

A cost-saving strategy for desalination plants

As the need for fresh water increases around the world, desalination is proving to be an increasingly attractive alternative to overtaxed fresh water sources.

At the beginning of 2008, there were more than 13,000 desalination plants worldwide producing more than 12 billion gallons of fresh water a day. According to *Global Water Intelligence* estimates, as reported in *BusinessWeek*, 5/21/08, the market is expected to more than double within the next 10 years. As new desalination plants are built and present facilities are expanded, plant operators can realise significant cost savings by employing a recent advance in online process instrumentation – wireless technology. Two of the most promising applications for wireless technology are the measurement of pH and conductivity.

There are two basic desalination technologies: Membrane separation (reverse osmosis) and distillation. Because it consumes less power than distillation, reverse osmosis (RO) is often the preferred method, particularly in the Western world. In the RO process, raw seawater or brackish groundwater is pumped at high pressure against a semi-permeable membrane. The membrane permits water to pass through, but blocks and rejects dissolved solids as concentrated brine. Modern RO membranes can reject up to 99% of the dissolved solids in the feedwater.

Membrane fouling

RO membranes are susceptible to chemical degradation and fouling by solids in the raw water. Pretreatment protects the membranes by removing harmful chemicals, filtering out suspended solids, and controlling scale formation. (Scale forms when slightly soluble salts concentrate and eventually precipitate as the water passes through the RO module.)

Fouled membranes can be cleaned, but irreversible fouling can also occur. Permanently fouled or chemically degraded membranes must be replaced. The membranes are a significant capital investment, so it is important to monitor carefully the effectiveness of the pretreatment process.

Typical measurements in the pretreatment system are pH and ORP. Cellulose acetate RO membranes are highly sensitive to feedwater pH and degrade rapidly in an alkaline environment. Therefore, the feedwater should be maintained at approximately pH 5 and monitored continuously.

Monitoring dechlorination

Aromatic polyamide composite membranes are more resistant to pH, often tolerating any pH between 2 and 10. They can,

Wireless liquid analytical instrumentation comes to the fore

however, be damaged by chlorinated water. Chlorine is generally avoided in systems using polyamide membranes, but in some cases, the risk of biological fouling is so high that chlorination is necessary. Whether chlorine is intentionally added or is already present, it must be removed, usually by treatment with a dechlorinating chemical.

A convenient way of monitoring dechlorination is to measure ORP (oxidation reduction potential). Another important goal of pretreatment is stopping scale formation. Scale has many sources, requiring different control strategies, but in some cases, simply adding acid to lower the pH is effective. Continuous monitoring of pH is necessary to prevent overfeeding or underfeeding of acid.

Measuring membrane performance

The most useful measurement in the separation process itself is conductivity. The objectionable solids in seawater or brackish water are primarily ionic, so conductivity is an inexpensive and easy way of measuring membrane performance. Typically, the conductivity of both the feedwater and permeate are measured, allowing continuous calculation of percent solids rejection by the membrane.

Unexpected changes in performance immediately alert the operators to a problem. Traditionally, adding process instrumentation also meant installing an extensive network of cables to connect each transmitter to the control system. Cables, conduit, marshalling panels, engineering, and installation costs often far exceeded the cost of the instrumentation itself.

Significant cost savings with wireless technology

As new plants are built or new capacity installed, original equipment manufacturers (OEMs) and plant managers can eliminate this expense by specifying wireless instrumentation. A skid equipped with wireless transmitters at the time of manufacture requires no additional wiring after installation in the plant. Because a desalination plant often contains dozens of skids, wireless technology provides a significant cost savings.

Quite recently, the industry's first wireless transmitters for pH and conductivity have appeared on the market. These transmitters use the WirelessHART® communication protocol, an open platform that is rapidly emerging as the de-facto industry standard in plant wireless technology. Because WirelessHART is an open standard administered by the HART Communication Foundation, early adopters need not worry

that their investment in wireless technology will lock them into a single supplier. The transmitters seamlessly integrate into any network of WirelessHART-compliant devices (see box story on page 42 for the latest development in the HART Communication Foundation).

The WirelessHART protocol allows wireless transmitters to operate in a "self-organising network." In this configuration, every wireless device on the network acts as a router for nearby devices. This ensures high data reliability and network availability since all devices work together to identify and use the most efficient communication path for each message. The network dynamically reconfigures itself without manual intervention and without disrupting the flow of data. The large number of skids and instruments within a typical desalination plant makes for a robust wireless network.

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pH
Conductivity
Dissolved
Oxygen
ORP
Chlorine
and more



One of the technologies that will contribute to its viability and cost-effectiveness is wireless instrumentation and the emergence of wireless pH and conductivity analyzers represents an effective step.

Wireless benefits

Security is always a concern with a wireless network. The new transmitters take full advantage of the multilayered security features present in the WirelessHART standard which includes encryption with automatic key rotation, device authentication and data verification. External interference is mitigated by spread-spectrum broadcasts and automatic channel selection that avoids the noisy spectrum. The resulting network offers security and reliability similar to a hard-wired system.

An additional benefit of the WirelessHART protocol is the availability of diagnostics through the wireless signal. WirelessHART pH transmitters, for example, provide data such as slope, offset, and glass and reference impedances, which can help identify a dirty or broken sensor or a sensor nearing the end of its life. Diagnostic information is relayed along with process variables to the plant control system,

providing operators with a quantitative means of evaluating the validity of the pH reading. This level of data sophistication can significantly reduce the risk of an unplanned outage, while preventing unnecessary maintenance cost.

Wireless transmitters are equipped with a high power battery module that lasts several years in most applications.

The future potential of desalination continues to grow. One of the technologies that will contribute to its viability and cost-effectiveness is wireless instrumentation and the emergence of wireless pH and conductivity analyzers represents an effective step. [WWA](#)

This article is written by Mr Joe Covey, senior product manager, Emerson Process Management, Rosemount Analytical Liquid.

HART Communication Foundation supports latest enhancements to Electronic Device Description Language standard

The HART Communication Foundation supports the latest enhancements to Electronic Device Description Language (EDDL) incorporated in the second edition of the International Electrotechnical Commission's IEC 61804-3 standard. EDDL is the key industry standard for integrating real-time diagnostic and asset management information from millions of intelligent field devices for optimum data and device interoperability with automation systems.

"The latest improvements to the EDDL standard benefit users throughout the process automation industry. Devices continue to get more sophisticated and EDDL makes them easier to use, transforming data into information so users can take full advantage of intelligent instrumentation," says Mr Ron Helson, HART Communication Foundation executive director. "The EDDL standard delivers unparalleled ease of use, stability and backward compatibility for industrial automation – ensuring that existing DDs are protected and users have a continuous forward migration path with no investment loss."

Recent improvements to the EDDL standard enhance the integration of intelligent devices with automation systems, specifically:

- support for offline configuration with default parameter values suggested by the device manufacturer to simplify and speed device commissioning;
- support for Unicode character sets, enabling parameter labels, diagnostics, and device manufacturer expert help text to be displayed in many different languages including Chinese,

Japanese, Russian, etc.;

- ability to display all device diagnostics and setup information with rich user friendly graphics for easier and faster completion of commissioning and maintenance tasks; and
- new capabilities to support the display of illustrations based in user preferred language, such as images with explaining text to convey know-how from the manufacturer for help in the interpretation of advanced diagnostics, guide setup and for troubleshooting.

A key element of the HART Communication Protocol since 1990, EDDL is the HART standard and the only technology endorsed by the HART Communication Foundation for configuration, set-up, maintenance and support of HART-enabled devices. With these new enhancements: The EDDL standard remains backward compatible and stable for the long life cycle needs of industrial automation; installed devices and systems remain compatible; EDDL files load and perform on systems in the same way; and updates continue without the problems of executable software.

EDDL is a text-based language standard to describe the unique characteristics of intelligent field devices for integration with systems. The HART Communication Protocol was the first to implement EDDL, enabling suppliers to define their products in a single, open and consistent format readable by the multitude of host applications required by industry including hand-held communicators, control systems, PCs and other process interface devices.