Preventing data overload

KJELL WOLD & ANGELA MYHRE, ROXAR AS, NORWAY, DISCUSS MANAGING AND ANALYSING CORROSION MONITORING DATA.

IBM Business Consulting Services recently estimated that advances in monitoring technologies have resulted in a single oil or gas field generating on average up to one terabyte of data per day.[1]

This is a stunning figure! While E&P companies require a complete picture of their reservoir throughout the production phase in order to be able to make better decisions, there is a real danger of being overwhelmed with raw production data.

There is no doubt that information relating to corrosion, temperature, pressure or flowrates can be vital for determining the production capabilities of the field and each well within it. If not managed in an integrated way, however, it has the potential to leave the operator reeling from information overload.

Just as unstructured data is a challenge, so is the need to generate data from ever more hostile and remote environments. Operators today are having to generate information from deeper and more complex reservoirs and are facing challenging and environmentally sensitive operating conditions.

The growth of SCADA

The growth of Supervisory Control and Data Acquisition (SCADA) systems has been seen as playing a crucial role in transforming this raw data into valuable decision-making information and in helping generate data from remote locations.

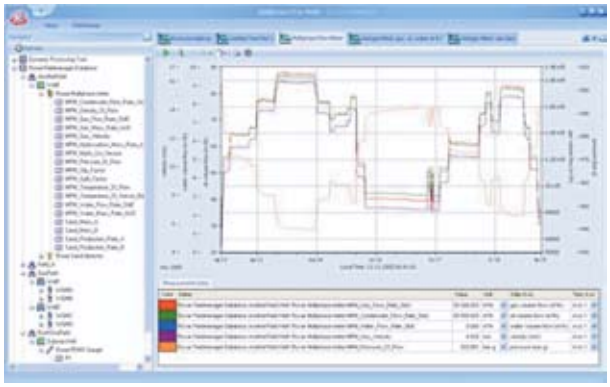

Figure 1. Roxar Fieldwatch graphical presentation of multi-phase flowmeter (MPFM) data.

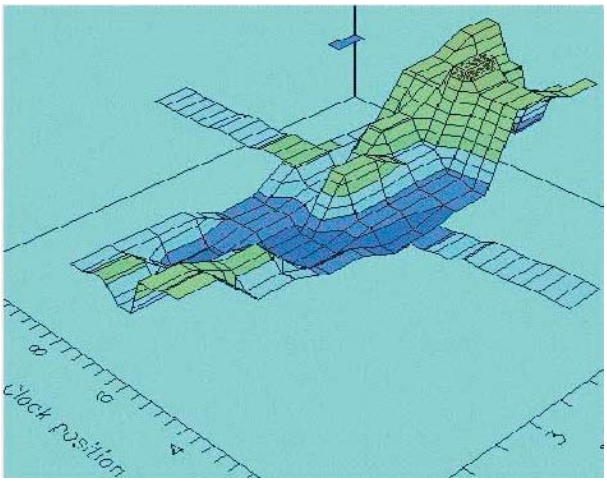

Figure 2. FSM monitoring software produces graphical plots that indicate the location and severity of defects and also calculates corrosion rates.

Figure 3. Typical FSM deepwater system installed on pipe spool prior to offshore installation, complete with subsea electronics and protection frame.

The growth in intelligent field devices, increased automation, expanded communication networks, and improved compatibility with IT have all helped SCADA generate real-time information from remote environments – information that can go straight to the operator desktop.

According to ARC Advisory Group, a research and advisory firm, the worldwide market for SCADA systems for the oil and gas industry is expected to see annual growth rates of 9.3% over the next five years with the market forecast to be worth over US$ 1.3 billion by 2012.[2]

The report says that SCADA "will be at the core of technology adoptions as the world economy strengthens, and as the industry moves to improve business processes to meet growing energy demand and economic challenges."

Yet, despite these optimistic figures, many SCADA systems today remain fragmented and address only specific segments of the operator's responsibilities, such as exploration, drilling, completion or production.

It is only through an integration of data that SCADA can reach its full potential. The age-old criticisms from engineers that they spend more time managing rather than analysing their data can also be confronted.

Let's take a look at an issue close to the heart of today's pipeline operator and one that has not been traditionally seen as a natural partner to SCADA – corrosion monitoring.

This article looks at the data that can be generated from corrosion monitoring, and how it can operate alongside other information flows on the user desktop.

Field signature corrosion monitoring

With flow assurance, environmental compliance, and investment returns coming to the fore in the oil and gas industry and many pipeline assets ageing, the need for accurate, non-intrusive corrosion and erosion monitoring of large surface areas has never been higher.

The dangers of production losses, shut-downs or safety and environmental set-backs due to the corrosion of key infrastructure are simply not an option for today's oil and gas operator.

Non-intrusive field signature technology has been applied for internal corrosion monitoring for more than 15 years, being most commonly used for subsea pipelines, land-based pipelines, high temperature applications in refineries, and sour production environments.

Installation is also more cost-effective and easier to apply on the most critical positions of a pipeline. For example, the bottom section (6 o'clock) of horizontal pipelines, where water collection is most likely to take place. This is compared to traditional corrosion probes which require concrete pits under the pipelines.

The field signature method measures corrosion or erosion by detecting small changes in current flow due to metal loss. This is achieved through non-intrusive sensing pins, which are distributed over the areas to be monitored and detect changes in the electrical field pattern. Voltage measurements are then compared to the 'field signature', which provides the initial reference.

The benefits to the operator include high levels of accuracy and sensitivity; and the non-intrusive nature of the corrosion monitoring, increasing operator safety in sour production environments, for example, and reducing costs.

Online corrosion monitoring

How is the corrosion data managed?

The increase in the real-time monitoring of the reservoir and the need to prevent expensive corrosion failures – through a localised attack like weld root corrosion, for example – has resulted in corrosion data being incorporated further into SCADA systems and has resulted in the data being seen as an important input into reservoir monitoring. Today, corrosion data stands alongside temperature, pressure, flowrates, and breakthrough water detection information.

For the operator, there are also cost savings as collecting data separately at remote locations can be extremely costly in terms of both money and resources.

To reflect operator demand, Roxar has introduced online and real-time corrosion monitoring to the field signature method.

By inducing an electrical current into strategically located pipe sections, changes in the electrical field pattern can be monitored and the slightest initial signs of metal loss through uniform and localised corrosion can be identified at an early stage.

The online system and new, online data logger can be used with a wide range of wireless communication solutions (radio, telephone, GSM, satellite phone), as well as being powered through solar panels. It is based on sensing pin matrixes similar to those used previously, with the same sensing pin options and the same temperature ratings for the pipe mounted components.

The FSMLog instrument is charged and communicates via a FIU (Field Interface Unit) with up to four field signature instruments connected online to one FIU. Power consumption is also only seven watts, making the system suitable for solar panels.

MultiTrend software then analyses and filters the data and presents it through comprehensive and explanatory graphs in real-time. The monitoring software indicates the severity and location of defects and also calculates corrosion rates.

The advantages to the operator of online corrosion monitoring are significant. These include a higher data collection frequency, thereby increasing the accuracy of the system and the ability to distinguish trends from random variations; and an online system which allows remote and wireless data communications direct to the operators' offices. Continuous data will also increase the system's resolution.

The ability to distinguish localised attacks and general corrosion in real-time as well as detect corrosion rates much earlier than traditional corrosion methods (allowing corrective action to be taken before damage occurs) is also crucial to operators as they look to guarantee real-time flow assurance.

Take-up for the new online corrosion monitoring system has been encouraging, particularly in China and the Far East.

Making best use of the information

We have seen how real-time data is accumulated from an online corrosion monitoring solution but how can we ensure that the data can be turned into valuable decision-making information?

Roxar has developed Roxar Fieldwatch, a specialised Windows-based field monitoring system which enables E&P operators to 'watch their fields' remotely.

Built on Roxar's data acquisition technology, DACQUS®, the rapid retrieval and display capabilities of Fieldwatch provides the user with the ability to quickly visualise data and identify trends, patterns or areas of interest for further analysis. The result will be increased information and reduced uncertainty when making crucial production optimisation and reservoir management decisions.

The system also contains a set of integrated modules that provide automatic data acquisition, data logging, monitoring, replication, data analysis and event notification.

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 Roxar Fieldmanager which, based at the field's onshore control centre, provides a suite of more detailed analysis and interpretation tools and local storage for the data.

Whereas the majority of DCS and SCADA systems typically have limited storage capabilities, the system's full life of field storage allows the operator to perform reservoir analysis on short to mid-term historical data, as well as the opportunity to perform look back analyses on the complete history of the well or reservoir.

The simplified and streamlined process, the interoperability with third party petroleum engineering applications, and the powerful interpretation, analysis and monitoring tools go a long way to addressing the critics of SCADA systems in the past. Through Roxar Fieldwatch and Roxar Fieldmanager, users spend more of the time analysing the data and less time collating or finding it.

It is Roxar's goal that corrosion monitoring becomes a major element of the Fieldwatch system through a component – Fieldwatch Sensor Manager. This will allow operators to be more proactive in taking the necessary remedial action to prevent corrosion failure and access this data along with other real-time field production data.

Tying in the corrosion data with other data

Of course, there is additional data that the operator needs in order to make decisions relating to corrosion and the flow assurance of the pipelines – data that can all be sourced from the instrumentation.

The ability to predict and measure the water production profile in a well, for example, has become critical for preventing hydrate, scale and corrosion in the

Figure 4. FSMLog instrument.

pipelines and ensuring a reliability of supply. Corrosion is also often caused by the presence of carbon dioxide in the gas, with the corrosion rate highly dependent on the pH of the MEG/water mixture. The lower the pH, the greater the corrosion rate.

The same goes for sand. Sand clogged production equipment erodes completion components and impedes wellbore and pipeline access. Sand erosion can be a major contributor to corrosion by removing protecting coatings.

In an ideal world, the operator, through a combination of instrumentation and software, can monitor production continuously, observe and control fields from remote locations, and make immediate decisions to face down immediate production threatening problems – the introduction of a corrosion inhibitor, for example.

With today's E&P operator demanding an integrated, reservoir monitoring and asset management system, where the economic impact and risk of reservoir management decisions can be fully assessed, SCADA and systems, such as Fieldwatch and online corrosion monitoring, are rising to the challenge and delivering. WP

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