AUGUST 2013

Securing Critical Control Systems in the Water Industry Where Do I Start?

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Executive Summary

Public health and safety depend on the availability and reliability of water systems. Cyber attacks on information technology (IT) networks are well known, but attacks on the control systems used to monitor and control plant processes are increasing in frequency and in their potential threat to public safety. The highly sophisticated Stuxnet worm discovered in 2010 was the first publicly known malware to specifically target industrial control systems used in critical infrastructure. Stuxnet is proof that potential threats to critical infrastructure can no longer be ignored.

IT professionals are responsible for ensuring the availability and security of enterprise networks. However, protecting an IT network from a cyber attack can be very different from protecting an industrial control system. As a result, plant engineering and operations will need to take an active role in developing a security plan to protect critical control systems that will minimize the potentially adverse impact of a cyber event on public health and safety. For many, the greatest challenge in developing a security plan is knowing where to begin.

This paper will review existing and emerging threats to critical infrastructure and the potential impact of cyber events on water systems. It will provide an overview of industry standards, guidelines and recommendations and other available resources to aid in the development of a utility security plan essential for protecting critical assets.

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Introduction

Computer networks are attacked millions of times a day. Reports of cyber attacks on IT networks are a common occurrence, yet many attacks go unreported for a variety of reasons, including avoidance of negative publicity. Successful cyber attacks go undetected or are detected only after the damage has been done. Malicious attacks leading to data breaches can result in significant costs to both individuals and organizations. Cyber threats can range from unsophisticated attacks by individuals to concerted, state-sponsored attacks that can pose serious economic threats to large populations.

"U.S. said to be target of massive cyber-espionage campaign" (*The Washington Post*, February 10, 2013) A new intelligence assessment has concluded that the United States is the target of a massive, sustained cyber-espionage campaign that is threatening the country's economic competitiveness. Cyber-espionage, which was once viewed as a concern mainly by U.S. intelligence and the military, is increasingly seen as a direct threat to the nation's economic interests.[1]

Attacks on critical infrastructure, including water systems, occur regularly as well and can have a profound impact on the public's security, safety and economic well-being. In the past, cyber threats to control systems were of limited concern, given the proprietary nature of legacy systems and the relatively isolated environments in which they operated. Much has changed in the past two decades.

The use of open communication standards such as Ethernet has greatly increased interconnectivity between control systems and IT networks. There are many benefits realized through increased information flow between control networks, business systems and public networks. However, increased connectivity also has allowed well-known and commonly exploited vulnerabilities in the IT world to migrate into process control networks. This increases the likelihood and severity of attacks on critical control and supervisory control and data acquisition (SCADA) systems. Cyber attacks on industrial control systems (ICS) are increasing in frequency, and more alarming, there has been a dramatic change in the threat scenario of potential attacks.

Over the last few years the threat of a cyber attack on critical infrastructure has taken on greater importance with the discovery of a highly sophisticated malware (malicious software) known as Stuxnet.

Stuxnet – Cyber Weapon of Mass Destruction[2]

In the summer of 2010, reports of problems with nuclear centrifuges at the Natanz facility in Iran led to the discovery of Stuxnet. Security experts determined that the control system used to monitor and control the centrifuges had been infected with malware, causing the centrifuges to self-destruct. The malware, dubbed Stuxnet, is unique because it is the first known malware that specifically targets industrial control components. More important, unlike other malware, the intent of Stuxnet was not to steal sensitive data but to do physical damage to a real-time control system.

Ralph Langner, a German control system security consultant, and his team were involved in deciphering the structure and purpose of Stuxnet. Mr. Langner describes Stuxnet as "…rocket science. Like nothing we've ever seen before." Given the apparent purpose of Stuxnet, Mr. Langner called it a "cyber weapon of mass destruction."[2]

Because of its complexity, Stuxnet was believed to be a state-sponsored effort. Although no nation officially took credit for Stuxnet, it has been reported that Stuxnet was part of a cyber campaign conducted by the United States and Israel against Iran.[3] According to reports in the *New York Times*, Stuxnet was the result of a program started under the Bush administration and accelerated by President Obama during the early part of his administration. The cyber attacks had been underway for some time; however, a coding error in one variant of the malware allowed Stuxnet to escape the Natanz facility in the summer of 2010 and spread throughout the world via the Internet.

Since that time, two other cyberweapons related to Stuxnet have been identified – Duqu and Flame. Although different from Stuxnet in their nature and intended purpose, Duqu and Flame are believed to have been developed as part of the same campaign as Stuxnet.[4]

Some utilities might consider the threat of a state-sponsored attack unimportant due to the low probability of its occurrence. The real threat of cyber weapons such as Stuxnet is that "Pandora's box" has been opened. Now copycat attackers could use readily available malicious code as a blueprint to attack critical infrastructure in target-rich countries such as the U.S.

In an interview with Steve Kroft on a CBS *60 Minutes* segment entitled "Stuxnet,"[5] retired Gen. Mike Hayden, former head of the National Security Agency and CIA director under George W. Bush, said, "We have entered into a new phase of conflict in which we use a cyber weapon to create physical destruction, and in this case, physical destruction in someone else's critical infrastructure." Stuxnet is proof that the threat of cyber attacks on critical infrastructure can no longer be ignored.

In 2012, former Defense Secretary Leon Panetta warned that the United States is increasingly vulnerable to a cyber attack on critical infrastructure by an aggressor nation or extremist group. As an example Panetta said an attack could contaminate the water supply in major cities or shut down the power grid across large parts of the country, causing significant casualties or economic damage. According to Panetta the most destructive possibilities involve "cyber-actors launching several attacks on our critical infrastructure at one time, in combination with a physical attack." He said the results would be a "cyber-Pearl Harbor that would cause physical destruction and the loss of life, an attack that would paralyze and shock the nation and create a profound new sense of vulnerability."[6]

Protecting Critical Infrastructure

The Department of Homeland Security (DHS) is responsible for protecting and ensuring the continuity of critical infrastructure and key resources (CIKR) of the United States. Homeland Security Presidential Directive 7 (HSPD-7) established U.S. policy for enhancing protection of CIKR. This directive established a framework to identify, prioritize and protect the nation's CIKR from terrorist attacks. It identified 18 CIKR sectors, including the water sector. This sector includes both drinking water and wastewater utilities, which are vulnerable to a variety of attacks, including cyber attacks.

A key component in protecting critical infrastructure is protecting the control and SCADA systems used to monitor and control plant processes. At the direction of DHS, the U.S. Computer Emergency Readiness Team (US-CERT) established the Control Systems Security Program (CSSP). This program aims to reduce industrial control system risks within and across all CIKR sectors by coordinating efforts among federal, state and local governments, as well as ICS owners, operators and vendors. The CSSP coordinates activities to reduce the likelihood of success and severity of impact of a cyber attack against critical infrastructure control systems through risk-mitigation activities.

Threats to Water System

An attack on a critical control system used in a water process can significantly alter the system's performance and negatively impact public health and safety. In their report, "Roadmap to Secure Control Systems in the Water Sector," [7] the Water Sector Coordinating Council (WSCC) highlights some of the ways a cyber event could impact water system operations. The Council identified potentially adverse effects a cyber event could have on water systems (see Figure 1).

To ensure the availability and reliability of water systems, control systems and SCADA networks must be protected against cyber attacks. It is important to understand the threats and associated risks to control systems in order to establish a plan for protecting critical assets.

Cyber Threats for Industrial Control Systems

Establishing a plan to protect ICS from cyber attack begins with understanding the source of potential attacks. The US-CERT Control System Security Program (CSSP) referenced previously defines a cyber threat to an ICS as "a person or persons who attempt unauthorized access to a control system device and/or network using a data communications pathway. This access can be directed from within an organization by trusted users or from remote locations by unknown persons using the Internet. Threats to control systems can come from numerous sources, including hostile governments, terrorist groups, disgruntled employees, and malicious intruders." [8]

A critical point is that a cyber threat can come not just from outside the organization, but from inside as well, even by a trusted user. This point is reinforced by the fact that Stuxnet is believed to have been introduced into the Iranian nuclear plant on a USB memory stick. A security strategy of maintaining an "air gap" between critical control networks and the outside world does not fully address the threat of cyber attacks. A comprehensive plan to reduce the threat of cyber attack on control systems and networks must consider all possible threats.

How Can Cyber Events Affect Water Systems?

Cyber events can affect water system operations in a variety of ways, some with potentially significant adverse effects in public health. Cyber events could do the following:

- Interfere with the operation of water treatment equipment, which can cause chemical overdosing or underdosing
- Make unauthorized changes to programmed instruction in local processors to take control of water distribution or wastewater collection systems, resulting in disabled service, reduced pressure flows of water into fire hydrants, or overflow of untreated sewage into public waterways
- Modify the control systems software, producing unpredictable results
- Block data or send false information to operators to prevent them from being aware of conditions or to initiate inappropriate actions
- Change alarm thresholds or disable them
- Prevent access to account information
- Although many facilities have manual backup procedures in place, failures of multiple systems may overtax staff resources — even if each failure is manageable in itself
- Be used as ransomware

Figure 1: How Can Cyber Events Affect Water Systems?[7]

Why Control Networks Need Security

Cyber attack is only one of many threats to ICS. Preventing or minimizing the possibility of any action, intended or otherwise, that impacts the availability and reliability of a critical control system should be a priority. A variety of cyber events can impact system performance, including:

- ***Technical defects:*** Hardware problems resulting in broadcast storms that overload the network and limit access to control functions and data
- ***Human errors:*** Improper operation of system, introduction and dissemination of malware or phishing, resulting in reduced system reliability or loss of sensitive data
- ***Malware (malicious software):*** Harmful software that negatively impacts system operation or loss of data
- ***Intended, targeted attacks from inside and outside:*** Sabotage, espionage, white-collar crime or cyber terrorism resulting in loss of control, or denial-of-service of critical systems, loss of sensitive data, extortion or theft-of-service

These same threats also apply to IT networks; however, the associated risks have far different implications for control networks used in critical infrastructure. When a critical system is disabled or its reliability diminished, the results can lead to:

- Loss of control over critical functions negatively impacting public health and safety and the environment
- Loss of compliance with regulatory directives resulting in fines or litigation
- Damage to public image or loss of public confidence
- Denial-of-service, resulting in economic losses

Developing a Security Plan for Control Systems – Where Do I Begin?

When developing a security plan to protect critical control and SCADA systems, it is important to remember that cyber security is not an absolute. It is not a “safe” versus “unsafe” matter. Security is a matter of degree.

Additionally, because of limits to resources such as funding and personnel, it is neither practical nor feasible to mitigate all threats. There will always be risks associated with any plan. Asset owners and operators must determine acceptable levels of risk and establish an appropriate plan to mitigate known vulnerabilities. Further, because control systems and networks change over time, utilities must reassess risks and vulnerabilities on a recurring basis and revise security plans as needed.

Standards, Guidelines and Recommendations

Although there are no specific directives in the water sector for securing ICS, there are numerous standards, guidelines and recommendations that are useful in developing a security plan for protecting critical control systems as part of an overarching security plan.

The ANSI/AWWA G430-09 standard: Security Practices for Operation and Management provides a framework for establishing a security plan.[9] Its purpose is to define the minimum requirements for a protective security program for a water or wastewater utility that will promote the protection of employee safety, public health, public safety and public confidence. The standard defines a security plan as a comprehensive plan developed by the utility, which includes its security goals, objectives, strategies, policies and procedures. The security plan should coordinate closely with the utility's Emergency Preparedness Plan and Business Continuity Plan. A key point of the standard is the establishment of an **explicit commitment to security.**

> Section 4.1.1 Explicit and visible commitment of senior leadership to security: The utility shall establish an explicit, visible, easily communicated, enterprise-wide commitment to security.[9]

Given the rapid change of cyber threats to ICS, an effective, sustainable security plan to protect critical systems requires a commitment to security supported by policies, procedures and personnel.

The G430-09 standard addresses various aspects of security such as intrusion detection and contamination detection. The standard also addresses protection of critical, security-sensitive and information systems that are essential to the efficient and continuous operation of a utility. The G430-09 standard recommends the Roadmap to Secure Control Systems in the Water Sector[7] as an aid in evaluating ICS or SCADA vulnerabilities and for strategies in securing critical control systems.

Roadmap to Secure Control Systems in the Water Sector

The Roadmap to Secure Control Systems in the Water Sector (Roadmap) was developed by the Water Sector Coordinating Council (WSCC) Cyber Security Working Group (CSWG) with support from the Department of Homeland Security National Cyber Security Division and American Water Works Association (AWWA). The Roadmap considers many variables for mitigating vulnerabilities and reducing risks to control systems in the water sector.

The purpose of the Roadmap is to:

- Define a consensus-based framework that articulates strategies to manage and reduce risks to ICS
- Produce a broad-based plan for improving security preparedness, resilience and response/recovery of ICS
- Guide efforts of industry, academia and government to plan, develop and implement ICS security solutions
- Promote extensive collaboration among key stakeholders to accelerate ICS security in the water sector

The key provision of the Roadmap is to define a strategy for securing ICS in the water sector. The Roadmap outlines the vision, challenges, goals, milestones and end state of this strategy. As noted in the Roadmap, by implementing this strategy “industry leaders believe that within ten years (by 2018) ICS throughout the water sector will be able to operate with no loss of critical function in vital applications during and after a cyber event.

Vision for Securing Industrial Control Systems in the Water Sector

In ten years, industrial control systems for critical applications will be designed, installed and maintained to operate with no loss of critical function during and after a cyber event.

Figure 2: Roadmap — Vision for Securing ICS in the Water Sector[7]

This vision confronts the formidable technical, business, operational, and societal challenges that lie ahead in strengthening the resilience of critical systems against increasingly sophisticated cyber attacks.” [7]

The G430-09 standard provides a framework for developing an overarching security plan for a utility, while the Roadmap highlights general strategies for securing critical control systems. They are not meant to be a recipe for securing ICS. Asset owners and operators require a more prescriptive standard for developing a comprehensive security plan for industrial automation and control systems.

ISA99 Security for Industrial Automation and Control Systems

The Industrial Automation and Control Systems committee (ISA99) of the International Society of Automation (ISA) produces standards, recommended practices, technical reports and related information defining procedures for implementing electronically secure manufacturing and control systems, and security practices for assessing electronic security performance. The ISA99 committee is continuing development of a multipart standard and technical reports focused on cyber security for industrial automation and control systems (IACS). Part 1 of the series was released in 2007 as an American National Standards Institute (ANSI) document and outlined the ISA99 series as shown in Figure 3. Part 1 serves as the foundation of the series and defines the terminology, concepts and models that are referenced throughout the standard.

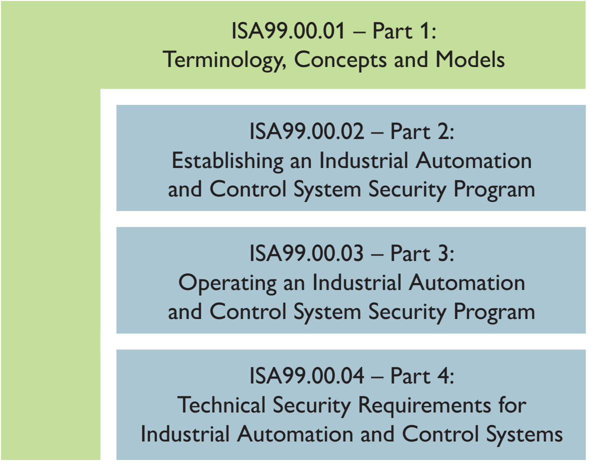

ISA99.00.01 – Part 1:
Terminology, Concepts and Models
ISA99.00.02 – Part 2:
Establishing an Industrial Automation and Control System Security Program
ISA99.00.03 – Part 3:
Operating an Industrial Automation and Control System Security Program
ISA99.00.04 – Part 4:
Technical Security Requirements for Industrial Automation and Control Systems

Figure 3: The ISA99 Series for IACS Security

ANSI/ISA-99.01.01-2007	Terminology, Concepts and Models
ANSI/ISA-TR99.01.02-2007	Security Technologies for Industrial Automation and Control Systems
ANSI/ISA-99.02.01-2009	Establishing an Industrial Automation and Control System Security Program
ISA-99.02.02	Operating an Industrial Automation and Control System Security Program (in development)
ISA-99.03.xx	Technical Security Requirements for Industrial Automation and Control Systems (in development)

Table 1: The ISA99 Series: Security for Industrial Automation and Control Systems[10]

With the release of the ANSI document in 2009 of what had been known as Part 2, there have been minor revisions in the designations of the standard's segments. Table 1 lists the components of the ISA99 series as currently defined.

Three parts of the series have been released as ANSI documents. The other two are currently under development. The ISA99 series also serves as a foundation for the IEC 62443 series of the same title being developed by the International Electrotechnical Commission (IEC).[10] The ISA99 standard is being relabeled to align with the IEC designations. In the future, the ISA standard will be designated as ISA-62443-xx.xx; however, the nomenclature of the ISA99 standards will be maintained for continuity purposes.

The ISA99 series provides guidance for those designing, implementing or managing control systems as well as users, system integrators, security practitioners, and control systems manufacturers and vendors. The purpose of the standards is to improve the confidentiality, integrity and availability of components or systems used for manufacturing or control and provide criteria for procuring and implementing secure control systems.[11]

ANSI/ISA-99.01.01-2007 (ISA-62443.01.01) Terminology, Concepts and Models

This standard describes the basic concepts and models relating to cyber security and serves as the basis for the other parts of the ISA99 series. It focuses primarily on industrial automation and controls and SCADA systems used in critical infrastructure industries such as water and wastewater. In addition to defining key concepts and terminology the standard provides a series of models that can be used in the design of a security program. These control and SCADA system models are used to identify security needs at a level of detail necessary to address security issues with a common understanding of the framework and vocabulary.[12]

ANSI/ISA-99.02.01-2009 (ISA-62443.02.01) Establishing an Industrial Automation and Control System Security Program

This standard describes the elements contained in a cyber security management system (CSMS) for use in the IACS environment and provides guidance on how to develop those elements. These elements are primarily related to policy, procedures, practice and personnel and are grouped into three main categories:

- Risk analysis
- Addressing risk with the CSMS
- Monitoring and improving the CSMS

As noted in the standard, it is not the intent of the standard to specify a particular sequential process for identifying and addressing risk that incorporates these elements. Thus, an organization will create such a process in accordance with its culture, organization, and the current status of its cyber security activities.[10] However, to assist organizations with application of the standard, an example of a process for identifying and addressing risk is provided, as well as a step-by-step guide that an organization can reference as it begins to establish a cyber security management system.
The first main category of a CSMS is “Risk analysis” that includes risk identification, classification and assessment. There are a number of risk assessment methodologies available on the market that identify and prioritize risks related to IACS assets. A free Cyber Security Evaluation Tool (CSET) available from DHS is discussed later in this paper.

The second main category is “Addressing risk with a CSMS.” This category contains the bulk of the CSMS requirements and is divided into three element groups:

- Security policy, organization and awareness
- Selected security countermeasures
- Implementation

The third main category is “Monitoring and improving the CSMS.” Elements in this category ensure that the CSMS is being used and its effectiveness reviewed on a regular basis.

Assessing Risk

Developing an actionable plan for protecting critical systems begins with understanding vulnerabilities and associated mitigation strategies. There are a variety of assessment tools available to aid in this process.

Risk is defined as a function of the likelihood of an event, vulnerability to the event, and the consequence of the event. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 required water utilities serving more than 3,300 people to perform security vulnerability assessments.[13] Various methodologies were developed or adopted by industry groups to conduct these vulnerability assessments for utilities. These methodologies assess the general security posture of a utility and are instrumental in helping asset owners and operators make informed decisions on resource allocation to mitigate risk in the most efficient manner possible.

Risk assessment tools are available to aid in the evaluation of IACS as well. A useful tool from DHS is the Cyber Security Evaluation Tool (CSET) that assists organizations in protecting their key cyber assets. CSET is a stand-alone, desktop software tool that guides users through a step-by-step process to assess their control system and IT network security practices against recognized industry standards. The output from CSET is a prioritized list of recommendations for improving the cyber security posture of the organization's enterprise and industrial control cyber systems. CSET is available from the DHS National Cyber Security Division as a download or DVD.

RAMCAP®

Cyber risk assessment tools such as CSET are useful in securing critical control systems, and thus help to protect critical infrastructure. However, asset owners may want a more holistic security methodology, one that mitigates risk for "all hazards," both naturally occurring and intended attacks. The Risk Analysis and Management for Critical Asset Protection (RAMCAP®)[13] Standard for Risk and Resilience Management of Water and Wastewater Systems meets that need. RAMCAP is a process for analyzing and managing the risks to critical infrastructure associated with intended attacks, such as a cyber attack, and naturally occurring hazards such as hurricanes and tornadoes.

As part of a RAMCAP analysis, risks from specific reference threat scenarios can be quantified to assess options for reducing these elements of risk. This process allows for evaluation of the benefit (changes in threat likelihood, vulnerability and/or consequences) versus the cost of a specific countermeasure or mitigation option. As a result, decisions on resource allocation can be made based on the benefit-to-cost ratio, ensuring the most efficient use of resources to protect critical assets.

One of the RAMCAP reference hazards is sabotage, either by physical attack or a cyber attack. In both scenarios the attack can be quantified as an attack by an insider or by someone outside the organization. By including cyber attacks as a reference hazard, RAMCAP ensures that all hazards are considered when developing a security plan.

SAFETY Act of 2002

As part of the Homeland Security Act of 2002, the Support Anti-Terrorism by Fostering Effective Technologies (SAFETY) Act was enacted to encourage the development and deployment of products and services that could prevent or mitigate a terrorist attack by providing legal protections from potential liabilities stemming from a terrorist attack. The Act provides unprecedented immunities, liability protections, caps and other incentives for approved entities who use, supply, design, manufacture, provide or are otherwise involved in preventing, deterring, mitigating, responding to or recovering from a terrorism event.[14] The AWWA G430-09 and J-100 standards have been given SAFETY Act designation. As a result, they can provide certain protections for municipalities that employ the standards.

Summary

The Department of Homeland Security identified the water sector as one of the critical infrastructures and key resources essential to the nation's security, public health and safety, economic vitality and way of life. Protecting critical infrastructure from the threat of cyber attack has become more challenging due to the increased connectivity between critical control systems and enterprise networks. Cyber attacks on control and SCADA systems are increasing in frequency and severity. Stuxnet is proof that threats to critical assets cannot be ignored. Industry standards, guidelines and recommendations are useful aids for developing strategies for protecting industrial automation and control systems. Risk analysis and management methodologies for the water industry are essential tools for establishing security plans for critical asset protection and resource allocation. The development of comprehensive security plans will help to ensure the availability and reliability of water systems in the future.

List of Acronyms

AWWA	American Water Works Association
CIKR	Critical Infrastructure and Key Resources
CSET	Cyber Security Evaluation Tool
CSMS	Cyber Security Management System
CSSP	Control System Security Program
CSWG	Cyber Security Working Group
DHS	Department of Homeland Security
HSPD-7	Homeland Security Presidential Directive – 7
IACS	Industrial Automation and Control Systems
ICS	Industrial Control System
IEC	International Electrotechnical Commission
IT	Information Technology
RAMCAP®	Risk Analysis and Management for Critical Asset Protection
SCADA	Supervisory Control and Data Acquisition
US-CERT	U.S. Computer Emergency Readiness Team
WSCC	Water Sector Coordinating Council

References

[1] Nakashima, Ellen, *The Washington Post.* "U.S. said to be target of massive cyber-espionage campaign." February 10, 2013.

[2] "Ralph Langer: Cracking Stuxnet, a 21st century cyber weapon." TED2011 TALKS. <http://www.ted.com/talks/ralph_langner_cracking_stuxnet_a_21st_century_cyberweapon.html>.

[3] Sanger, David E., *The New York Times.* "Obama Order Sped Up Wave of Cyberattacks Against Iran." June 1, 2012. <http://www.nytimes.com/2012/06/01/world/middleeast/obama-ordered-wave-of-cyberattacks-against-iran.html?_r=1&pagewanted=all>.

[4] Perlroth, Nicole, *The New York Times.* "Researchers Find Clues in Malware." May 30, 2012. <http://www.nytimes.com/2012/05/31/technology/researchers-link-flame-virus-to-stuxnet-and-duqu.html?_r=1>.

[5] Steve Kroft. "Stuxnet" CBS News *60 Minutes*. Aired March 4, 2012. <http://www.cbsnews.com/8301-18560_162-57390124/stuxnet-computer-worm-opens-new-era-of-warfare/?tag=contentMain;contentBody>.

[6] Bumiller, Elisabeth & Shanker, Thom, *The New York Times.* "Panetta Warns of Dire Threat of Cyberattack on U.S." October 11, 2012. <http://www.nytimes.com/2012/10/12/world/panetta-warns-of-dire-threat-of-cyberattack.html?pagewanted=all&_r=0 >.

[7] Water Sector Coordinating Council Cyber Security Working Group. "Roadmap to Secure Control Systems in the Water Sector." March 2008. <http://www.awwa.org/Portals/0/files/legreg/Security/SecurityRoadmap.pdf>.

[8] US Computer Emergency Readiness Team. Cyber Threats Source Descriptions. <http://www.us-cert.gov/control_systems/csthreats.html>.

[9] ANSI/AWWA G430-09 (First Edition) Standard: Security Practices for Operation and Management (Effective date: May 1, 2009).

[10] ANSI/ISA-99.02.01-2009: Security for Industrial Automation and Control Systems, Part 2: Establishing an Industrial Automation and Control System Security Program (approved January 13, 2009).

[11] ISA99, Industrial Automation and Control Systems Security. <http://www.isa.org/MSTemplate.cfm?MicrositeID=988&CommitteeID=6821>.

[12] ANSI/ISA-99.00.01-2007: Security for Industrial Automation and Control Systems, Part 1: Terminology, Concepts, and Models (approved October 29, 2007).

[13] ANSI/ASME-ITI/AWWA J100-10 (First Edition) Standard: Risk Analysis and Management for Critical Asset Protection (RAMCAP®) Standard for Risk and Resilience Management of Water and Wastewater Systems (Effective date: July 1, 2010).

[14] Support Anti-Terrorism by Fostering Effective Technologies (SAFETY) Act. (Approval date: Feb. 14, 2012). <https://www.safetyact.gov/>.

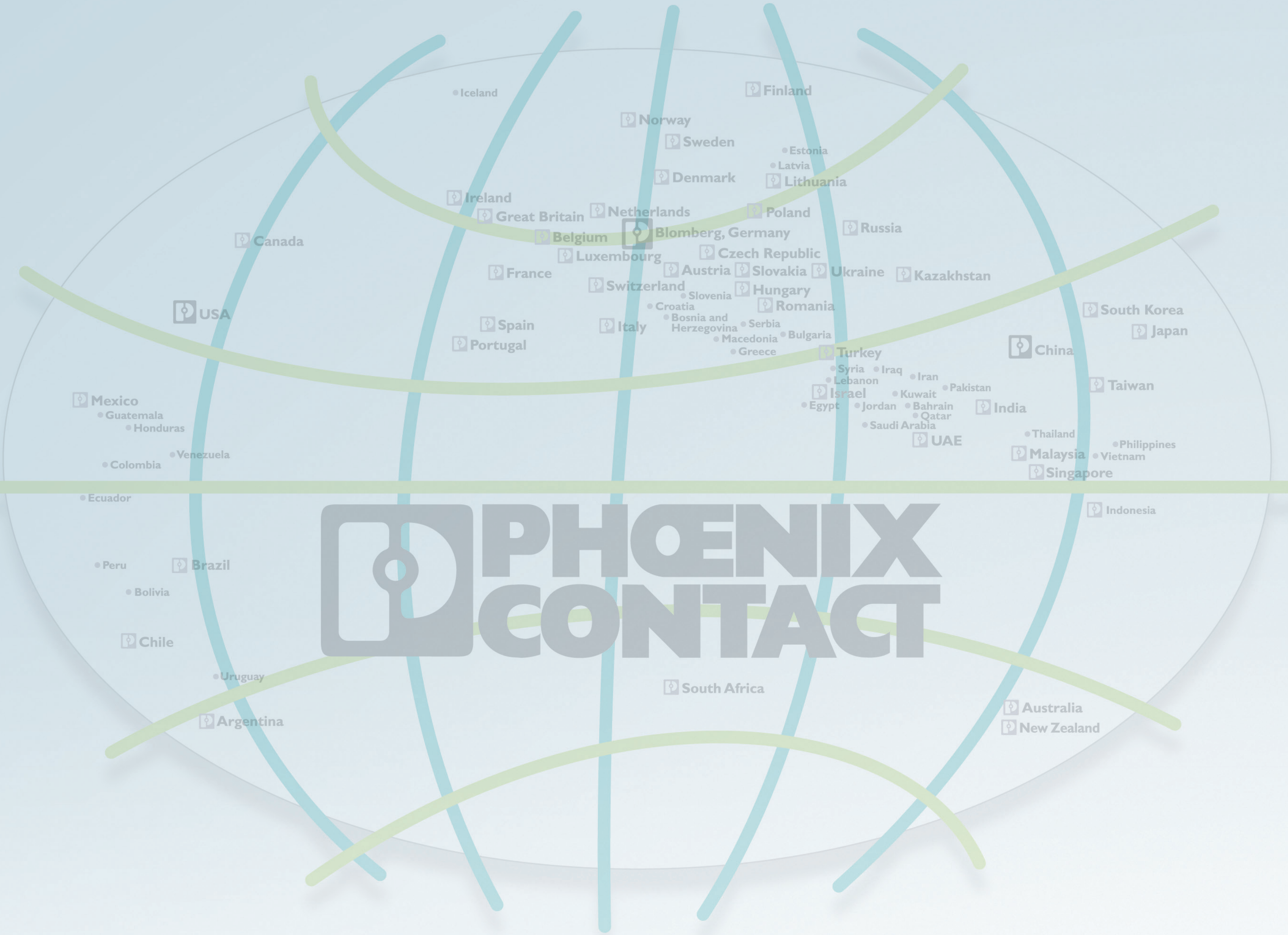
Resources for Additional Information on Protecting Control Systems

Department of Homeland Security: Protecting Critical Infrastructure
http://www.dhs.gov/files/programs/gc_1189168948944.shtm
Homeland Security Presidential Directive 7 (HSPD-7) established U.S. policy for enhancing protection of Critical Infrastructure and Key Resources (CIKR) by establishing a framework to identify, prioritize and protect the nation's CIKR from terrorist attacks. The directive identified 17 CIKR sectors and designated a federal Sector-Specific Agency (SSA) to lead CIKR protection efforts in each. The Environmental Protection Agency (EPA) is the federal lead for the Water Sector's critical infrastructure protection activities. All EPA activities related to water security are carried out in consultation with DHS and the EPA's Water Sector partners. The Water Sector includes both drinking water and wastewater utilities that are vulnerable to a variety of attacks, including cyber attacks. Successful attacks would impact public health and economic vitality.

U.S. Computer Emergency Readiness Team (US-CERT)
http://www.us-cert.gov/
US-CERT is the operational arm of the National Cyber Security Division (NCSD) at the Department of Homeland Security (DHS). It is a public-private partnership. The NCSD was established by DHS to serve as the federal government's cornerstone for cyber security coordination and preparedness, including implementation of the National Strategy to Secure Cyberspace. US-CERT is charged with providing response support and defense against cyber attacks for the Federal Civil Executive Branch (.gov) and information sharing and collaboration with state and local government, industry and international partners. US-CERT interacts with federal agencies, industry, the research community, state and local governments, and others to disseminate reasoned and actionable cyber security information to the public.

Control Systems Security Program (CSSP)
www.us-cert.gov/control_systems/
The goal of the DHS National Cyber Security Division's Control Systems Security Program (CSSP) is to reduce industrial control system risks with and across all critical infrastructure and key resource sectors by coordinating efforts among federal, state, local and tribal governments, as well as industrial control systems owners, operators and vendors. The CSSP coordinates activities to reduce the likelihood of success and severity of impact of a cyber attack against critical infrastructure control systems through risk-mitigation activities.

US-CERT Cyber Security Evaluation Tool (CSET)
http://www.us-cert.gov/control_systems/satool.html
The Cyber Security Evaluation Tool (CSET) is a DHS product that assists organizations in protecting their key cyber assets. CSET is a desktop software tool that guides users through a step-by-step process to assess their control system and IT network security practices against recognized industry standards. The output from CSET is a prioritized list of recommendations for improving the cyber security posture of the organization's enterprise and industrial control cyber systems. CSET is available from the DHS National Cyber Security Division, on DVD.



Our Crucial Water Supply

Water is an essential natural resource that needs to be actively protected and preserved. To help accomplish this, Phoenix Contact is constantly expanding our offering of innovative products that are the foundation of effective and sustainable solutions for managing water resources.

Phoenix Contact offers a wide range of product and application solutions for secure, scalable industrial networks, remote connectivity and reliable power to ensure the availability and reliability of control and SCADA systems for water management.

ABOUT PHOENIX CONTACT

Phoenix Contact develops and manufactures industrial electrical and electronic technology products that power, protect, connect and automate systems and equipment for a wide range of industries. Phoenix Contact GmbH & Co. KG, Blomberg, Germany, operates 50 international subsidiaries, including Phoenix Contact USA in Middletown, Pa.

For more information on Phoenix Contact and its solutions for the water industry, visit http://www.phoenixcontact.com/water

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