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How experts justify the Cost of Comprehensive SCADA in Drinking Water Plants

Due to their critical role in protecting the health of customers, drinking water treatment systems require a high degree of care and oversight. To this end, many utilities have adopted supervisory control and data acquisition (SCADA) systems to provide advanced monitoring, control, reporting, and alarms management. However, these combinations of hardware, software, and communication networks can be costly to implement and maintain. When considering a SCADA system, utilities have a responsibility to local ratepayers to understand exactly how they hope to improve service and create savings into the future. In this article two water treatment experts, one from the utility world the other from consulting, discuss justifying the cost of comprehensive SCADA systems for drinking water plants.

James Hause is a recently retired Control Systems Manager at the Warren County Water and Sewer Department in Ohio. "My responsibilities included designing and maintaining SCADA systems including computers, PLCs, networking equipment, and a microwave network backbone." Working closely with engineers and operators, Hause developed two water SCADA projects and one wastewater project in the past nine years.

Gordon F. Balcombe is a Process Engineer with ABL Environmental Consultants in Nova Scotia, Canada. He has extensive experience in developing pilot scale treatment studies leading to full scale implementation. Balcombe has hands-on experience in the commissioning, operation, and troubleshooting of a variety of treatment plants and processes, and is a certified Class I Water Treatment Plant Operator.

How are drinking water SCADA systems different from Wastewater systems?

James Hause – "Drinking water systems employ more control functions and monitor inputs to generate alarms. Control functions are usually for well pumps and high service pumps while monitoring is for tank levels, line pressures, and water quality alarms. These controls also provide pacing signals for chemical injection pumps. Wastewater systems seem to be more for plant monitoring with alarms and reporting of the wastewater plant operations."

Gordon F. Balcombe – "Potable water supply systems tend to have more analytical equipment for quality monitoring than wastewater systems. Wastewater plants may monitor a few parameters such as pH, dissolved oxygen, and effluent quality. Potable water treatment processes require the monitoring of various parameters for raw water quality, control parameters at various stages of treatment, and final treated water quality. Automation of equipment has become widespread in current water and wastewater system designs. As a result, monitoring of process performance and alarm indication on equipment faults is critical."

What motivates utilities to adopt comprehensive SCADA systems for drinking water plants?

GB – "In an effort to make potable water supplies safer for the public, government agencies frequently update regulatory requirements for the design and operation of source, treatment, and distribution systems. This makes it essential to have an automated control system with alarm indication capability. The requirement is to have systems in place to ensure that unsafe water does not reach consumers."

JH – "Automatic control of the water plant, distribution system, and well fields are vital to the utility in order for it to provide a quality water product to the customer at an economical cost. The alarm system for pump, tank level, and chemical problems are essential for operators to maintain a water system efficiently."

GB – "In addition to preventative measures, there are new regulations for verification. Routine reporting requires the analysis of key water quality parameters that are observed using online plant instrumentation and are recorded by the SCADA system. Exporting this data in a format suitable for reporting to regulatory authorities with minimal manipulation is an important feature of a well-designed SCADA system."

JH – "All the historical data that is stored in the SCADA system can be used for billing and reports. Engineers and consultants use the historical data to plan for the future needs of the water system."

What are some important considerations when determining what kind of SCADA system you need?

GB – "With water supplies there has to be a high degree of reliability. No system is ever 100% foolproof but, through the use of redundant systems and verification of process response and alarm indication, an acceptable level of reliability must be achieved."

JH – "Never include alarms that are not needed. These alarms may be recurring and meaningless which can cause operators to disregard vital alarms that are needed."

GB – "You don't want a lot of low priority alarms. Warnings are OK, but critical alarms should be reserved for truly critical conditions. Key parameters should be readily available for the operator."

GB – "The ability to save trend groups is important. An operator may routinely look at filter flow rate, headloss, underdrain pressure, and turbidity on a single trend. If they need to sort out an issue quickly, it is valuable to bring these parameters up for each filter with a click."

JH – "The developers must work with the operators to ensure that the graphics and tags are correct. A few engineers and/or operators on your staff should be monitoring the project development daily for screen design and consistence in tag naming."

GB – "Make sure that operators are getting the control functionality they require. We try to make operators an integral part of the startup and commissioning process. By including them at this stage, they not only provide valuable input to developers, they also develop a better understanding of the system. People can only absorb a certain amount of information in a dedicated training session prior to hand over. If the operator has been a part of the implementation process they will retain a much better understanding of the system."

GB – "Add at least one hot backup. We often see SCADA installations on a single computer connected to the control system. There may be a daily backup of data to provide a minimal level of security. However, this can cause a scramble when the computer fails and the HMI needs to be re-loaded. Having a redundant computer simplifies computer maintenance and replacement."

How can utilities recover the cost of new SCADA?

JH – "Mitigating this cost is not difficult. With an alarm call system, plants can go unmanned for longer periods. Alarm monitoring for the plant and distribution systems allowed us to reduce our Environmental Protection Agency manned hours at both water plants saving man hours."

GB – "Remote access to the plant HMI (e.g. Thin Clients) enables operations staff to review alarm conditions and decide if call outs are necessary. In some cases corrective action can be taken without attending the plant in person. In other cases, follow-up adjustments can be made remotely reducing the amount of time on site. A single call out can cost hundreds of dollars in overtime pay. Also, if a remote alarm indication and response prevents the need for a utility to initiate a Boil Water Advisory, they are able to avoid the significant cost of public notification, flushing, resampling, and performing regulatory reporting as well as inconvenience to the public."

JH – "The historical reports and trending allows the engineering staff to review plant and system operation that may increase plant operation efficiency which may result in lowering operational costs. With some power utility cooperation, plants can be automated to run high power consumption equipment during off-peak demand hours, reducing electricity costs."

GB – "One of the biggest advantages of an effective HMI is its use when troubleshooting mechanical or process issues. By layering trends of various parameters over a range of time scales, it is often possible to deduce related events that would otherwise be impossible to observe. For example, the behavior of a piece of equipment may be affecting a process element several hours downstream in the system."

What advice would you give a utility considering this move?

JH – "Utilities need to diligently monitor their computers and software to ensure they are operating correctly and have up-to-date software and virus protection. Computers breakdown and will have viruses. Make sure you have backups of software, applications, and history. We run redundant servers at each plant to provide backup operation and history on all of our systems. Our systems are not directly connected to the Internet. We were able to use our Telecom Department's secure access system to permit key staff members to have access to our SCADA servers via the Internet. Internet security is essential to a SCADA system's reliability."

GB – "We have had a few Municipalities acquire a developers license after the fact once they have learned that they could be capable of making their own enhancements to their HMI. That certainly provides a cost saving for future system maintenance and upgrades."

JH – "Our staff has had SCADA training, so we did our last project in-house. This is only recommended if you have a properly trained staff."

GB – "An application that has been focused on operational requirements may not have a lot of management capability built into it. Some more advanced utilities will take advantage of the data collection to provide management reports for scheduling of maintenance etc. For example, monitoring pump performance over time using head/pressure vs flow data to aid in scheduling replacement and rebuilds."

GB – "On the hardware side, one of the more common cost saving measures is the use of fixed-speed motor controls rather than variable-speed drives. In certain applications, significant energy savings can be achieved using VFD's and appropriate control strategies."

JH – "This is a good time to look into SCADA for a new or upgraded system. Use a consulting engineering firm with a strong presence in SCADA and controls."