitoring is becoming a major focus of the Fieldwatch system, allowing operators to be more proactive in taking remedial action to prevent sand interference. The system also provides the ability to access sand management data alongside other real-time field production data.

Fieldwatch's sand management module will be upgraded to include a new erosion modeling feature that predicts erosion in bends and reducers. The feature will enable operators to determine erosion modeling at other pipeline locations based on measured sand erosion rates. Operators will be able to convert measured erosion rates from one location (for example, the sand probe) based on extensive knowledge and flow models to find the corresponding erosion rates at other locations in the piping system — for example, in the bends and reducers.

Other sand management features include rapid response capabilities, alarm settings, data evaluation, the ability to handle large volumes of data, and as previously mentioned, integration with corrosion and other monitoring systems. The same software format also can handle corrosion probes installed at the platform. E&P

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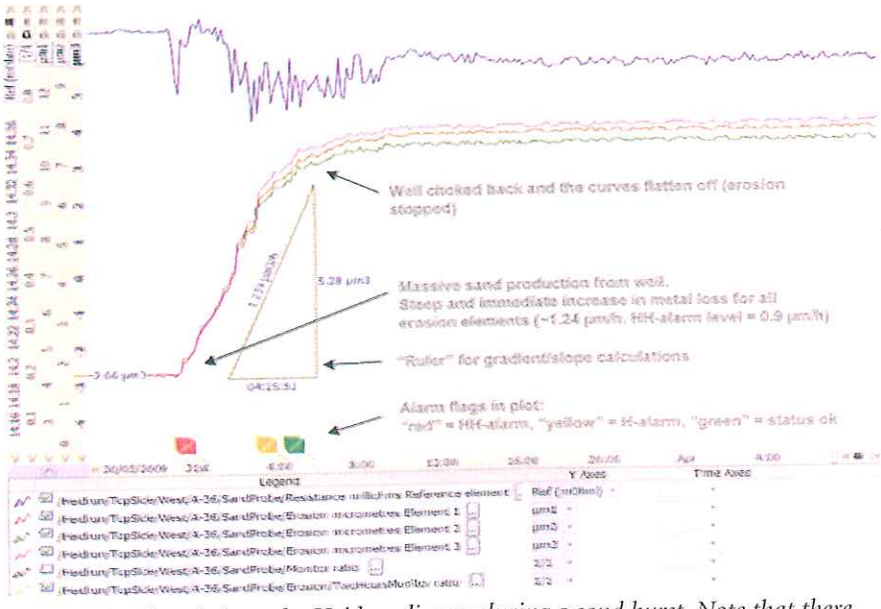

Figure 3. This data is from the Heidrun license during a sand burst. Note that there are three parallel readings from the different elements on the sand probe. The comparison of the measurements at each individual element, as well as readings of the reference element, is used to verify that the probe data is valid.