FINAL WORKSHOP REPORT

STANDARDIZATION FOR ENTERPRISE POWER SECURITY AND CONTINUITY

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STANDARDIZATION FOR ENTERPRISE POWER SECURITY AND CONTINUITY

FINAL WORKSHOP REPORT

Organizer

ANSI Homeland Security Standards Panel (HSSP)

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Audience for this Report

A primary objective of this report is to capture in one place all the relevant standards and guidance documents in the marketplace on the subject of enterprise power security and continuity. It additionally serves as a reference point for further exploration in the pursuit of power security. This report is intended for anyone interested in this important homeland security related area, but especially for the following:

- The Standards Portfolio of the U.S. DHS Science and Technology (S&T) Directorate
- Standards Developing Organizations (SDOs)
- Entities working in the field of power security who serve as the end users of standards and codes

The standards listed in this report will also be added to the American National Standards Institute (ANSI) Homeland Security Standards Database (HSSD) which includes standards for the overall area of homeland security.

Background for the ANSI-HSSP Workshop

The ANSI Homeland Security Standards Panel (HSSP) has as its mission to identify existing consensus standards, or if none exists, assist the U.S. Department of Homeland Security (DHS) and those sectors requesting assistance to accelerate development and adoption of consensus standards critical to homeland security. The ANSI-HSSP promotes a positive, cooperative partnership between the public and private sectors in order to meet the needs of the nation in this critical area. To address specific homeland security standards areas, workshops are convened under the ANSI-HSSP to bring together subject matter experts in that particular security area.

During the December 13-14, 2004 Panel plenary meeting, the subject of enterprise power security and continuity was endorsed as one of two new areas to be explored via workshops due to its importance to homeland security. Mark Mills, Co-Chair Critical Power Coalition and Partner, Digital Power Capital, presented his organization's position on this subject area and agreed to serve as the workshop leader to arrange the kick-off meeting of the group.

Workshop Objectives and Launch

The workshop was created with the objectives of identifying existing standards, standards under development, and gap areas in standardization for enterprise power security and continuity. The workshop was also tasked with examining the current state or need for accreditation and certification programs to support these standards.

The first workshop meeting was held March 16, 2005 in conjunction with the Enterprise Power Security & Continuity Summit in Washington DC. The Summit was focused on the practical challenges and solutions relating to keeping critical operations, equipment or facilities powered when the public electric grid is not available. The agenda for this well-attended Summit addressed the following major areas:

- Electric Power Situation Analysis
  Risks, demands & emerging requirements for enterprise power operational security and continuity
- Enterprise-level realities
  Private sector power imperatives and challenges
- Technology Solutions – reality check
  Hardware, software, fuel and operational realities

Following the Summit, the ANSI-HSSP workshop was convened. Introductory presentations included lessons learned and best practices from data centers, as well as presentations on several standards related to power security and continuity. The majority of the workshop meeting was spent discussing user needs for standards in the area of enterprise power security and the key issues and challenges that should be considered when tackling this subject. Volunteers were identified at the meeting to serve on a task group to further examine the role for standards and conformity assessment programs.

Methodology

The primary goals of this workshop effort were to identify all the relevant standards and guidance documents in the area of power security and continuity, as well as make recommendations for addressing standards gaps and needs areas. Towards this end, the **Standards and Guidelines** section of the report provides a

comprehensive list of standards agreed upon by workshop participants. Furthermore, the **Codes** and **Government Publications** sections provide additional information.

As a secondary goal, workshop participants determined that it would be useful to examine these standards against a set of benchmark areas in order to further determine existing coverage and where there are gaps. After several rounds of discussion, the task group members selected the document *FEMA 426 - Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings* as the most appropriate means for benchmarking existing standards. *FEMA 426* provides guidance to reduce physical damage to structural and non-structural components of buildings and related infrastructure, and also to reduce resultant casualties during conventional bomb attacks, as well as attacks using chemical, biological, and radiological agents.

During conference calls and e-mail communication, the task group identified the standards, best practices, guidance documents and government documents related to the field of power security. Task group members spent the latter part of 2005 reviewing these standards and documents against the following *FEMA 426* benchmark areas:

- Vulnerability Assessment
- Risk Assessment
- Assets Assessment
- Capital Expenditures
- Infrastructure
- Buildings
- Systems
- Planning
- Design
- Maintenance
- Training
- Life Safety
- Personnel Safety
- Energy Generation
- Energy Distribution
- Energy Storage
- Communications
- Transportation
- Hazard Materials
- Disaster Prevention
- Disaster Preparedness
- Disaster Recovery

- Security
- Natural Disaster
- Manmade Disaster/Terrorism

Due to resource constraints, the review work against the *FEMA* 426 benchmark areas were performed by small groups of workshop participants, in some case by a single individual. Therefore, it was agreed that the matrix would exist separate from the workshop report, with the following disclaimer, "This matrix contains standards and guideline documents benchmarked against criteria contained in *FEMA 426*. It is provided as a supplement to the ANSI-HSSP workshop report on this subject. This matrix should be used at the individual's discretion as the assignments have not been reviewed or approved by the workshop as a whole." The matrix is available upon request (mdeane@ansi.org) in Excel format. The worksheet tabs provide further details on the specific clauses and text within each standard that applies to the *FEMA 426* benchmark areas.

The workshop examined the issue of conformity assessment programs for power security and the results of this examination are included in the Findings and Recommendations section of the report.

Participation

Two in-person workshop meetings were held for this workshop:

March 16, 2005	Hosted by the US Chamber of Commerce (Washington, DC)
March 8, 2006	Hosted by ANSI (New York City)

Additionally, conference calls and e-mail communications were used to facilitate and collect the workshop participants' input. The following organizations supplied experts to one or more of these workshop meetings:

American Power Conversion Corporation
American Public Transportation Association
Architectural Engineering Institute of the American Society of Civil Engineers – Committee Chair
BSI Americas, Inc.
Carnegie Mellon University
Caterpillar Energy Solutions, Caterpillar Inc.
Critical Power Coalition
Duke Energy

Eaton Electrical
EYP Mission Critical Facilities
Fannie Mae
Global Engineering Solutions
Independent Electrical Contractors, Inc.
International Association of Electrical Inspectors
IT ServerCenter, LLC.
KEMA, Inc.
Lawrence Livermore National Laboratory
Liebert Corporation
National Electrical Contractors Association
National Electrical Manufacturers Association
National Fire Protection Association
National Joint Apprenticeship & Training Committee
New York Life Insurance Company
North American Electric Reliability Council
S&C Electric Company
Sandia National Laboratories
Science Applications International Corporation
Skokowski Consulting
Square D - Schneider-Electric
Syska Hennessy Group
Telecom/Electric Power Interdependencies Task Force - Chair
Telecommunications Industry Association
U.S. Department of Defense, Defense Continuity and Crisis Management Office
U.S. Department of Energy, National Renewable Energy Laboratory
U.S. Department of Homeland Security – Science & Technology Directorate
Underwriters Laboratory
Yahoo!

Findings and Recommendations

Following the review of standards for enterprise power security and continuity, the workshop concluded that the necessary codes and component specific standards sufficiently cover the technical areas of power security and continuity. However, the workshop believes that the following gaps exist in this subject area:

- There is the need for a practical standard or recommended practice on how an organization should assess, plan, prioritize, etc. for overall power security and continuity. This would be aimed at both the private enterprise and entities at the municipal level.
- Better private sector engagement with the public sector is needed for power security, backup, etc., both from a motivational and "how to" perspective.

- The appropriate authority with jurisdiction measures compliance with applicable codes for safety, but there is a gap for measuring performance. The workshop noted however that the National Electrical Code (NEC) is currently in a revision cycle. The proposal phase has yielded a new article on Critical Operations Power Systems. This article will address unique requirements for mission critical facilities. NFPA 110 will address the performance requirements for emergency systems.
- The group agreed that conformity assessment in the area of power security and continuity was a good idea, but a standard is needed against which to certify. In addition to needing a standard, one must determine who accredits the certifiers and what the incentives for becoming certified are (*e.g.*, insurance discounts, better credit rating, etc.). Property management companies responsible for financial-sector buildings were cited as one source that would potentially be interested in the certification process. The workshop also noted that the US Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building Rating System should be looked at as a model for those pursuing this area further.

Based upon the examination and analysis of the area of enterprise power security and continuity, the workshop makes the following recommendations:

1. An appropriate Standards Developing Organization (SDO) should initiate development of a voluntary consensus standard to quantify power security and continuity performance. The standard would provide measurable performance elements for power security and continuity that could then be used to certify compliance with the voluntary standard.
2. A conformity assessment program, involving accreditation and certification, should be launched to measure compliance upon publication of the standard in the first recommendation. Incentives for organizations to become certified should also be examined prior to the implementation of this program.
3. Further exploration should be conducted on the subject of private sector engagement with the public sector for power security and continuity, both from a motivational and "how to" perspective.
4. Instrumentation and control systems, and the role for standards, should be studied further as they are important to power security and continuity
5. The field of cyber security should focus more attention on the issue of power security, and vice versa, as there is a critical interdependency between cyber and power security at the grid and enterprise level.

Acknowledgements

ANSI wishes to acknowledge the support and participation of all the organizations that supplied experts to the workshop. ANSI also wishes to expresses sincere appreciation to all the individuals who served on the workshop task group, especially the following individuals, whose major contributions and dedicated efforts were essential to the successful completion of the standards list and matrix:

- Brian Beck, Caterpillar Energy Solutions
- Bill Black, Sandia National Laboratories
- Richard DeBlasio, U.S. Department of Energy, National Renewable Energy Laboratory
- Mark Earley, National Fire Protection Association
- Charles Franklin, Global Engineering Solutions
- Kfir Godrich, EYP Mission Critical Facilities
- Steve McCluer, American Power Conversion Corporation
- Jack Pouchet, Liebert Corporation
- Terry Rodgers, Syska Hennessy Group
- James Ruggieri, Architectural Engineering Institute of the ASCE – Committee Chair
- Joe Weiss, KEMA, Inc.

ANSI further thanks the sponsors for the workshop meetings: Eaton, EYP Mission Critical Facilities, and the Critical Power Coalition. Their generosity allowed the workshops meetings to be held at no cost to ANSI and allowed for the meetings to be convened without a participation fee to attendees.

ANSI offers its appreciation to Mark Mills, whose leadership was instrumental in successfully launching this initiative and keeping it on track. Thanks are also extended to Matt Deane of ANSI, for his project management of this activity and helping to insure that the final report was completed in a timely manner.

Standards and Guidelines

As defined by *ISO/IEC Guide 2*, a standard is a "Document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context." The following table contains national and international standards on the subject of enterprise power security and continuity. The majority of these standards are available in the ANSI Electronic Standards Store. Otherwise, they can be obtained directly from the developer.

Developer	Designation	Title	Description/Scope
Canadian Standards Association (CSA)	C282	Emergency Electrical Power Supply for Buildings	This Standard applies to the design, installation, operation, maintenance, and testing of emergency generators and associated equipment for providing an emergency power supply to electrical loads in buildings and facilities when the normal power supply fails and an emergency power supply is required by the National Building Code of Canada (NBC).
International Electrotechnical Commission (IEC)	61000-4-2	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques-Electrostatic discharge immunity test	Immunity requirements and test methods, levels and procedures for electrical and electronic equipment subjected to static electricity discharges, from operators directly, and to adjacent objects
International Electrotechnical Commission (IEC)	61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques-Electrical fast transient burst/burst immunity test	Immunity requirements and test methods, levels and procedures for electrical and electronic equipment subjected to repetitive fast transients/bursts.
International Electrotechnical Commission (IEC)	61000-4-5	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Surge immunity test	Immunity requirements and test methods, levels and procedures for electrical and electronic equipment subjected to unidirectional surges caused by overvoltages from switching and lightning transients.
IEEE	C62.22.1	IEEE Guide for the Connection of Surge Arresters to Protect Insulated, Shielded Electric Power Cable Systems	Surge arrester installation methods at distribution cable terminal poles in order to minimize total impressed transient voltage on medium voltage distribution cables.

Developer	Designation	Title	Description/Scope
IEEE	C62.43	Guide for the Application of Surge Protectors used in Low-Voltage (Equal to or Less than 1000V rms or 1200V dc) Data, Communications, and Signaling Circuits.	Assistance for the selection of the most appropriate type of low-voltage data, communications, and/or signaling circuit surge protector for a particular application or set of conditions.
IEEE	IEEE Battery Standards: 450 1106 1188	Maintenance & Testing of stationary batteries: Vented lead acid Nickel-Cadmium VRLA	Best practices for maintaining stationary battery systems to optimize performance and life
IEEE	IEEE Battery Standards: 484 1106 1187	Installation of stationary batteries: Vented lead acid Nickel-Cadmium VRLA	Best practices for designing battery installations
IEEE	IEEE Battery Standards: 485 1115 1189 1184	Selection and sizing of stationary batteries: Vented lead acid Nickel-Cadmium VRLA UPS batteries	Best practices for selecting the best battery for the application
IEEE	IEEE Battery Standards: 1375 1491	Protection & monitoring of stationary batteries: Battery Protection Battery Monitoring	Best practices for designing DC electrical circuits in a facility and for monitoring state of health of battery systems
IEEE	644	IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines	This standard provides uniform procedures for the measurement of power frequency electric and magnetic fields from alternating current overhead lines and for calibration of the meters used in these measurements.
IEEE	1023	Recommended Practice for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations and Other Nuclear Facilities.	Recommended practices for applying HFE to systems and equipment that have significant human interfaces in nuclear power generating stations and other nuclear facilities.
IEEE	1100	Powering and Grounding Sensitive Electronic Equipment	Recommended design, installation, & maintenance practices for electrical power and grounding of mission-critical electronic processing equipment used in commercial & industrial applications. This document does not explicitly address "cyber security" - users should consider cyber-security implications when connecting their systems

Developer	Designation	Title	Description/Scope
IEEE	1289	Recommended Practice for the Application of Human Factors Engineering in the Design of Computer-Based Monitoring and Control Displays for Nuclear Power Generating Stations.	System design considerations, information display and control techniques, and HFE guidelines for use in nuclear power generating stations.
IEEE	1366	IEEE Guide for Electric Power Distribution Reliability Indices	Guide identifies distribution indices and factors that effect their calculations for distribution subsystems, substations, circuits and defined regions
IEEE	C2	National Electrical Safety Code	Provisions for safeguarding persons during installation, operation, or maintenance of electric supply and communication lines and associated equipment. The NESC covers utility facilities and functions up to the service point. (The National Electrical Code covers wiring requirements beyond the service point). This document does not explicitly address "cyber security" control aspect - users should consider cyber-security implications when complying with NESC.
IEEE	1547	IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems	Provides a uniform standard for interconnection of distributed resources with electric power systems relevant to performance operation, testing, safety considerations and maintenance of the interconnection.
IEEE	C62.21	Guide for the Application of Surge Voltage Protective Equipment on AC Rotating Machinery 1000V and Greater	Application of surge voltage protective equipment on AC rotating machinery, 100V and greater. The guide does not cover motors applied in solid-state switched adjustable speed drives.
IEEE	C62.41	Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits	Information on surge voltages in low-voltage AC power circuits for designers and users to determine their need for surge protective devices.
ISA	ISA-SP99	Manufacturing and Control Systems Security	Guidance is directed towards those responsible for designing, implementing, or managing manufacturing and control systems and shall also apply to users, system integrators, security practitioners, and control systems manufacturers and vendors.
National Electrical Contractors Association (NECA)	90-2004	Recommended Practice for Commissioning Building Electrical Systems	Describes procedures for commissioning newly installed or retrofitted building electrical systems. It defines the process of commissioning building electrical systems and provides sample guidelines for attaining optimum system performances that conform to design, specifications, and industry-accepted codes and standards.

Developer	Designation	Title	Description/Scope
InterNational Electrical Testing Association (NETA)	ETT-2000	Standard for Certification of Electrical Testing Technicians	Specifies requirements leading to certification of technicians performing testing of electrical power equipment and systems.
National Fire Protection Association (NFPA)	70	National Electrical Code	Installation of electrical conductors, equipment, and raceways; signaling & communication conductors, equipment & raceways; and optical fiber cables & raceways.
National Fire Protection Association (NFPA)	70B	Electrical Equipment Maintenance	Preventive maintenance for electrical, electronic, and communication systems and equipment - typical of those installed in industrial plants, institutional & commercial buildings and large multifamily residential complexes.
National Fire Protection Association (NFPA)	70E	Electrical Safety in the Workplace	Electrical safety requirements for employee workplaces, necessary for the practical safeguarding of employees in their pursuit of gainful employment.
National Fire Protection Association (NFPA)	72	National Fire Alarm Code	Application, installation, location, performance, and maintenance of fire alarm systems and their components
National Fire Protection Association (NFPA)	75	Standard for the Protection of Electronic Computer/Data Processing Equipment	Outlines requirements for computer installations needing fire protection and special building construction, rooms, areas, or operating environments. Application is based on risk considerations such as the business interruption aspects of the function--as in computers used in the stock market--or the fire threat to the installation.
National Fire Protection Association (NFPA)	76	Recommended Practice for the Fire Protection of	Provides minimum requirements for life safety issues, and includes both performance-based and prescriptive options for: Telecommunications equipment spaces; Cable entrance facilities; Power areas and battery spaces; Main distribution frames; Standby engine areas; Technical support areas; Administrative areas; Building services and support areas within large and small facilities
National Fire Protection Association (NFPA)	99	Standard for Health Care Facilities	Fosters fire safety and fire protection with rules for the safe application of electrical systems, gas and vacuum systems, and environmental systems, along with materials and emergency management practices. The 2005 edition has been completely updated to reflect recent developments in medical equipment and processes as well as new methods to mitigate fire, explosion, and electrical hazards.

Developer	Designation	Title	Description/Scope
National Fire Protection Association (NFPA)	101	Life Safety Code	Establishes a minimum threshold of safety in all new and existing buildings, plus contains a performance-based compliance option. The 2006 edition incorporates the latest technologies, advances, and safety strategies to help meet today's challenges and achieve higher levels of protection for building occupants.
National Fire Protection Association (NFPA)	110	Standard for Emergency and Standby Power Systems	Performance requirements for emergency & standby power systems providing an alternate source of electric power to loads in buildings and facilities, in the event the primary power source fails.
National Fire Protection Association (NFPA)	111	Standard on Stored Electrical Energy Emergency and Standby Power Systems	Performance requirements for stored electrical energy systems providing an alternate source of electrical power in buildings & facilities in the event the normal electrical power source fails.
National Fire Protection Association (NFPA)	730	Guide for Premises Security	Construction, protection, occupancy features, and practices intended to reduce security vulnerabilities to life and property.
National Fire Protection Association (NFPA)	731	Standard for the Installation of Electronic Premises Security Systems	Application, location, installation, performance, testing and maintenance of electronic premises security systems and their components.
National Fire Protection Association (NFPA)	1221	Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems	Installation, performance, operation & maintenance of public emergency service communication systems and facilities.
National Fire Protection Association (NFPA)	1600	Standard on Disaster/Emergency Management and Business Continuity Programs	This standard establishes a common set of criteria for disaster management, emergency management, and business continuity programs to mitigate, prepare for, respond to, and recover from disasters and emergencies.
North American Electric Reliability Council (NERC)	Various	Many standards for the reliable operation and planning of the bulk electric system, including cyber security standards.	NERC's mission is to ensure that the bulk electric system in North America is reliable, adequate and secure. Since its formation in 1968, NERC has operated successfully as a self-regulatory organization, relying on reciprocity and the mutual self-interest of all those involved. Among the functions that NERC performs to fulfill its mission, NERC sets standards for the reliable operation and planning of the bulk electric system, as well as, monitors, assesses, and enforces compliance with reliability standards.
Project Under Development: Architectural Engineering Institute (AEI) of the American	C2P	Recommended Electrical Installation Practices for Control, Communication and Power (C2P) of Critical Facilities	The purpose of this recommended practice is to identify methods, techniques, and guidelines to enhance security, reliability and continuity of life safety systems, and essential operations for communications, control and power systems in critical facilities. The impetus for developing a

Developer	Designation	Title	Description/Scope
Society of Civil Engineers (ASCE)			standard addressing manmade, natural, and technological events was inspired by the many recent incidents of global terrorism.
Telecommunications Industry Association (TIA)	464	Telecommunications – Multiline Terminal Systems – Requirements for PBX Switching Equipment	This document fills a recognized need in the telecommunications industry, brought about by the interconnecting of public and private networks using equipment supplied by different manufacturers.
Telecommunications Industry Association (TIA)	942	Telecommunications Infrastructure Standard for Data Centers	Specifies minimum requirements for telecommunications infrastructure of data centers and computer rooms including single tenant enterprise data centers and multi-tenant Internet hosting data centers.

Additionally, the following guideline documents are relevant to the subject:

Developer	Title	Scope
ASIS International	Threat Advisory System Response Guideline	A tool to allow an organization to decide upon and provide a security architecture characterized by appropriate awareness, prevention, preparedness, and response to changes in threat conditions (DHS Alert Levels) in accordance with the Homeland Security Advisory System (HSAS)
Building Industry Consulting Service International (BICSI)	Electronic Safety and Security Design Reference Manual	
BITS	BITS Guide to Business-Critical Power	The BITS Guide to Business-Critical Power provides financial institutions with industry business practices for understanding, evaluating, and managing risks associated when the predicted reliability and availability of the electrical system is disrupted. Further, it outlines ways financial institutions can enhance reliability and ensure uninterrupted back-up power.
Electricity Sector Information Sharing and Analysis Center (ESISAC)	Various guideline documents	Note: The ESISAC is operated by the North American Electric Reliability Council on behalf of the electricity sector.
Network Equipment Building System (NEBS)	Network Equipment Building System (NEBS) Level 3 certification	NEBS Level 3 certification guarantees the maximum operability of the equipment. It also certifies that the equipment will perform well in harsh environmental conditions and will not interfere with other electronic devices around. NEBS Level 3 certified networking equipment is vital in mission-critical applications.

Codes

Certain users, such as engineers, may be particularly interested in knowing which of the standards listed in previous sections are “codes.” The following codes have been identified as having widespread adoption and enforcement. Users should check with their local authorities having jurisdiction for applicable electrical and building codes which apply.

Developer	Designation	Title	Scope
IEEE	C2	National Electrical Safety Code	Provisions for safeguarding persons during installation, operation, or maintenance of electric supply and communication lines and associated equipment. The NESC covers utility facilities and functions up to the service point. (The National Electrical Code covers wiring requirements beyond the service point). This document does not explicitly address "cyber security" control aspect - users should consider cyber-security implications when complying with NESC.
National Fire Protection Association (NFPA)	70	National Electrical Code	Installation of electrical conductors, equipment, and raceways; signaling & communication conductors, equipment & raceways; and optical fiber cables & raceways.
National Fire Protection Association (NFPA)	72	National Fire Alarm Code	Application, installation, location, performance, and maintenance of fire alarm systems and their components
National Fire Protection Association (NFPA)	99	Standard for Health Care Facilities	Fosters fire safety and fire protection with rules for the safe application of electrical systems, gas and vacuum systems, and environmental systems, along with materials and emergency management practices. The 2005 edition has been completely updated to reflect recent developments in medical equipment and processes as well as new methods to mitigate fire, explosion, and electrical hazards.
National Fire Protection Association (NFPA)	101	Life Safety Code	Establishes a minimum threshold of safety in all new and existing buildings, plus contains a performance-based compliance option. The 2006 edition incorporates the latest technologies, advances, and safety strategies to help meet today's challenges and achieve higher levels of protection for building occupants.
National Fire Protection Association (NFPA)	110	Standard for Emergency and Standby Power Systems	Performance requirements for emergency & standby power systems providing an alternate source of electric power to loads in buildings and facilities, in the event the primary power source fails.

Government Publications

Developer	Designation	Title	Scope
Army Technical Manual (TM)	5-689	ADP/Computer Electrical Installation and Inspection for C4ISR Facilities	Focused in supplying electrical power to automated data processing (ADP) systems. Special emphasis is placed on areas most often overlooked or misunderstood by experienced designers and personnel responsible for maintaining an outflow of quality data from an ADP installation. Covers many inter-related aspects of an ADP installation in regard to the electrical and life-safety systems. Reviews the systems found in the typical data center.
Army Technical Manual (TM)	5-689-1	Reliability/Availability of Electrical & Mechanical Systems for C4ISR Facilities	The standard focuses on the availability of electrical and mechanical systems for command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR) facilities and the role reliability plays in determining availability.
Army Technical Manual (TM)	5-689-3	Reliability Primer for C4ISR Facilities	The standard provides a basic introduction to and overview of the subject of reliability. It is particularly written for personnel involved with the acquisition and support of Command, Control, Communication, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) equipment.
Army Technical Manual (TM)	5-691	Utility Systems Design Requirements for C4ISR Facilities	The standard addresses engineering design, fabrication, and installation of specifically designated fixed ground-based facilities in a threat-hardened C4ISR network. Minimum performance requirements are prescribed for the design of highly reliable utility systems that will permit C4ISR operation free from man-made threats. The standard applies to both new construction and to retrofit of existing facilities. Use of the standard for threat protection of other ground-based communications electronics facilities that require high reliability is also encouraged.
Army Technical Manual (TM)	5-692-2	Maintenance of Mechanical and Electrical Equipment at C4ISR Facilities	The standard is specific for maintenance requirements of mechanical and electrical systems for C4ISR sites.

Developer	Designation	Title	Scope
Army Technical Manual (TM)	693	Uninterruptible Power Supply System Selection, Installation, and Maintenance for C4ISR Facilities	The standard presents the process for identifying the need for an UPS system, selecting, installing, and maintaining the UPS system. Covered are: theory and principles of static and rotary UPS systems, design and selection of UPS, installation and testing of UPS, maintenance and operation of UPS systems, principles of static and rotary UPS, UPS system rating and sizing selection, operations/maintenance, batteries, troubleshooting, harmonic distortions, grounding, checklists, and acceptance testing.
The Critical Infrastructure Security Standards Working Group (CISSWG)		A Summary of Control System Security Standards Activities in the Energy Sector	The Critical Infrastructure Security Standards Working Group, led by the United States Department of Energy and composed of representatives from four national laboratories, has a charter to consider energy sector cyber security standards. Included in this sector are Electrical Power and Oil and Gas. This document is a compilation of the activities and initiatives concerning control system security that are influencing the standards process in the development of secure communication protocols and systems. Also contained in this report is a comparison of several of the sector standards, guidelines, and technical reports, demonstrating standards coverage by security topic.
Federal Emergency Management Agency (FEMA)	426	Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings (December 2003)	Provides guidance to reduce physical damage to structural and non-structural components of buildings and related infrastructure, and also to reduce resultant casualties during conventional bomb attacks, as well as attacks using chemical, biological, and radiological (CBR) agents.
Federal Emergency Management Agency (FEMA)	427	Primer for Design of Commercial Buildings to Mitigate Terrorist Attacks	Provides guidance to building designers, owners and state and local governments to mitigate the effects of hazards resulting from terrorist attacks on new buildings. While the guidance provided focuses principally on explosive attacks and design strategies to mitigate the effects of explosions, the document also addresses design strategies to mitigate the effects of chemical, biological and radiological attacks.
Federal Emergency Management Agency (FEMA)	429	Insurance, Finance, and Regulation Primer for Terrorism Risk Management in Buildings	Provides guidance to the building insurance, finance, and regulatory communities to the issue of terrorism risk management in buildings and the tools currently available to manage that risk. Insurance, finance and regulation are considered the 'change levers' of the built environment.

Developer	Designation	Title	Scope
Federal Emergency Management Agency (FEMA)	452	Methodology for Preparing Threat Assessments for Commercial Buildings	The objective of this How-To Guide is to outline methods for identifying the critical assets and functions within buildings, determining the threats to those assets, and assessing the vulnerabilities associated with those threats and to provide a means to assess the risk to the assets and to make risk-based decisions on how to mitigate those risks.
Federal Emergency Management Agency (FEMA)	453	Multihazard Shelter (Safe Havens) Design	Future publication not yet available.
Federal Emergency Management Agency (FEMA)	455	Rapid Visual Screening for Building Security	Future publication not yet available.
Federal Emergency Management Agency (FEMA)	459	Incremental Rehabilitation to Improve Security in Buildings	Future publication not yet available.
National Communications System (NCS)		NCS Document on Standards for Protection of Telecommunications Links	
National Institute of Standards and Technology (NIST)	Special Publication 800-30	Risk Management Guide for Information Technology Systems	This document provides a method for both the public and private sector IT/business/operations/management professional to understand and define their hardware, software, and infrastructure risks, how to assess them, mitigate them, plan for likely threat scenarios, test these plans, and then evaluate their effectiveness while updating the plan on a running basis.
Sandia National Laboratories	RAM-T	Risk Assessment Methodology for Electric Power Transmission (RAM-T), Official Use Only	Methodology used to assess vulnerabilities in the electrical transmission system, it also considers a relative ranking of consequences and the relative likelihood of an identified and credible adversary attacking specific transmission facilities (See response sheet for full description)
U.S. Department of Defense		Unified Facilities Criteria (UFC)	This document provides guidance to be used for the execution and submittal of Army real property master plans; Short Range Component - Five Year Development Plan of the Capital Investment Strategy; military construction projects for intergovernmental coordination, review with comments, and approval by the National Capital Planning Commission and the Commission of Fine Arts.

Developer	Designation	Title	Scope
U.S. Securities and Exchange Commission (SEC)	Interagency Paper	Sound Practices to Strengthen the Resilience of the U.S. Financial System	Establishes a framework and defines requirements for business continuity/resilience within the U.S. Financial System for those organizations that are vial to the daily operation of the U.S. Financial system most notable those working in critical financial markets of: Federal funds, foreign exchange, commercial paper, U.S. Government and agency securities, and corporate debt and equity securities

Annex A – Industry White Papers

In addition to standards, guideline documents and government specifications, white papers can provide useful information in a number of different areas. The white papers, or sources for white papers, contained in this annex are simply provided for information. They are not necessarily endorsed by the workshop participants, but rather are listed should users wish to read more on this subject.

Source	Title	Description
American Power Conversion Corp. (APC)	WP-37, Avoiding Costs From Oversizing Data Center and Network Room Infrastructure	The physical and power infrastructure of data centers and network rooms is typically oversized by more than 100%. Statistics related to oversizing are presented. The costs associated with oversizing are quantified. The fundamental reasons why oversizing occurs are discussed. An architecture and method for avoiding oversizing is described.
American Power Conversion Corp. (APC)	WP-112, Performing Effective MTBF Comparisons for Data Center Infrastructure	Mean Time Between Failure (MTBF) is often proposed as a key decision making criterion when comparing data center infrastructure systems. Misleading values are often provided by vendors, leaving the user incapable of making a meaningful comparison. When the variables and assumptions behind the numbers are unknown or are misinterpreted, bad decisions are inevitable. This paper explains how MTBF can be effectively used as one of several factors for specification and selection of systems, by making the assumptions explicit.
American Power Conversion Corp. (APC)	WP-120, Guidelines for Specification of Data Center Power Density	Conventional methods for specifying data center density are ambiguous and misleading. Describing data center density using Watts / ft2 or Watts / m2 is not sufficient to determine power or cooling compatibility with high density computing loads like blade servers. Historically there is no clear standard way of specifying data centers to achieve predictable behavior with high density loads. An appropriate specification for data center density should assure compatibility with anticipated high density loads, provide unambiguous instruction for design and installation of power and cooling equipment, prevent oversizing, and maximize electrical efficiency. This paper describes the science and practical application of an improved method for the specification of power and cooling infrastructure for data centers.
American Power Conversion Corp. (APC)	Various white papers	White papers addressing network-critical physical infrastructure in IT spaces.

EYP Mission Critical Facilities	Assuring Operational Continuity In C4ISR Facilities	This white paper suggests practices and processes for evaluating and 'hardening' mission critical facilities. The primary focus is electrical power to the C4ISR subsystems, including advanced powering topologies and technologies, and this paper shows how these practices and processes can be further extrapolated to other mission critical support functions, such as mechanical, architectural and environmental.
EYP Mission Critical Facilities	Total DC Integrated Data Centers	The unique approach presented in this paper involves multiple data center spaces with backup from an array of three-dimensional (3D) sources or storage devices. This approach features a data center architectural design that significantly improves A_o; not just for one or two subsystems, but for the entire data center. The paper emphasizes the fact that different dimensions are based on different technologies, adding another best practice beyond the more traditional redundancy level approaches such as dual path or fault tolerance. The concept presented is known as $(DC)^{2}$ ™ (pronounced 'DC Square').
Liebert	Regulatory Compliance and Critical System Protection: The Role of Mission-Critical Power and Cooling in Ensuring Data Integrity and Availability	Identifies regulatory compliance issues that impact business continuity planning and how mission-critical power, cooling, & monitoring strategies support business continuity.
Syska Hennessy Group, Inc	Will Liquid Cooled Solutions Save Energy?	An in-depth look at various liquid cooling technology scenarios and the energy efficiencies they deliver.
Syska Hennessy Group, Inc	Mission Critical vs. Critical Mission Thinking	An executive level overview of consequential factors that should encourage organizations to progress to critical mission thinking.
Syska Hennessy Group, Inc	Mission Critical Facilities and Operations	Addresses how reliability, uptime, security, flexibility and controls of mission critical operations have emerged as an overriding concern in C-suites and board rooms of an organization.
Syska Hennessy Group, Inc	Commissioning Critical Facilities	A comprehensive insight into the best global practices related to commissioning considerations for critical facilities.
Syska Hennessy Group, Inc	Outsourcing Considerations for Critical Facilities	Examines the benefits of this approach for certain critical functions, including engineering operations, property management and computer support services of an organization.
Syska Hennessy Group, Inc	The Criticality Levels™ of Facilities, Defined and Balanced	A new approach to the levels of criticality for data, telecom and other critical elements necessary to achieve a comprehensive balance of uptime and reliability.
Syska Hennessy Group, Inc	Security Considerations for Critical and Hypercritical Facilities	Specific and practical guidance for implementing multiple levels of safeguards including policies and procedures to improve the protection of mission critical facilities.
Syska Hennessy Group, Inc	Mission Critical Facilities White Papers (Various)	A link to all of Syska Hennessy Group's Critical Facilities white papers, and other technical briefs.

Annex B – Glossary of Acronyms

Acronym	Entity	URL and Contact Info
AEI	Architectural Engineering Institute of the American Society of Civil Engineers	www.aeinstitute.org aei@asce.org
ANSI	American National Standards Institute	www.ansi.org 212-642-4980 info@ansi.org
APC	American Power Conversion Corp.	www.apcc.com 877-800-4272 www.apcc.com/support/contact/index.cfm
ASCE	American Society of Civil Engineers	www.asce.org 800-548-2723 www.asce.org/contact.cfm
ASIS International	American Society for Industrial Security International	www.asisonline.org 703-519-6200 asis@asisonline.org
BICSI	Building Industry Consulting Service International	www.bicsi.org 813-979-1991 or 800-242-7405 bicsi@bicsi.org
BITS	BITS is not an acronym. At one time, BITS stood for "Banking Industry Technology Secretariat," but that is no longer used.	www.bitsinfo.org 202-289-4322 bits@fsround.org
CISSWG	The Critical Infrastructure Security Standards Working Group	
CSA	Canadian Standards Association	www.csa.ca 800-463-6727 certinfo@csa-international.org
DHS	U.S. Department of Homeland Security	www.dhs.gov 202-282-8000 www.dhs.gov/dhspublic/contactus
ESISAC	Electricity Sector Information Sharing and Analysis Center	www.esisac.com esisac@nerc.com
FEMA	Federal Emergency Management Agency	www.fema.gov 800-480-2520

Acronym	Entity	URL and Contact Info
HSSD	ANSI Homeland Security Standards Database	www.hssd.us 212-642-8908 kpeabody@ansi.org
HSSP	ANSI Homeland Security Standards Panel	www.ansi.org/hssp 212-642-4992 mdeane@ansi.org
IEC	International Electrotechnical Commission	www.iec.ch inmail@iec.ch
IEC	Independent Electrical Contractors	www.ieci.org 703-549-7351 info@ieci.org
IEEE	Institute of Electrical and Electronics Engineers, Inc.	www.ieee.org 800-701-IEEE communications@ieee.org
ISA	The Instrumentation, Systems and Automation Society	www.isa.org 919-549-8411 info@isa.org
NCS	National Communications System	www.ncs.gov 703-235-5516 ncsweb1@dhs.gov
NEBS	Network Equipment Building system	www.arcelect.com/NEBS.htm 1-800-926-0226 arc@arcelect.com
NEC	National Electrical Code	
NECA	National Electrical Contractors Association	www.necanet.org 301-657-3110 www.necanet.org/about/contact.cfm
NERC	North American Electric Reliability Council	www.nerc.com 609-452-8060 info@nerc.com
NETA	International Electrical Testing Association	www.netaworld.org 303-697-8441 neta@netaworld.org
NFPA	National Fire Protection Association	www.nfpa.org 617-770-3000 custserv@nfpa.org

Acronym	Entity	URL and Contact Info
NIST	U.S. Department of Commerce, National Institute of Standards and Technology	www.nist.gov 301-975-NIST inquiries@nist.gov
SDO	Standards Developing Organization	
SEC	U.S. Securities and Exchange Commission	www.sec.gov 202-942-8088 publicinfo@sec.gov
TIA	Telecommunications Industry Association	www.tiaonline.org 703-907-7500 standards@tiacomm.org