WATER SECTOR LEADS THE WAY IN FACING BIOTERRORISM

Sustainability & Resilience

BY MARIE SHADDEN

ABSTRACT

Look to the water industry if you seek a model for progress in resiliency and sustainability. Comprised of myriad agents devoted to source water protection, drinking water production, and wastewater reclamation, the water sector protects the public health against the threats to clean drinking water represented by bioterrorism as well as the possibilities of natural disaster and industrial accident. In planning and improving operations to enhance protection of the public health since original passage of the Clean Drinking Water Act, the industry is extremely well supported by its multiple professional associations. In the perilous times since September 11, 2001, and the all hazards environment in which we live, the leadership of the U.S. Environmental Protection Agency (USEPA) guides coordination and is a model of the government role in protecting clean water essential to the national economy and public health. Water sector voluntary standards are models for best practice in other critical infrastructure industries.

Photo Credit: FEMA

FEMA officials confer about flooded homes in the Township of Spring Green, Wisconsin. Sewage and infectious algae growth became a major problem in this development of 19 homes, which remained uninhabitable for weeks after a flood in summer 2008. New voluntary standards in the water industry are designed to identify vulnerabilities and prevent catastrophic loss of drinking water systems.

Communities across the nation depend on a number of infrastructure parameters for growth and development. At the top of the list is a reliable, plentiful supply of clean water. Without clean drinking water, reliable removal of wastewater, and sufficient firefighting resources, the very essence of public health is at risk. Bioterrorism, the deliberate contamination of a water supply, is just one of the risks considered and mitigated daily by trained professionals in the water and wastewater industry. Challenges to the essential water and wastewater sectors' mission of protecting public health are rapidly increasing. Vigilance and asset-management principles guiding the industry have generated a healthy respect for emerging threats such as bioterrorism, but the response continues to evolve in ways that effectively show leadership to other sectors in the critical infrastructure. Recent publication of voluntary standards such as RAMCAP demonstrates leadership in preventing catastrophic loss.

This article is approved by the following for continuing education credit: The American Board for Certification in Homeland Security, CHS® provides this continuing education opportunity for those individuals Certified in Homeland Security, who are required to obtain 30 Certification Maintenance Unit's (CMU) per 3-year recertification cycle.

AFTER STUDYING THIS ARTICLE, PARTICIPANTS SHOULD BE BETTER ABLE TO DO THE FOLLOWING:

1. Describe the water/wastewater sector role in the NIPP.
2. List the generally accepted provisions of active security programs in the water sector.
3. Explain the public health significance of voluntary consensus standards applied to safe drinking water.
4. Recognize the seven-step process for resiliency in the water sector known as RAMCAP.
5. Analyze how bioterrorism might impact the public health through the water supply.

KEYWORDS: Bioterrorism prevention, water sector, RAMCAP, resilience, security metrics

TARGET AUDIENCE: Managers and executives in critical infrastructure industries charged with responsibility for security and business continuity plans.

PROGRAM LEVEL: Intermediate

DISCLOSURE: The author has nothing to disclose.

PREREQUISITES: None

Overview

Bioterrorism has long been one of the threats faced by those who protect, produce and maintain the clean drinking water supply. But the events of September 11, 2001, emphasized the need to promote clean water as a component of public health and to recognize unusual disease trends and early warning signs that may result from biological or chemical terrorism. Although the risk is extremely low, attacks could include an assault on water safety. Primary care practitioners throughout the United States were advised to remain as vigilant as water professionals in protecting water resources and their community's health. (American College of Preventive Medicine, 2010). Waterborne or vectored illnesses can impact the vital health of a community in a natural disaster that affects water treatment or production, or in the event of criminal activity such as terrorism–whether the method of terror chosen is physical destruction, interruption of service, or contamination. Dysentery and diarrheal diseases can spread quickly. Typhoid, cholera, leptospirosia and hepatitis A (World Health Organization, 2010a) can decimate a community and place an unacceptably high demand on health providers. The epidemic of cholera in Haiti due to unclean water and post-disaster living conditions had claimed 917 lives among the 14,642 reported (Watson, 2010) cases as of November 15, 2010, and had begun to spread into the Dominican Republic. During the Hurricane Katrina disaster, communities were disabled and families were prevented from returning to their homes due to contamination of water supplies caused by flooding and waterborne illnesses that prevailed in the contaminated waters.

Current preventive measures being used to control the outbreak include treating ill people with oral rehydration solution, providing access to safe water, and encouraging good hygiene and sanitation practices (World Health Organization, 2010b). Without a consistent supply of safe water in the event of a disaster, whether natural or man-made, oral rehydration and good hygiene practices are nearly impossible. Additional threats from lack of clean water are wound infection, dermatitis, conjunctivitis and infections of the ear, nose, and throat.

Considerable progress has been made in the technology of providing clean drinking water to affected populations after a disaster. Mechanical decontamination and purification devices are designed to fit the emergency and are more rapidly available. Military units and the U.S. Army Corps of Engineers rapidly deploy sanitation systems and portable clean water supplies. Bottled water can be shipped to the affected region or stored where interruption of service is anticipated. Even efforts to engineer new ways to desalinate might provide timely solutions to need created by sudden incapacitation of utilities in coastal areas following hurricanes. The U.S military can bring emergency water treatment operations halfway around the globe in rapid deployment.

Conservation, reuse, and recycling are consistent with designs for sustainable water supply and are supported by both the private and public agencies within the water sector.

Fire is a community risk

The drinking water system is also essential to firefighters. The dependence of fire-suppression actions on adequate water supply and transmission lines is unique and hardly deniable, although a community can consider a few alternate sources as it plans for fire protection. Fire departments do have alternatives suitable for isolated building fires, on the one hand, and range or forest fires at the opposite end of the spectrum. What about the intermediate threat? The fires caused by ruptured gas mains in the 1908 San Francisco earthquake were exacerbated by standard methods of fire suppression when water service was interrupted. Consequently, those fires burned unabated until the U.S. Navy was able to position water boats and douse the flames from the bay. Recent fires caused by a ruptured natural gas line decimated a neighborhood in the San Francisco Bay Area. Every year, wildfires destroy homes and property in many Western regions. In many communities, fire departments assist with maintenance of water services by testing pressure in the distribution lines periodically as well as testing the flow and cleaning fire hydrants.

Supplies of safe water in communities enhance homeowner equity, attract growth, and control risk.

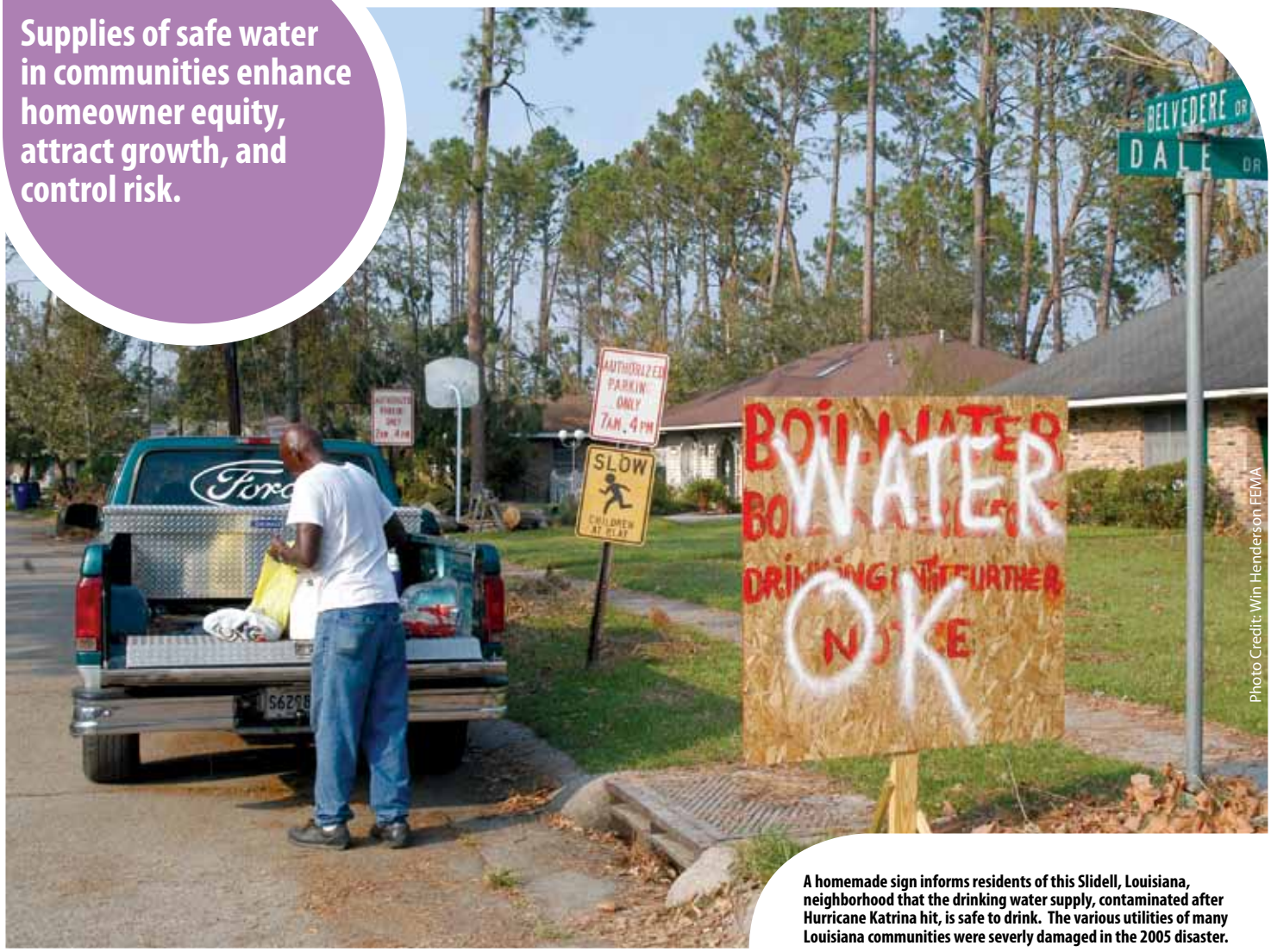

Photo Credit: Win Henderson FEMA

A homemade sign informs residents of this Slidell, Louisiana, neighborhood that the drinking water supply, contaminated after Hurricane Katrina hit, is safe to drink. The various utilities of many Louisiana communities were severly damaged in the 2005 disaster.

Community development, sustainment, and commerce initiatives also depend on a well-managed and productive water treatment and distribution system as well as a wastewater collection system. Conservation, reuse, and recycling are consistent with designs for sustainable water supply and are supported by both the private and public agencies within the water sector. These agencies contribute substantially to public education efforts that encourage such practices. Supplies of safe water in communities enhance homeowner equity, attract growth, and control risk through management of water features and sewerage collection systems. Industrial parks, golf courses and other attractions that make the community more livable and attractive all depend on reclaimed and reused water. Water features as community enhancements become detractive when fouled or defaced and even become a risk to public health if misused or contaminated through criminal acts.

Goals of the National Infrastructure Protection Plan

Safety of our drinking water is a public health issue of the highest order and is largely derived from:

- A national infrastructure of highly motivated water suppliers who take this as a primary goal.
- The U.S. Environmental Protection Agency (USEPA) and the states cooperate with aggressive enforcement programs.
- Federal funding available to assist public water systems (Cotruvo, 2010).

Protection of the public health has a high priority in the National Infrastructure Protection Plan (NIPP) and the water/wastewater industry is subject to oversight and regulation by several government agencies in conduct of routine and emergency operations. Chief among these is the USEPA, which has taken the lead for DHS in advising, assisting and auditing the security progress of the sector supported by state level Departments of Health and Environmental Protection (HHS and EPD). The agencies use the authority of multiple statutes to protect drinking water and sponsor scientific research to foster development of new ways to clean the drinking water, prevent contamination, and reuse existing supplies. The agencies issue and continually revise regulations concerning testing and analysis of the water supply and monitor closely levels of contamination that might indicate a bioterrorist attack among other sources including industry, agriculture and storm water runoff. Recently, the USEPA has added new regulations for acceptable levels of certain contaminates in the water supply (Cotruvo, 2010).

The industry is blessed with utility executives, professional water operators and managers, and active participation and leadership from professional associations such as the American Water

Photo Credit: Win Henderson FEMA

Plumbers prepare piping and connectors for use in the construction of a sewage treatment system to process 47,500 gallons daily to serve a 550-unit temporary housing site at Baker, Louisiana, in the aftermath of Hurricane Katrina. The 2005 disaster demonstrated the importance of integrating water systems into the National Infrastructure Protection Plan.

Water use and wastewater reclamation is of such consequence to communities that the states permit and regulate these functions to protect and distribute fairly what is already fast becoming a scarce resource.

Works Association (AWWA), Water Environment Federation (WEF), American Public Works Association (APWA), National Rural Water Association (NRWA), Water Quality Association, the National Clean Drinking Water Advisory Council, the Association of Metropolitan Sewerage Agencies, and very many others.

Public law supports resiliency and preparation

With enactment of Public Law 107-188, Public Health Security and Bioterrorism Preparedness Response Act of 2002, the Safe Drinking Water Act (title XIV) of the Public Health Service Act were amended to include terrorism and intentional acts and require that utility executives conduct vulnerability assessments using security standards and create emergency response plans (Public Law 107-188, 2002). Clearly, lawmakers meant to enhance security of this precious resource and critical infrastructure. Since water utilities completed the mandated vulnerability assessments several years ago in compliance with Public Law 10-188, progress that serves as a model for other industry sectors has been made due in large part to the leadership, professionalism, and creativity of executives and workers within the sector, both public and private. There are several outstanding examples of the leadership exercised by the professionals in the water sector for those in other critical infrastructure industries, but, unfortunately, until quite recently very little of the millions of dollars required to improve security in the water sector have come from the federal government infrastructure protection programs.

HSPD-7, The National Infrastructure Protection Plan, was taken very seriously by the water industry in general, and industry interests were specifically represented by the host of professional associations. Given the general federal mandate to protect critical infrastructure assets and manage risk by detection, deterrence, mitigation, and minimizing consequences, the water industry began a long process to incorporate protection or redundancy throughout their systems and areas of responsibility. In addition to physical security and hardening, the methods selected to support the NIPP are: increasing the level of awareness among employees and customers, reducing the attractiveness of water targets, cyber security, crime prevention by environmental design (CPTED), training and exercises, redundancy, sharing information and mutual aid agreements (Morley, 2010c).

The USEPA established the Water Security Initiative in response to Homeland Security Presidential Directive 9, under which the agency must "develop robust, comprehensive, and fully coordinated surveillance and monitoring systems, including international information, for…water quality that provides early detection and awareness of disease, pest, or poisonous agents" (USEPA, 2010).

Progress in phased approach

USEPA implemented the Water Security Initiative in three phases.

- A conceptual design for timely detection and response to water contamination to mitigate public health impact.
- A demonstration of contamination warning systems through pilot programs at drinking water utilities.
- The development of practical guides and promotion of voluntary standards for comprehensive contamination warning systems (USEPA, 2010).

Efforts to protect the public health and improve sustainability in the sector have been supported predominantly by ratepayers, municipal bonds, revolving state funds, and grant authorities across the country. The risk of financial loss is high for a water utility that fails to protect itself or offer proof that plans and management create resiliency in the face of constant threats from diverse sources. Utilities have found that planning with an all hazards approach is more efficient than creating divergent, overly specific and perhaps even contradictory plans.

Water use and wastewater reclamation is of such consequence to communities that the states permit and regulate these functions to protect and distribute fairly what is already fast becoming a scarce resource. Critical interdependencies among water resources are becoming public knowledge, which in some ways contributes to the bioterrorism threat and the risk of other criminal activity. Efforts to conserve water have become a standard of "greening" and serve an important role in educating the public about water scarcity. On the positive side, educating the public has also created avenues for the public to participate in protection and surveillance as well as conservation. The USEPA sponsors a program called "Water Watchers" comprised of neighbors trained in ways similar to Neighborhood Watch groups, only with specific goals concerning local plants, treatment centers, pump stations and other components.

Water and wastewater utility executives formulate plans to serve their customer needs–demands that impact both the available resources with critical interdependencies and the public health itself. According to Craig Riley, the Vice Chair of the Water Environment Federation's Water Reuse Committee, climate change is affecting collection and management of the resource (Jackson, 2010). Groundwater is being withdrawn in densely populated developed areas much faster than it is replenished. Water reuse is an essential concept for protecting public health challenges in the face of threats from the all hazards environment. Many readers will be surprised to learn that enormous quantities of water are treated, used, and disposed of to support the needs of a large metropolitan area, despite single source of supply or diminishing capacity. For example, the Miami-Dade area of Florida has 3.2 million customers using 347 million gallons per day (Jackson).

Plan for risk reduction

An important part of the vulnerability assessment process that evolved from Public Law 107-188 is risk reduction (Spence, Ross, and Tuzzoli, 2010). Capital improvement plans across the water

Leadership by water-sector professionals led to advances in standards for resiliency and security.

Photo Credit: Adam DuBrowa FEMA

A 7.2 magnitude earthquake in June 2010 struck the water treatment tanks and damaged massive resevoirs in Calexico, California. FEMA, Cal EMA, and local officials inspected the structures for cracks and damages associated with Public Assistance (PA) emergency protective measures.

Workers at Gulfport, Mississippi, decontaminate search and rescue vehicles returning from flooded areas in the aftermanth of Hurricane Katrina. All vehicles must be decontaminated upon returning to base, since flood water carries disease and toxins.

sector are currently being adapted to reduce risk, manage the expected life cycle of major assets, and plan for business continuity. Utility managers well understand the historic risk of natural disaster but had not previously grasped the threat represented by terrorism and criminal activity. They soon imagined the impact that sudden and unanticipated loss would create in their communities. A voluntary standard addressing physical security and contamination was issued as ANSI/AWWA G-430-09, Security Practices for Operations and Management.

Additionally, the intervening years brought disasters that reinforced the fact that catastrophic consequences can spring from natural disasters and industrial accidents as well. In recent years, prudence has demanded the best use of the scarce funding available to build resiliency and sustainability into the water and wastewater sector considering an All Hazards environment. AWWA took a leadership role in adapting security best practices for the water industry, including how and where to seek additional funding. In 2008, the association published a white paper concerning critical funding issues and lessons learned from those who had made progress in their efforts to secure their systems and resources (Spence, et al, 2010).

The water and wastewater industries gradually moved away from simply buying and installing security hardware and hiring guards, although these mainstays certainly bridged a gap until capital improvement projects could be handled within the asset management and budget processes (Shadden, 2006). Security professionals were welcomed into the water industry and carried with them additional experience and best practices in physical protection that blended with organization culture, asset management, disaster preparedness, plant and personnel safety, customer service, and business continuity to promote continuous improvement of security in the sector. The overall result and affect is a systematic layered security that will be familiar to military readers expressed in terms of interlocking secure zones or distributed area defense.

Technicians, long familiar with electronic monitoring of the plant operations, called Supervisory Control and Data Acquisition (SCADA) systems, appreciated the leverage over physical security that could be managed by coordinating the systems, and some water utilities quickly adapted. Sensitive to Internet security issues, most water systems kept their SCADA systems separate from any network but could foresee how their own centralized control system could be enhanced by incorporating and coordinating security measures. SCADA systems routinely coordinate actions within the plant, such as stopping and starting pumps, opening and closing valves, and shutting down the operation in reaction to emergencies. It is perhaps a small step to incorporate data collected from security receptors as well. Some utilities prefer to separate the two control systems to provide additional security for the SCADA system itself and to prevent possible virus intrusion from exterior connections (AWWA, 2010). It is of increasing importance to prevent, detect and deter cyber crime. Executives, managers, employees, and customers who had perhaps never previously considered security dynamics developed new protocols and interventions designed specifically for appropriate use in the water and wastewater utility environment. The "outsiders" typically came from security backgrounds, but many in advisory capacities also came from law enforcement. The infusion of this perspective gave rise to industry recognition and eventually a

more widespread cognizance of water system employee performance as first responders as defined by the Homeland Security Act of 2002 and the Homeland Security Presidential Directive 8 (Spence et al, 2010).

First responders

Historically, "first responders" were so considered because they arrived first on the scene of an event, usually one that required immediate control by police or fire agencies. But with the mandated use of the National Incident Management System (NIMS) and nearly a decade of natural and industrial disasters in which interdependencies were striking, the concept of first responder has expanded and certainly includes water and wastewater essential operators. After all, it can be quite difficult to suppress fire in an environment in which the water system has also been impacted, as in the case of earthquake, ice storm or flooding. This sad truth is evident in reports of homes or businesses burning even as the storm rages or flood waters rise. Leaking water lines have been known to cause sinkholes that threaten public safety and commerce without the swift interdiction of skilled repair crews, and contamination quickly follows without skilled intervention by chemists and water treatment technicians. The inclusion of the Federal Emergency Management Agency (FEMA) within the Department of Homeland Security (DHS) in 2003 contributed to the expansion of the first responder concept as well, since FEMA brought with it the perspective of preparation, response and recovery in addition to the initial homeland security perspective of prevention and response.

Utility managers well understand the historic risk of natural disaster but had not previously grasped the threat represented by terrorism and criminal activity.

Improved business continuity planning, along with improvements in asset management strategies, highlighted the many ways in which public and private enterprises within public health, energy, fire services and the environment are highly interdependent. The water industry has taken several initiatives collectively, led by the professional associations, and which, in turn, inform other industries as to "lessons learned" in the process. Leaders in the professional associations are volunteers for the most part from the industry and are experienced in both private companies and public entities. Safety core competencies of water professionals are generally highly developed due to the emphasis for generations on safety and quality of the water supply. The general desirability of safety concepts afforded a sturdy bridge to building a security culture. There are also many water operators, distribution managers, maintenance and security/safety managers with experience in other industries applying considerable potential for cross feed, information sharing and expansive contact networks. The leadership, thus having the benefit of volunteers of this caliber, offers the advantage of very strong advisory voice to informing lawmakers, regulators, and governing bodies, when called upon. There is also continuous collaboration with other interested professional association members, such as the American Society for Industrial Security (ASIS). State management of certain aspects of the water industry–for example, EPD allocation of permits for water use and licensing of technicians such as operators–gives rise to further collaboration with State Emergency Management Agencies (EMA), Homeland Security (HSD) and National Guard units that respond to disasters.

This network of collaboration is useful for informing and validating the business continuity planning process. One of the initiatives emerging from the collaborative network exchanging new ideas was the establishment of mutual assistance or aid entities that were more formalized than previous goodwill and good business practices. Military units have historically used formalized mutual aid plans as attachments to larger security plans. Another initiative was the early establishment of a Water Information Sharing and Analysis Center (ISAC). These information-sharing centers were created by several industries in the late 1990s, and the water industry was ready to stand up its version in December 2002.

Mutual Assistance and WARN

If Water ISAC informed the industry about what had, in fact, happened at other plants and systems throughout the country, the business continuity planning process advised utility executives of their capacity to continue operations during extended emergencies. Plans were made and business continuity-based exercises (as opposed to emergency-response exercises) tested and validated the plans given these interdependencies. Redundancy was enhanced with strategies to continuously improve resiliency, including layering prevention techniques such as:

Water Watchers in addition to sensors, redundant vendors to sustain essential supply lines including contracts in place, redundant intakes in addition to physical security of existing intakes, and contamination detector devices scattered throughout the system in addition to traditional sampling.

Agencies and utilities, both privately and publicly owned, built mutual aid plans, encouraged by the USEPA, and subscribed to Water Assistance Regional Networks (WARN). Employees practiced the plans drawn up, and tabletop exercises gave shift workers unusual training opportunities, and they added their own observations. AWWA worked diligently to guide the formation of these WARNs across the country, capitalizing on the association ability to traverse easily the public and private domains (Blankenship and Morley, 2008). The WARN system has proven dramatically effective in regional disasters such as the Nashville flooding of May 2010, floods along the Missouri River, and hurricane impact zones in Florida and the Gulf Coast. WARNs are one of the ways mutual assistance has enhanced resiliency within the water critical infrastructure, without requiring much additional funding. The stickiest issues involve payment and health insurance, particularly when utility employees in one system cross from the public to private sector or travel outside of traditional governed boundaries to afford assistance. Unwilling to volunteer or denial of assistance is very rarely heard.

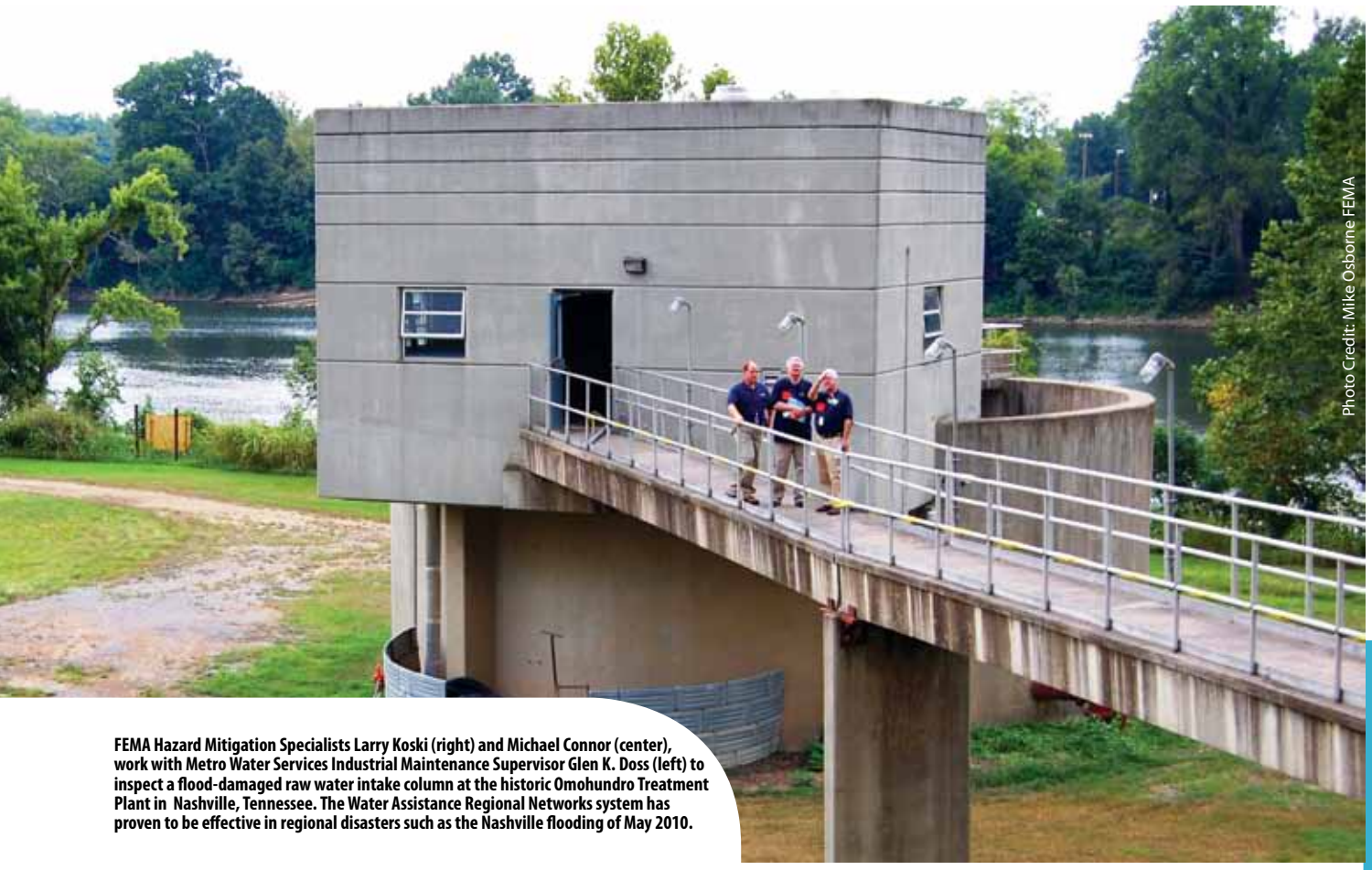

Photo Credit: Mike Osborne FEMA

FEMA Hazard Mitigation Specialists Larry Koski (right) and Michael Connor (center), work with Metro Water Services Industrial Maintenance Supervisor Glen K. Doss (left) to inspect a flood-damaged raw water intake column at the historic Omohundro Treatment Plant in Nashville, Tennessee. The Water Assistance Regional Networks system has proven to be effective in regional disasters such as the Nashville flooding of May 2010.

Design Improved

Another initiative within the water industry was the adaptation of Crime Prevention Through Environmental Design (CPTED) and security engineering in the design process. Water producers and distributors and wastewater collectors and reclamation operations have both plant operations and transportation requirements. Added to those factors is an active and often-vocal consumer base having point-of-sale, environmental and educational interest in the sites where drinking water is produced and wastewater is reclaimed. These plants are often built in or near residential areas, or residential areas become populated around them. Distribution and collection systems traverse the area, passing through neighborhoods and business districts. It is not possible to prevent the public from using or accessing some of the utility operations and facilities. Indeed, isolating the plants would be unacceptably costly both in terms of physical security and lost public relations and educational opportunities. AWWA has provided facility security guidance for new plants and facilities and has encouraged the use of physical security design to harden facilities and systems against outright attack and unique traffic flow and camouflage techniques to "hide in plain view" critical components of the system. Asset management projects brought about extensive appropriate use of RFID tags for control of stock and supplies, and GPS for fleet management among other innovations. GIS was soon incorporated for various needs related to the security of the water sources, flood plains and wetland protection (Carl, 2010). Web-based applications improved the speed with which a drinking water utility could respond to complaints and incidents within the distribution and storage system.

Homeland Security Funding

DHS grants remain one of the primary ways of accessing government funding for security improvement of the critical infrastructure, but this source of funding has so far been stressed to support improvements for fire, police, emergency medical and emergency management agencies. The DHS announced in 2010 that $1.8 billion will be made available in the coming federal fiscal year budget to continue strengthening protection, prevention, response and recovery within the critical infrastructure (Spence et al, 2010). Allocated and distributed mostly through the states, awards recently have been made to water sector utilities. Water and wastewater executives are becoming more knowledgeable of these grants, in addition to bonding and ratepayers, as a funding source. DHS grants carry the general caveat that the applicant agency must be trained and proficient in the use of the Incident Command System (ICS) and the National Incident Management System (NIMS). This is an effective way of insuring that all those agencies, including utilities and public works that respond to disasters such as Hurricane Katrina, are ready and able to fully par-

ticipate and immediately work with one another. The requirement creates a standard for communicating with other agencies and interacting with them with the level of professional skill needed during emergency operations. By 2005, utilities started to engage and become active participants in local and regional emergency response exercises in order to be more fully prepared. No doubt other first responder agencies learned a great deal from this interaction as well. From there it was a short step to creating functional and regional preparedness exercises that included or even began with water industry vulnerabilities. Though perhaps unwelcome at first, not bred from the "thin blue line," water utilities began to participate in local coordinating committees and Urban Area Security Initiative grant working groups.

Performance metrics for water security systems emerged through industry collaboration as one component of the "Active and Effective Security Program" guidance developed by the Water Security Working Group (WSWG) of the National Drinking Water Advisory Council (NDWAC) and published in that group's report in May 2005.

The DHS announced in 2010 that $1.8 billion will be made available in the coming federal fiscal year budget to continue strengthening protection, prevention, response and recovery within the critical infrastructure

The USEPA recognized and accepted the industry voluntary standards, published in February 2006. "Ultimately, the goal of implementing the 14 security features recommended by the NDWAC is to create a significant improvement in water security on a national scale, by reducing vulnerabilities, and therefore risk to public health from terrorist attacks and natural disasters. To create a sustainable effect, the sector as a whole must not only adopt and actively practice the features, but also incorporate the features into "business as usual" (USEPA, 2006).

By taking the threat seriously, and accepting many recommendations of DHS, the industry had succeeded in establishing professional credibility, a unified approach and maintained independence in setting reasonable standards for achieving water security throughout the nation. The final security measures were palatable and viable for large urban utilities as well as smaller rural districts.

Along with credibility in homeland security, the water industry also gained a reputation for reliability in applying or adapting security principles and concepts that are viable for unique and essential requirements. To this end, the association produced a "design guide" for security products and services to provide common acceptable specifications and guidance for water industry applications (AWWA, 2009). The specifications carried in the association's design guide express the best collective judgment for risk reduction with the most economy. Design guides contain references for both materiel and performance and are often used as the basis for project specifications. The guide was written us-

Features of An Active and Effective Water Security Program

1. Make an explicit and visible commitment of the senior leadership to security.
2. Promote security awareness throughout the organization.
3. Assess vulnerabilities and periodically review and update vulnerability assessments to reflect changes in potential threats and vulnerabilities.
4. Identify security priorities and, on an annual basis, identify the resources dedicated to security programs and planned security improvements, if any.
5. Identify managers and employees who are responsible for security and establish security expectations for all staff.
6. Establish physical and procedural controls to restrict access to utility infrastructure to only those conducting authorized, official business and to detect unauthorized physical intrusions.
7. Employ protocols for detection of contamination consistent with the recognized limitations in current contaminant detection, monitoring, and surveillance technology.
8. Define security-sensitive information, establish physical and procedural controls to restrict access to security-sensitive information as appropriate, detect unauthorized access, and ensure information and communications systems will function during emergency response and recovery.
9. Incorporate security considerations into decisions about acquisition, repair, major maintenance, and replacement of physical infrastructure; this should include consideration of opportunities to reduce risk through physical hardening and the adoption of inherently lower risk design and technology options.
10. Monitor available threat-level information; escalate security procedures in response to relevant threats.
11. Incorporate security considerations into emergency response and recovery plans, test and review plans regularly, and update plans as necessary to reflect changes in potential threats, physical infrastructure, utility operations, critical interdependencies, and response employees, response protocols in partner organizations.
12. Develop and implement strategies for regular, ongoing security related communications with external organizations and customers.
13. Forge reliable and collaborative partnerships with communities, managers of critical interdependent infrastructure, and response organizations.
14. Develop utility-specific measures of security activities and achievements, and self assess against these measures to understand and document program progress.

NDWAC Final Report May 2005

ing different perspectives including engineering, security, budget and legal review. The general format is that of the Construction Specification Institute and related Master Format, thus acquiring a common vocabulary, technical approach and organization.

Voluntary standards accepted by the industry

The water sector has produced a number of voluntary consensus standards, including many that outline safety and security procedures for a number of chemicals used in the industry. Others among the 196 standards and 52 manuals issued by AWWA since 1881 promote the development of critical performance measures (Morley, 2010c). The water sector was one of the first to transpose its operational history of measurable criteria into a series of measurable results for security programs as outlined in the 14 steps of an active security program. ANSI/AWWA G430: Security Practices for Operations and Management defines minimum requirements for protective programs at drinking water and wastewater utilities (Morley, 2010b). In it, enhanced measurable criteria are outlined for employee safety, public health, public safety and public confidence in the safety of drinking water. Bottled water campaigns notwithstanding, U.S. tap water ranks among the safest and best tasting in the world. The standard documents a long-standing practice in the water sector for a multi-barrier approach to security resulting in achieving measurable goals and objectives related to the safety of the drinking water and the environment. Actually, this system of interlocking and multiple barriers is also recognized in the security plans for military operations and has been largely adopted for critical infrastructure sectors by the DHS.

Steps Explained in the RAMCAP Standard

- Asset Characterization
- Threat Characterization
- Consequence Analysis
- Vulnerability Analysis
- Threat Likelihood Analysis
- Risk/Resilience Analysis
- Risk/Resilience Management

RAMCAP Sustainability and Resiliency

The latest product in a long process of support for the industry's continuous improvement in business continuity planning and risk reduction is the publication of JS-100, RAMCAP, Standard for Risk and Resilience Management of Water and Wastewater Systems in 2010. (RAMCAP is Risk Analysis and Management for Critical Asset Protection.) It was developed in partnership with the American National Standards Institute (ANSI) and American Society of Mechanical Engineers Innovative Technologies Institute. The standard training programs and introductory workshops are available through AWWA. Go to *http://www.awwa.org/standardj100* and *http://www.awwa.org/ramcaptraining*.

This standard pushes forward progress toward achieving sustainability and resiliency throughout the industry and is an approach that promises to further unify regions, both urban and rural. The standard was developed with a grant from DHS. The standard describes a seven-step process that is familiar to those who have been working in the security profession for any length of time. But this iteration is comprehensive in terms of reducing risk within the water sector, regardless of the size or ownership of the utility. It is more than the sum of its parts. Implementing the standard means that business continuity plans will not sit idly on the engineer or security bookshelf, but will become "the way we do business."

Basically, a *best practices* application of business continuity models, the seven processes or "steps" in RAMCAP follow:

- **Asset Characterization** in which the critical assets are determined by establishing the absolute essentials that protect the public health.
- **Threat Characterization** by which is meant winnowing out the worst case but reasonably imagined scenarios.
- **Consequence Analysis** uses metric techniques to calculate loss and its impact on the community, including replacement time and cost.
- **Vulnerability Assessment** is used to determine which industrial, mechanical, cyber or human weaknesses inherent in the system would be most attractive to criminal exploitation or most susceptible to loss in other catastrophic events.
- **Threat Assessments** require the cooperation of law enforcement officials and basically indicate the likelihood that the water system is at realistic or specific risk of attack.
- **Risk/Resilience Assessment** is a mathematical calculation applying weighted measures to such factors as the consequences, likelihood, asset and vulnerability.
- **Risk/Resilience Management** is an active executive function of cost-benefit analysis and a rational discussion of options and alternatives with consideration of fiscal reality. (Morley, 2010a).

Standards are not law. The standards developed and produced by AWWA represent a consensus of opinion within the industry that adherence to the specifications or guidance will produce a satisfactory result. Together, the body of standards and specifications provides a foundation for current best practices, especially but not limited to construction and purchasing. The opinion is based upon collective experience, which, within the water industry, is extensive. A lot of hard work has gone into examining best practices and affirmative application despite the variety in size and ownership of the water utilities. The standards are generally developed by dedicated volunteers in committee and subjected to formal peer review and a uniform approval process. For RAMCAP, AWWA joined with ANSI and ASME-ITI in developing the reference standard for the water industry (Mercer, 2010). The industry is doing no less than "owning" security for this facet of public health by issuing such a voluntary consensus standard. Leadership of this sort cannot be appreciated nor could it have been exercised without the past decade's experiences ingrained in corporate memory from imposition of vulnerability assessments by law through several natural disasters and other incidents, work-

ing through business continuity planning concepts, and even seemingly endless cycles of change management at the utility level. But at a time when other critical infrastructure is only now accepting the challenges ahead of them, there is enormous value in the efficiency of absorbing the lessons to be learned.

Because there are always limited resources to post against competing demands, RAMCAP emphasizes selective differentiation of risks that can be mitigated or reduced and which can be accepted. That leaves planning resources available for managing the consequences of unacceptable risk, which may not have been imagined or cannot be treated with today's technology. Budget deficiencies also become a part of the planning process.

Guidance from USEPA updated

Recently, the USEPA revised earlier guidance and tools. The agency increased its regulation of total coliform, a measure of contamination present in drinking water, and reduced acceptable levels. A number of tools are available from the agency as well as many of the professional associations. Among some of the most useful are: the Vulnerability Self Assessment Tool (VSAT), an upgraded all hazards risk assessment tool; and The Water Health and Economic Analysis Tool (WHEAT), a consequence analysis tool. A compendium of other useful guides, tools and public information concerning water security can be found on the Association of State Drinking Water Administrators (ASDWA) Critical Infrastructure Protection web site.

The water industry is making progress in resiliency and sustainability. In taking dramatic steps to protect the public drinking water supplies and thereby the public health over the past 10 years, the industry is extremely well supported by its professional associations, and the USEPA has exercised considerable leadership in carrying out its mission during perilous times and the All Hazard environment in which we live. Surely it is an industrial role model.

References

American College of Preventive Medicine (2010). Recognizing waterborne disease and health effects of water pollution. In *Physicians On-line Reference Guide*, retrieved from www.waterhealthconnection.org

American Water Works Association (2009). *G430-09 Standard for Security Practices for Operations and Management,* STG, and U.S. Environmental Protection Agency, *Product Design Guides,* Safewater. Retrieved from http://www.epa.gov/safewater/watersecurity/initiative.cfm

American Water Works Association (2010). Water transmission and distribution, 4th edition. Denver: Author.

Blankenship, L., & Morley, K. M. (2008). Security and preparedness – Building a business case for WARN participation. *Journal AWWA*, *100*(11), 36-38, 40.

Carl, T. (2010, October). Old dog new tricks, *American City and County,* 40-42.

Cotruvo, J. A. (2010). A new regulatory strategy for implementing the SDWA. *Journal AWWA, 102*(10), 55.

Jackson, N. M. (2010, October). I'll drink to that: Wastewater and seawater are filling glasses across the country. *American City and County,* 36.

Mercer, K. (2010, November). How should I apply AWWA standards in specifications? *AWWA Opflow,* 6-7.

Morley, K. M. (2010a, January 13). Security and preparedness standards [presentation to the USEPA Security Partners Meeting].

Morley, K. M. (2010b). Security and preparedness – Advancing the culture of security and preparedness in the water sector. *Journal AWWA, 102*(6), 34-37.

Morley, K. M. (2010c, October 20). AWWA security and preparedness program manager: Introducing J100 RAMCAP [Webinar].

National Drinking Water Advisory Council (2005, May 18). *Water Security Working Group Findings* [Presentation].

Public Law 107-188, Public Health Security and Bioterrorism Preparedness Response Act of 2002, the Safe Drinking Water Act (title XIV) of the Public Health Service Act.

Shadden, M. (2006, January-February). Best practices: Reducing risk by optimizing physical security, *Water Utility Infrastructure Management (UIM).*

Spence, S., Ross, J., & Tuzzoli, C. (2010). Snagging funding for security, emergency response and resiliency projects. *Journal AWWA, 102*(10) 34-36.

Watson, I. (2010, November 15). Protests over Haiti's cholera outbreak turn violent. *CNN.* Retrieved from http://articles.cnn.com/2010-11-15/world/haiti.cholera_1_cholera-outbreak-peacekeeping-force-cholera-epidemic?_s=PM:WORLD

World Health Organization (2010a). Cholera, retrieved from http://www.who.int/mediacentre/factsheets/fs107/en/print.html

World Health Organization (2010b). Cholera in Haiti, retrieved from http://www.who.int/mediacentre

U.S. Environmental Protection Agency (2010). Water security initiative, *Safewater*, retrieved from http://www.epa.gov/safewater/watersecurity/initiative.cfm

U.S. Environmental Protection Agency, Office of Water (2006). *Active and Effective Water Security Programs,* EPA 817-K-06_001, www.epa.gov/watersecurity

Other Resources

Buck, George, Ph.D, *Preparing for biological terrorism, An emergency services guide,* Thomson Learning, Albany, NY, 2002.

Fennelly, Lawrence J, *Effective physical security,* 3rd Ed, Elsevier Inc, Burlington, MA, 2002.

Fisher, Donald C, Ph.D, *Homeland security assessment manual, a comprehensive organizational assessment based on Baldridge criteria,* ASQ Quality Press, Milwaukee, WI, 2005

Hogan, Aden Jr. and DeBoer, Jon, *Infrastructure security planning in an unstable world, a public official's guide*, American Water Works Association, 2005, 108 p.

States, Stanley PhD, *Security and emergency planning for water and wastewater utilities,* AWWA, 2010, 310p.

American Water Works Association Research Foundation (AWWARF), prepared by O'Brien and Gere Engineering, Inc., *Actual and threatened security events at water utilities*, 2003.

Association of State Drinking Water Administrators, blog *Security Notes*, Collection of Critical Infrastructure water protection web site.

AWWA Manual M19, *Emergency planning for water utilities,* 4th Edition. 2001.

Congressional Research Service (CRS), *Terrorism and security issues facing the water infrastructure sector,* May 26, 2009.

USEPA, Office of Water (4601M), *Active and Effective Water Security Programs,* EPA 817-K-06-001, February 2008.

ABOUT THE AUTHOR

MARIE SHADDEN writes for homeland security government and private enterprise clients. She has expertise in business continuity and security planning and training. A Lieutenant Colonel in the USAF, she served as a squadron commander and installation police chief. She earned recognition as an outstanding manager of security operations. She holds the CHS-IV, an MPA in Criminal Justice Administration from GGU and a BA in Criminology from the University of California, Berkeley. She holds certificates in Technical Training from AU and Incident Command from FEMA. She has authored numerous articles, reviews, government reports and training manuals.