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American Society of Civil Engineers

Guidelines for the Physical Security of Water Utilities

ANSI/ASCE/EWRI 56-10

Guidelines for the Physical Security of Wastewater/Stormwater Utilities

ANSI/ASCE/EWRI 57-10

This document uses both the International System of Units (SI) and customary units.

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ANSI/ASCE 3-91 Standard for the Structural Design of Composite Slabs and ANSI/ASCE 9-91 Standard Practice for the Construction and Inspection of Composite Slabs
ASCE 4-98 Seismic Analysis of Safety-Related Nuclear Structures
Building Code Requirements for Masonry Structures (ACI 530-02/ASCE 5-02/TMS 402-02) and Specifications for Masonry Structures (ACI 530.1-02/ASCE 6-02/TMS 602-02)
ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures
SEI/ASCE 8-02 Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members
ANSI/ASCE 9-91 listed with ASCE 3-91
ASCE 10-97 Design of Latticed Steel Transmission Structures
SEI/ASCE 11-99 Guideline for Structural Condition Assessment of Existing Buildings
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ASCE/EWRI 13-05 Standard Guidelines for Installation of Urban Subsurface Drainage
ASCE/EWRI 14-05 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage
ASCE 15-98 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)
ASCE 16-95 Standard for Load Resistance Factor Design (LRFD) of Engineered Wood Construction
ASCE 17-96 Air-Supported Structures
ASCE 18-96 Standard Guidelines for In-Process Oxygen Transfer Testing
ASCE/SEI 19-10 Structural Applications of Steel Cables for Buildings
ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations
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ANSI/ASCE/T&DI 21.4-08 Automated People Mover Standards—Part 4
SEI/ASCE 23-97 Specification for Structural Steel Beams with Web Openings
ASCE/SEI 24-05 Flood Resistant Design and Construction
ASCE/SEI 25-06 Earthquake-Actuated Automatic Gas Shutoff Devices
ASCE 26-97 Standard Practice for Design of Buried Precast Concrete Box Sections
ASCE 27-00 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction
ASCE 28-00 Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction
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EWRI/ASCE 33-09 Comprehensive Transboundary International Water Quality Management Agreement
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EWRI/ASCE 35-01 Guidelines for Quality Assurance of Installed Fine-Pore Aeration Equipment
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SEI/ASCE 37-02 Design Loads on Structures during Construction
CI/ASCE 38-02 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data
EWRI/ASCE 39-03 Standard Practice for the Design and Operation of Hail Suppression Projects
ASCE/EWRI 40-03 Regulated Riparian Model Water Code
ASCE/SEI 41-06 Seismic Rehabilitation of Existing Buildings
ASCE/EWRI 42-04 Standard Practice for the Design and Operation of Precipitation Enhancement Projects
ASCE/SEI 43-05 Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities
ASCE/EWRI 44-05 Standard Practice for the Design and Operation of Supercooled Fog Dispersal Projects
ASCE/EWRI 45-05 Standard Guidelines for the Design of Urban Stormwater Systems
ASCE/EWRI 46-05 Standard Guidelines for the Installation of Urban Stormwater Systems
ASCE/EWRI 47-05 Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems
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ANSI/ASCE/EWRI 56-10 Guidelines for the Physical Security of Water Utilities
ANSI/ASCE/EWRI 57-10 Guidelines for the Physical Security of Wastewater/Stormwater Utilities
ASCE/T&DI/ICPI 58-10 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways

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FOREWORD

These guidelines were developed as a joint effort between the American Society of Civil Engineers (ASCE) and the American Water Works Association (AWWA) with technical input from the Water Environment Federation (WEF), in accordance with ASCE Rules for Standards Committees, and were published initially as a proposed draft, *Guidelines for the Physical Security of Water Utilities* (ASCE/AWWA/WEF 2006). That consensus process included balloting by a balanced Standards Committee and reviewing during a public comment period. The provisions of this document have been written in permissive language and, as such, offer to the user a series of options or instructions but do not prescribe a specific course of action. Significant judgment is left to the user of these documents.

These guidelines use customary units with the International System of Units (SI) in parentheses. This approach was in the best interest of ASCE, AWWA, and WEF at the time of development of the initial Draft of these guidelines.

PURPOSE OF THE GUIDELINES

These guidelines apply to physical security for facilities used in potable water source, treatment, and distribution systems.

BACKGROUND OF THE DEVELOPMENT

Highlights related to the creation of all the Water Infrastructure Security Enhancements (WISE) guidance documents and/or standards in the early years of the twenty-first century are summarized below:

1. Under the U.S. Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL 107–188), drinking water utilities serving more than 3,300 customers were required to conduct vulnerability assessments (VAs) of their water systems. The VAs often recommended security improvements to reduce the risk of malevolent acts (such improvements may also reduce the risk associated with natural events). Similar requirements for wastewater utilities have yet to be promulgated, but the protection of wastewater utility facilities using similar approaches has been promoted by the U.S. Environmental Protection Agency (USEPA) and various industry organizations. In addition, ASCE, AWWA, and WEF agreed to work together to develop materials to assist in the implementation of security recommendations and the overall improvement of water and wastewater infrastructure security. The project was funded by USEPA under a cooperative agreement to foster public/private partnership in water and wastewater security. This project was known as the USEPA Water Infrastructure Security Enhancements (WISE) Project.
2. The three organizations each became responsible for a portion of the project: AWWA led the drinking water supply, treatment, and distribution systems effort; WEF led the wastewater and stormwater collection, treatment, and disposal systems effort; and ASCE led the effort concerning the methodology and characteristics pertinent to design of contaminant detection and monitoring systems for both water and wastewater systems.
3. Phase 1 of the USEPA WISE project focused on the creation of Interim Voluntary Security Guidance documents (ASCE/AWWA/WEF 2004a, 2004b, 2004c). The purpose of these documents was to provide a centralized starting point for utilities as they integrate modern security practices into the management, operation, construction, or retrofit of their water, wastewater, and stormwater systems. Training materials were developed in Phase 2 to disseminate the information contained in the Phase 1 guidance documents.
4. Under the direction of USEPA, Phase 3 focused solely on the development of physical security guidelines for water, wastewater, and stormwater facilities. These voluntary consensus guidelines were first developed as the Draft and were published initially as *Guidelines for Physical Security for Water Utilities* (ASCE/AWWA/WEF 2006). The primary reviewers were members of the Water Supply Subcommittee of the ASCE WISE Standards Committee (SC), and the USEPA/ASCE/AWWA/WEF WISE Project Phase 3 Team.
5. The sections compiled in these guidelines are intended to provide direction to water utilities on how to design or retrofit their infrastructure, with consideration given to their unique circumstances and threats. A discussion of the various security threats and incidents that have occurred at water and wastewater utilities is provided in an American Water Works Association Research Foundation report by Welter (2003). This document can provide additional information in the assessment of security measures for utilities.
6. The USEPA Water Security Working Group presented its report *Recommendations of the National Drinking Water Advisory Council to the U.S. Environmental Protection Agency on Water Security Practices, Incentives, and Measures* to the National Drinking Water Advisory Council (NDWAC) on May 18, 2005 (WSWG 2005). Those findings included 18 features of an "active and effective" security program. These guidelines address the following NDWAC recommendations, which discuss physical security:
   a. Establish physical and procedural controls to restrict access to utility infrastructure to only those conducting authorized, official business and to detect unauthorized physical intrusions.
   b. 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.
7. These guidelines should be implemented in concert with the other features and approaches described in the NDWAC report (WSWG 2005).

USE OF THESE GUIDELINES

The major points for the use of this document imply:

1. It is the responsibility of the user of an ASCE/EWRI standard or guideline to determine that the products and approaches described in the standard or guideline are suitable for use in the particular application being considered.
2. To effectively use these guidelines, a water utility should first complete a VA of its system. This VA should be completed in accordance with a generally accepted methodology such as the Risk Assessment Methodology for Water (RAM-W; Sandia Corporation 2002), the Vulnerability Self-Assessment Tool (VSAT; NACWA 2005), or other acceptable method. The resulting information will guide the utility in defining the capabilities and motives of its design basis threat (DBT) and in ranking each asset's criticality within the facility's system. The VA will also help to define the anticipated response time and response capability that, given the capabilities of the DBT, will characterize the robustness required for an effective security system.
3. The selection and recommendation of the physical protection approaches and measures contained in these guidelines are best engineering practices based on the collective experience and judgment of the WISE Standards Committee members. The physical security measures should be combined with management policies, operational procedures, and network security systems to form a comprehensive security system that provides multiple layers of protection or "protection in depth" for critical assets.
4. These guidelines contain information that utilities should consider when applying specific security technologies and methods to individual facilities or assets. These are described in Sections 2.0 through 7.0 (called "Guideline" in each section), which, in conjunction with the Foreword, Section 1.1 Introduction and its subsections, and the Appendices in this document, can be used as stand-alone documents. Most of the tables and figures of these guidelines were taken directly from ASCE/AWWA/WEF (2006) as cited herein, but Table 6-1 was adapted from that source due to public comments during the development process during the first six months of 2007 and the ASCE/EWRI Standards Committee ballots of 2008 and 2009.
5. It is important to recognize that a physical protection system should be designed as a site-specific system integrated into facility operations, response force capabilities, and the overall utility's security system to ensure that there are no gaps in protection. Furthermore, simply implementing the recommendations contained herein is no guarantee that an adversary cannot compromise a specific facility or critical asset.

SPECIAL ISSUES

1. These guidelines describe physical security approaches to delay or detect malevolent parties whose actions may otherwise defeat the mission of the utility. Enterprise-wide security approaches, while extremely important to any balanced security system, are beyond the scope of these guidelines. These approaches include management policies, administrative procedures, operational practices, and network security approaches, including supervisory control and data acquisition (SCADA) networks. Contaminant detection and monitoring systems, although briefly referenced in these guidelines, are also best employed as an integrated, enterprise-wide system. Guidance on enterprise-wide security approaches is provided in the USEPA WISE Phase 1 Interim Voluntary Security Guidance documents (ASCE/AWWA/WEF 2004a, 2004b, 2004c).
2. Added water security is beneficial for continuity of business, protection of water quality, provision of sufficient water quantity, ensuring public confidence, and protection of public health and safety. Thus, when implementing the security measures provided in these guidelines, the multiple benefits should be taken into account by utility staff and other stakeholders.
3. Within the scope of this document, domestic and international terrorists have been considered a special category of DBTs. With significantly enhanced tool and weapon capabilities, terrorists may be politically or ideologically motivated to cause maximum human casualties, often without regard for the terrorist's personal survival. Effectively protecting a facility from such a threat requires specialized security knowledge and equipment, and response forces typically not available to utilities. A utility that concludes that it is facing such a threat should seek guidance from specialized security experts and/or enhance its emergency response planning and execution to mitigate the consequences of such a terrorist attack. Strategies to counter such a defined threat may require higher-level measures than described in these guidelines.

DISCLAIMER

The information presented in these guidelines is intended to assist water utilities as they strive to improve the safety and security of their facilities, their employees, and the public. While the strategies and methods described here can reduce risk and enhance response and recovery actions, they cannot guarantee that any possible act of vandalism, violence, or terrorism will be prevented or stopped. As such, those responsible for the content and publication of this document can provide no guarantees for the performance of any actions taken in response to this guidance.

This document has been prepared in accordance with recognized engineering principles and should not be used without the user's competent knowledge for a given application. The publication of this document does not intend to warrant that the information contained herein is suitable for any general or specific use, and those responsible for the content and publication of this document take no position respecting the validity of patent rights. The user is advised that the determination of patent rights or risk of infringement is entirely their own responsibility.

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These voluntary guidelines were developed during the USEPA WISE Project, Phase 3 under the direction of the ASCE/EWRI WISE Standards Committee (ASCE/AWWA/WEF 2006). This committee consisted of the individuals listed below through the end of the Committee balloting process of August 2007. The members of the WISE Water Supply Subcommittee, which was the primary review group before the first ASCE/EWRI WISE SC pilot sections ballot, are also provided below. The CH2M HILL WISE Project Phase 3 Team members listed below drafted the document and assisted in the resolution reporting during the balloting process. The USEPA personnel listed with the Project Team reviewed material during the monthly WISE Project Partners conference calls of the USEPA WISE Project that ended around October 1, 2008.

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Guidelines for the Physical Security of Water Utilities

Chapter 1
APPLICATION OF GUIDELINES

1.1 INTRODUCTION

These water utility guidelines recommend physical and electronic security measures for physical protection systems to protect against identified adversaries, referred to as design basis threats (DBTs), with specified motivations, tools, equipment, and weapons. Additional requirements and security equipment may be necessary to defend against threats with greater capabilities.

1.1.1 Elements of a Physical Protection System. Effective physical and electronic protection systems balance four elements (ASCE/AWWA/WEF 2004c): deterrence, detection, delay, and response.

1.1.1.1 Deterrence. Security measures such as lighting, the presence of closed-circuit television (CCTV), a clearly visible facility with no visual obstructions, or people in the area may deter an adversary from attacking a facility. Deterrence is not generally considered a part of a physical protection system with a predictable level of effectiveness; however, it can reduce the occurrence of crime or low-level vandal attacks.

1.1.1.2 Detection. Security measures such as sensors are intended to detect the presence of an intruder. An effective detection system should include electronic features such as sensors as well as cameras or visual observation for assessment of alarm validity. Depending on the types of sensors, a detection system may include lighting systems, motion detectors, monitoring cameras, access control equipment, or other devices.

1.1.1.3 Delay. Security features such as physical barriers are designed to delay an adversary until a response force can interrupt the adversary's actions. Delay features consist primarily of physical hardening devices often employed in multiple layers to provide protection in depth. Delay features are only effective when placed within a layer of detection.

1.1.1.4 Response. "Response" refers to actions taken to interrupt the adversary's task. Utility staff, the utility's security response force, or law enforcement may carry out the response, with the appropriate responder dependent on the threat and policy of the utility.

The capabilities of the responders to a security event, including number, authority, and weaponry, should be greater than the capabilities of the perceived threat to the facility. The appropriate response force should be identified during the facility's vulnerability assessment (VA) with notification, communication, and protocol requirements established in the utility's emergency response plan or a similar plan.

Figure 1-1 illustrates the interaction of detection (at the perimeter fence and exterior door), delay (fence, exterior door, and interior door), and the response time to an adversary's sequence of actions. This figure was originally developed by Mary Lynn Garcia of Sandia National Laboratories and uses a thief (that is, a criminal) as the DBT to illustrate the time required for delay. Utilities should develop their own time sequence as part of their vulnerability assessment process.

1.1.2 Design Basis Threat. DBTs considered in these guidelines address persons who intend to interrupt the water treatment or delivery processes, contaminate the water, or trespass on the water utility property in order to commit a malevolent act. The following subsections summarize the objectives, motives, and fundamental security approaches for each DBT used in this guideline. Table 1-1 contains additional information on the objectives, motives, and capabilities of DBT levels. The table also elaborates on the differences between base and enhanced DBT levels.

1.1.2.1 Vandal. Vandals are intent on defacing, damaging, or destroying property. They primarily seek targets of opportunity, using stealth to avoid detection. Adversaries in this group do not intend to injure or kill people (although such may occur as an accidental result of their actions), and are assumed to be unarmed.

Security approaches for a base-level vandal threat generally consist of placing physical barriers between the assets and public areas, and visual detection of intruders by utility staff or the general public. Use of appropriate perimeter fences and gates, adequate perimeter and area lighting, and hardened locks often provides sufficient deterrence from all but the most motivated vandals. Where the damage that could be caused by vandals is of relatively low cost to repair, utilities should consider whether it is more cost-effective to focus on consequence mitigation (i.e., the repair or replacement of assets) rather than on investing in expensive security systems and protective measures.

An enhanced threat created by a more intense or invasive vandal (one consisting of a greater number of individuals who plan the activities or who have access to larger or more capable tools) requires security approaches that detect and delay the intruder until the appropriate response force can stop the threat. These measures are generally only appropriate when the value of the assets is sufficient that consequence mitigation is a more costly or an unacceptable approach. Liability issues should also be considered.

1.1.2.2 Criminal. The primary motivation for a criminal is the desire to obtain equipment, tools, or components that have inherent value and can be sold. Criminals typically use stealth to avoid apprehension, and response times should focus on the time required for the adversary to obtain the asset. Depending on their level of desperation or sophistication, criminals may be armed and willing to injure or kill to accomplish their objectives.

Protective approaches against the base-level criminal threat with limited hand tools are focused on deterrence and delay. Visual barriers act as a deterrent to prevent the detection of assets by an opportunistic criminal. Prevention or delay of the removal of equipment and other targets can result from physical separation from public areas, adequate lighting, and physical barriers