Water Security Regulation Compliance Facilitated by Operations Applications

Work Process Management-type solutions help water, wastewater facilities of all sizes develop and implement emergency response plans, lessen security risks and hasten recovery time.

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Introduction

Security at water treatment plants (WTPs) and wastewater treatment plants (WWTPs) has always been of concern to utility operators, but the level of concern in recent years has been magnified by terrorist-related activities around the world. Although water and wastewater systems as a whole continue to enjoy a track record of safety both for human health and the environment, municipal and business leaders are taking heed of government water safety initiatives and bolstering their security-related planning and infrastructure.

This white paper explores the types of security issues that could impact virtually any WTP or WWTP, and how effective use of software solutions can help to prevent security risks from being carried out as well as improving responses to security events.

The changing nature of security risks

The purposeful human contamination of water sources is certainly not a 21st century construct with which water treatment operators and engineers are just now being confronted, but the reality of the 21st century places strong emphasis on terrorist activity that would purposefully contaminate a municipal water system. Indeed, measures in the United States such as the Homeland Security Presidential Directive 9 and Environmental Protection Agency's Water Security initiative focus heavily on criminal human activity, whether by an individual or organized group, that is aimed at widespread harm through contamination of this essential element of social existence.

The overarching issue of water security, it must be remembered, also must include contamination or treatment capacity reduction from a wide variety of natural means as well as the artifacts of economic and residential development, breakdowns in infrastructure and malicious activity by thoughtless individuals such as adolescents who hardly would qualify as terrorists. Examples of these more traditional and widespread threats to the integrity of WTPs include:

- fence or building break-ins that could lead to stolen property
- nitrate contamination by septic tanks
- leaking underground storage tanks (LUST)
- fertilizer, pesticide and animal waste runoff from farms
- mobilization of contaminant ions by stepped-up production well drawdown
- leaking sewerage infrastructure
- hurricanes
- tornadoes
- heavy precipitation events or rapid snowmelt
- algal blooms and infestations by Cryptosporidium, Giardia and other pathogens

- forest and grassland fires that not only directly threaten facilities but also can create water-polluting runoff of firefighting chemicals, soil and ash

WWTPs, almost by definition, are located at the lowest point of a community to take advantage of gravity flow in the collection system. As such, it is not uncommon for WWTPs to be overwhelmed by stormwater during precipitation events or completely flooded when nearby streams overtop their banks.

Due to the criticality of safe drinking water and treated effluent, any type of security threat can have long-lasting impact on humans, aquatic and even terrestrial species, surface water and aquifers. Intentional security breaches of WTPs could, of course, result in acute risk to human health or even deaths. The illegal disposal of hazardous materials to collection systems, though not intended as a terrorist act, could pose a threat to wastewater treatment processes, which in turn could put operators at risk as well as cause noncompliant effluent to be discharged from the facility that would pose an acute threat to human health and environmental safety. Conversely, the risks to human health by natural causes are often chronic in form as a result of slow uptake of low levels of contaminants in the drinking water: the inability of cells to take up oxygen due to nitrification of drinking water; relatively slow absorption of natural contaminants such as arsenic or fluoride; and the slow uptake of low concentrations of heavy metals, pesticides and other induced toxic substances. An emerging area of concern in the water treatment arena is the effect of prescription medications that pass through conventional water treatment processes. As more and more drugs are disposed of into wastewater collection systems, often on the advice of the medical community itself, some researchers are finding increasingly harmful effects on aquatic species and raising concerns about the chemicals' impact on human health.

Few treatment facilities truly safe from risks

With such a wide range of potential security threats, virtually any WTP or WWTP, regardless of size, is susceptible to some level of risk. Some facilities, such as water treatment and storage assets in large metropolitan areas, will certainly be higher value targets for terrorist risk, but no facility should be considered safe from security threats, whether natural or human-caused.

Security risks can be expected to vary due to a variety of factors, including:

- the size of the water or wastewater treatment facility
- whether the utility is public or private
- the number and type (surface or ground) of potable water sources
- the number and type of industrial dischargers to wastewater treatment plants

- the type of treatment processes involved
- geographic location of treatment facilities

Many large water and wastewater utilities have done much already to prevent and prepare for security breach events, often as part of an overarching municipal or corporate security initiative. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 mandates that all U.S. systems with service populations greater than 3,300 are required to prepare an in-depth vulnerability assessment (VA) that examines security risk potential as well as an emergency response plan (ERP) based on the findings of the VA. The Act also requires technological modifications to provide perimeter and appurtenance control, prevent loss of electrical power and communications capabilities and ensure that critical at-risk mechanical assets such as lift stations are not damaged by sudden system stresses.

Conversely, many small facilities are still without VAs and ERPs to provide the planning and guidance needed to make anything more than a seat-of-the-pants response to any given security risk. Whether to bolster an existing security program or to launch one from scratch, one effective means is to leverage the wealth of electronic data available in virtually every treatment and distribution system by means of process and operations automation software systems.

Automation software manages alarms, responses

The first line of defense against many security risks is a human-machine interface/supervisory control and data acquisition (HMI/SCADA)-based alarm system to warn of breaches in the perimeter gates and fencing, sudden failure of critical fixed assets, or contaminant detection by sensors strategically emplaced in the conveyance or distribution systems. Already in place at many utilities for routine O&M purposes, existing SCADA data can be used to protect against many types of security risks as well as facilitate rapid response and corrective action should such an event occur. For a higher level of protection, the HMI/SCADA network can easily be expanded to include security-centric nodes such as closed-circuit television cameras, motion sensors, gate closures, and control room security systems.

A software system such as a Work Process Management system can then turn the SCADA system data into useful security information. For instance, GE's Workflow solution incorporates alarm and event response functionality that not only alerts oper-ators to potential security concerns but also gives guidance on what steps need to be taken in what order to ensure the safety of workers as well as the integrity of the treatment or distribution systems. Such software ensures that proper procedures are followed in every instance, and that any process and operations disruptions can be quickly resolved and brought back online.

GE Workflow also documents information about each secu-rity event, such as time of occurrence, where the alarms were activated, and when operators took action to resolve the issue.

GE Workflow can also be used to provide electronic versions of VAs and ERPs to replace traditional paper copies in binders. These electronic files can be made to be more user-friendly than hard-copy documents, and are instantly available on any HMI monitor. Operators would be able to quickly access the emergency response documents and thus provide a greater level of assurance that their WTP or WWTP will remain in compliance even in the event of a security threat.

Because VA and ERPs should be considered to be living documents with updates made as equipment, service area, regulatory mandates and other critical elements change, Work Process Management software also affords a secure and efficient way for managers to make revisions and immediately broadcast them to all HMI stations.

Employee Response is Critical

Obviously, rapid operator response is of utmost importance during a security threat to a water or wastewater treatment plant. Also important for the efficient operation of any plant, however, is the ability of the operator to quickly discern when an alarm has been triggered by weather, animals, routine equip-ment issues or other low-priority issues.

For example, an undefined breach of the perimeter fencing at a water storage tank could mean anything from a worker failing to secure the gate to someone entering with the intent of poisoning the water supply. Using GE Workflow, the operator at an HMI console in the administration building will receive a high-priority alarm that the operations area of this critical asset has been breached and that the tank itself may have been compromised. In addition, the operator will receive a list of possible causes and instructions to monitor the closed-circuit television camera at the tank. In this simplistic example, the operator may to be able to determine the cause of the alarm without the delay of sending a crew to the site. Operator or law enforcement inter-vention, should it be required, can therefore take place that much more quickly to potentially avert disaster.

The quick employee response afforded by alarm response management instructions is especially critical in situations involving water quality itself. When alarms indicate that a contaminant has been introduced to the conveyance or treat-ment phases of water treatment or that wastewater may be discharged before complete treatment, the software system can speed operator response by displaying on the HMI monitor which valves must be closed in what sequence to prevent the

contaminated flow from entering the water supply or discharge site. The software can then list the emergency response plans that detail what steps must be taken to protect public health and environmental degradation if contamination was released, what mutual aid notifications must be made, and what remediation steps must be taken to correct the process upset. An important measure that utility managers may choose to include in the emergency response instructions is the list of contacts that must be made during a security event, and what guidelines should be followed regarding public information and media relations.

After-action review of any type of security event is of critical importance for regulatory, law enforcement and public health information purposes. The GE Workflow solution documents the nature of the event, what operators did and when they did it.

Work Process Management software can also be an important tool in security training for operators, engineers, and business office personal at WTPs and WWTPs, as well as mutual aide personnel who otherwise would not have an understanding of water and wastewater operations. Such emergency response training can include security awareness, introduction to utility systems and processes for emergency responders, generator operations and understanding the ERP and VA documents.

Conclusion

Whether to respond to an actual security threat or comply with local, state or national security mandates, water and waste-water treatment plant managers, operators and engineers must now incorporate protection of the conveyance, treatment, storage and distribution systems into the normal manner of conducting business. The use of Work Process Management software such as GE's Workflow provides a means of automating much of the security monitoring process, and affords a means of providing critical guidance to personnel in the event of virtually any type of security event.

A major way that software solutions such as GE Workflow from GE can help with risk management issues is the ability to place secure emergency response plans on every HMI monitor for immediate access by all employees. This gives immediate access to all investigative and correc-tive action procedures for all identified security risks, and can dramatically reduce response times as a result. This ready access to ERPs also enhances training both for utility employees and mutual assistance workers who might not normally be exposed to water and wastewater operations.

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