The attached DRAFT document (provided here for historical purposes) has been superseded by the following publication:

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Title: **Security and Privacy Controls for Federal Information Systems and Organizations**

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- Information on other NIST Computer Security Division publications and programs can be found at: http://csrc.nist.gov/

The following information was posted with the attached DRAFT document:

Feb. 28, 2012

SP 800-53 Rev. 4

DRAFT Security and Privacy Controls for Federal Information Systems and Organizations (Initial Public Draft)

NIST announces the Initial Public Draft of Special Publication (SP) 800-53, Revision 4, Security and Privacy Controls for Federal Information Systems and Organizations. Special Publication 800-53, Revision 4, represents the culmination of a year-long initiative to update the content of the security controls catalog and the guidance for selecting and specifying security controls for federal information systems and organizations. The project was conducted as part of the Joint Task Force Transformation Initiative in cooperation and collaboration with the Department of Defense, the Intelligence Community, the Committee on National Security Systems, and the Department of Homeland Security. The proposed changes included in Revision 4 are directly linked to the current state of the threat space (i.e., capabilities, intentions, and targeting activities of adversaries) and the attack data collected and analyzed over a substantial time period. In particular, the major changes in Revision 4 include:

- ***New security controls and control enhancements;***
- ***Clarification of security control requirements and specification language;***
- ***New tailoring guidance including the introduction of overlays;***
- ***Additional supplemental guidance for security controls and enhancements;***
- ***New privacy controls and implementation guidance;***
- ***Updated security control baselines;***
- ***New summary tables for security controls to facilitate ease-of-use; and***
- ***Revised minimum assurance requirements and designated assurance controls.***

Many of the changes were driven by particular cyber security issues and challenges requiring greater attention including, for example, insider threat, mobile and cloud computing, application security, firmware integrity, supply chain risk, and the advanced persistent threat (APT). In most instances, with the exception of the new privacy appendix, the new controls and enhancements are not labeled specifically as "cloud" or "mobile computing" controls or placed in one section of the catalog. Rather, the controls and enhancements are distributed throughout the control catalog in various families and provide specific security capabilities that are needed to support those new computing technologies and computing approaches. The breadth and depth of the security and privacy controls in the control catalog must be sufficiently robust to protect the wide range of information and information systems supporting the critical missions and business functions of the federal government—from the Department of Homeland Security, to the DoD warfighters, to the Federal Aviation Administration, to the Social Security Administration. As the federal government continues to implement its unified information security framework using the core publications developed under the Joint Task Force, there is also a significant transformation underway in how federal agencies authorize their information systems. Near real-time risk management and the ability to design, develop, and implement effective continuous monitoring programs, depends first and foremost, on the organization's ability to develop a strong information technology infrastructure—in essence, building stronger, more resilient information systems using system components with sufficient security capability to protect core missions and business functions. The security and privacy controls in this publication, along with the flexibility inherent in the implementation guidance, provide the requisite tools to implement effective, risk-based, cyber security programs—capable of addressing the most sophisticated of threats on the horizon.

Public comment period: February 28th through April 6th, 2012.

Public comment period: February 28th through April 6th, 2012. This will be the only comment period. Publication of the final document is anticipated in July 2012. Comments can be sent to:

sec-cert @ nist.gov.

To support the public review process, NIST will publish a markup version of Appendices D, F and G. This will help organizations plan for any future update actions they may wish to undertake after Revision 4 is finalized. There will not be any markups provided for the main chapters or the other appendices.

NIST Special Publication 800-53
Revision 4

National Institute of Standards and Technology
U.S. Department of Commerce

Security and Privacy Controls for Federal Information Systems and Organizations

JOINT TASK FORCE
TRANSFORMATION INITIATIVE

I N F O R M A T I O N S E C U R I T Y

INITIAL PUBLIC DRAFT

Computer Security Division
Information Technology Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899-8930

February 2012

U.S. Department of Commerce
John E. Bryson, Secretary

National Institute of Standards and Technology
Patrick D. Gallagher, Under Secretary for Standards and Technology and Director

Reports on Computer Systems Technology

The Information Technology Laboratory (ITL) at the National Institute of Standards and Technology (NIST) promotes the U.S. economy and public welfare by providing technical leadership for the nation's measurement and standards infrastructure. ITL develops tests, test methods, reference data, proof of concept implementations, and technical analyses to advance the development and productive use of information technology. ITL's responsibilities include the development of management, administrative, technical, and physical standards and guidelines for the cost-effective security and privacy of other than national security-related information in federal information systems. The Special Publication 800-series reports on ITL's research, guidelines, and outreach efforts in information system security, and its collaborative activities with industry, government, and academic organizations.

Authority

This publication has been developed by NIST to further its statutory responsibilities under the Federal Information Security Management Act (FISMA), Public Law (P.L.) 107-347. NIST is responsible for developing information security standards and guidelines, including minimum requirements for federal information systems, but such standards and guidelines shall not apply to national security systems without the express approval of appropriate federal officials exercising policy authority over such systems. This guideline is consistent with the requirements of the Office of Management and Budget (OMB) Circular A-130, Section 8b(3), *Securing Agency Information Systems*, as analyzed in Circular A-130, Appendix IV: *Analysis of Key Sections*. Supplemental information is provided in Circular A-130, Appendix III, *Security of Federal Automated Information Resources*.

Nothing in this publication should be taken to contradict the standards and guidelines made mandatory and binding on federal agencies by the Secretary of Commerce under statutory authority. Nor should these guidelines be interpreted as altering or superseding the existing authorities of the Secretary of Commerce, Director of the OMB, or any other federal official. This publication may be used by nongovernmental organizations on a voluntary basis and is not subject to copyright in the United States. Attribution would, however, be appreciated by NIST.

NIST Special Publication 800-53, 375 pages

(February 2012)

CODEN: NSPUE2

Public comment period: February 28 through April 6, 2012

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Compliance with NIST Standards and Guidelines

In accordance with the provisions of FISMA,[1] the Secretary of Commerce shall, on the basis of standards and guidelines developed by NIST, prescribe standards and guidelines pertaining to federal information systems. The Secretary shall make standards compulsory and binding to the extent determined necessary by the Secretary to improve the efficiency of operation or security of federal information systems. Standards prescribed shall include information security standards that provide minimum information security requirements and are otherwise necessary to improve the security of federal information and information systems.

- Federal Information Processing Standards (FIPS) are approved by the Secretary of Commerce and issued by NIST in accordance with FISMA. FIPS are compulsory and binding for federal agencies.[2] FISMA requires that federal agencies comply with these standards, and therefore, agencies may not waive their use.
- Special Publications (SPs) are developed and issued by NIST as recommendations and guidance documents. For other than national security programs and systems, federal agencies must follow those NIST Special Publications mandated in a Federal Information Processing Standard. FIPS 200 mandates the use of Special Publication 800-53, as amended. In addition, OMB policies (including OMB Reporting Instructions for FISMA and Agency Privacy Management) state that for other than national security programs and systems, federal agencies must follow certain specific NIST Special Publications.[3]
- Other security-related publications, including NIST interagency reports (NISTIRs) and ITL Bulletins, provide technical and other information about NIST's activities. These publications are mandatory only when specified by OMB.
- Compliance schedules for NIST security standards and guidelines are established by OMB in policies, directives, or memoranda (e.g., annual FISMA Reporting Guidance).[4]

[1] The E-Government Act (P.L. 107-347) recognizes the importance of information security to the economic and national security interests of the United States. Title III of the E-Government Act, entitled the Federal Information Security Management Act (FISMA), emphasizes the need for organizations to develop, document, and implement an organization-wide program to provide security for the information systems that support its operations and assets.

[2] The term *agency* is used in this publication in lieu of the more general term *organization* only in those circumstances where its usage is directly related to other source documents such as federal legislation or policy.

[3] While federal agencies are required to follow certain specific NIST Special Publications in accordance with OMB policy, there is flexibility in how agencies apply the guidance. Federal agencies apply the security concepts and principles articulated in the NIST Special Publications in accordance with and in the context of the agency's missions, business functions, and environment of operation. Consequently, the application of NIST guidance by federal agencies can result in different security solutions that are equally acceptable, compliant with the guidance, and meet the OMB definition of *adequate security* for federal information systems. Given the high priority of information sharing and transparency within the federal government, agencies also consider reciprocity in developing their information security solutions. When assessing federal agency compliance with NIST Special Publications, Inspectors General, evaluators, auditors, and assessors consider the intent of the security concepts and principles articulated within the specific guidance document and how the agency applied the guidance in the context of its mission/business responsibilities, operational environment, and unique organizational conditions.

[4] Unless otherwise stated, all references to NIST publications in this document (i.e., Federal Information Processing Standards and Special Publications) are to the most recent version of the publication.

Acknowledgements

This publication was developed by the *Joint Task Force Transformation Initiative* Interagency Working Group with representatives from the Civil, Defense, and Intelligence Communities in an ongoing effort to produce a unified information security framework for the federal government. The National Institute of Standards and Technology wishes to acknowledge and thank the senior leaders from the Departments of Commerce and Defense, the Office of the Director of National Intelligence, the Committee on National Security Systems, and the members of the interagency technical working group whose dedicated efforts contributed significantly to the publication. The senior leaders, interagency working group members, and their organizational affiliations include:

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groups, and organizations in the public and private sectors, both nationally and internationally, whose thoughtful and constructive comments improved the overall quality, thoroughness, and usefulness of this publication.

Notes to Reviewers

NIST Special Publication 800-53, Revision 4 (Initial Public Draft), represents the culmination of a year-long initiative to update the content of the security controls catalog and the guidance for selecting and specifying security controls for federal information systems and organizations. The project was conducted as part of the *Joint Task Force Transformation Initiative* in cooperation and collaboration with the Department of Defense, the Intelligence Community, the Committee on National Security Systems, and the Department of Homeland Security. The proposed changes included in Revision 4 are directly linked to the current state of the threat space (i.e., capabilities, intentions, and targeting activities of adversaries) and the attack data collected and analyzed over a substantial time period. In particular, the major changes in Revision 4 include:

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Many of the changes were driven by particular cyber security issues and challenges requiring greater attention including, for example, insider threat, mobile and cloud computing, application security, firmware integrity, supply chain risk, and the advanced persistent threat (APT). In most instances, with the exception of the new privacy appendix, the new controls and enhancements are *not* labeled specifically as "cloud" or "mobile computing" controls or placed in one section of the catalog. Rather, the controls and enhancements are distributed throughout the control catalog in various families and provide specific security capabilities that are needed to support those new computing technologies and computing approaches. The breadth and depth of the security and privacy controls in the control catalog must be sufficiently robust to protect the wide range of information and information systems supporting the critical missions and business functions of the federal government—from the Department of Homeland Security, to the DoD warfighters, to the Federal Aviation Administration, to the Social Security Administration.

As the federal government continues to implement its *unified information security framework* using the core publications developed under the Joint Task Force, there is also a significant transformation underway in how federal agencies authorize their information systems. Near real-time risk management and the ability to design, develop, and implement effective continuous monitoring programs, depends first and foremost, on the organization's ability to develop a strong information technology infrastructure—in essence, building stronger, more resilient information systems using system components with sufficient security capability to protect core missions and business functions. The security and privacy controls in this publication, along with the flexibility inherent in the implementation guidance, provide the requisite tools to implement effective, risk-based, cyber security programs—capable of addressing the most sophisticated of threats on the horizon.

To support the public review process, NIST will publish a markup version of Appendices D, F, and G (i.e., baseline allocations and the catalog of security controls for information systems and organizations) to show the proposed changes to the individual security controls. This will help organizations plan for any future update actions they may wish to undertake after Revision 4 is finalized. There will *not* be any markups provided for the main chapters or the other appendices.

We would like to express our sincere appreciation to the many organizations and individuals in the public and private sectors who took the time to submit contributions to the update of Special Publication 800-53. Your feedback to us during the public review period is invaluable as we attempt to provide state-of-the-practice cyber security and privacy guidance to our customers.

-- RON ROSS
JOINT TASK FORCE LEADER
FISMA IMPLEMENTATION PROJECT LEADER

DEVELOPING COMMON INFORMATION SECURITY FOUNDATIONS

COLLABORATION AMONG PUBLIC AND PRIVATE SECTOR ENTITIES

In developing standards and guidelines required by FISMA, NIST consults with other federal agencies and offices as well as the private sector to improve information security, avoid unnecessary and costly duplication of effort, and ensure that NIST publications are complementary with the standards and guidelines employed for the protection of national security systems. In addition to its comprehensive public review process, NIST collaborates with the Department of Defense (DoD), the Office of the Director of National Intelligence (ODNI), the Intelligence Community (IC), and the Committee on National Security Systems (CNSS) to establish a common foundation for information security across the federal government. A common security foundation will provide the Intelligence, Defense, and Civil sectors of the federal government and their contractors, more uniform and consistent ways to manage the risk to organizational operations (including missions, functions, image, and reputation), organizational assets, individuals, other organizations, and the Nation that results from the operation and use of information systems. A common foundation will also provide a strong basis for reciprocal acceptance of security assessment results and facilitate information sharing. NIST is also working with public and private sector entities to establish specific mappings and relationships between the security standards and guidelines developed by NIST and the International Organization for Standardization and International Electrotechnical Commission (ISO/IEC).

FIPS 200 AND SP 800-53

IMPLEMENTING INFORMATION SECURITY STANDARDS AND GUIDELINES

FIPS Publication 200, *Minimum Security Requirements for Federal Information and Information Systems*, is a mandatory federal standard developed by NIST in response to FISMA. To comply with the federal standard, organizations first determine the security category of their information system in accordance with FIPS Publication 199, *Standards for Security Categorization of Federal Information and Information Systems*, derive the information system impact level from the security category in accordance with FIPS 200, and then apply the appropriately tailored set of baseline security controls in NIST Special Publication 800-53, *Security and Privacy Controls for Federal Information Systems and Organizations*. Organizations have flexibility in applying the baseline security controls in accordance with the guidance provided in Special Publication 800-53. This allows organizations to tailor the relevant security control baseline so that it more closely aligns with their mission and business requirements and environments of operation.

FIPS 200 and NIST Special Publication 800-53, in combination, ensure that appropriate security requirements and security controls are applied to all federal information and information systems. An organizational assessment of risk validates the initial security control selection and determines if additional controls are needed to protect organizational operations (including mission, functions, image, or reputation), organizational assets, individuals, other organizations, or the Nation. The resulting set of security controls establishes a level of security due diligence for the organization.

PRIVACY CONTROLS

PROVIDING PRIVACY PROTECTION FOR FEDERAL INFORMATION

Appendix J, *Privacy Control Catalog*, is a new addition to NIST Special Publication 800-53. It is intended to address the privacy needs of federal agencies. The objective of the Privacy Appendix is fourfold:

- Provide a structured set of privacy controls, based on international standards and best practices, that help organizations enforce requirements deriving from federal privacy legislation, policies, regulations, directives, standards, and guidance;
- Establish a linkage and relationship between privacy and security controls for purposes of enforcing respective privacy and security requirements which may overlap in concept and in implementation within federal information systems, programs, and organizations;
- Demonstrate the applicability of the NIST Risk Management Framework in the selection, implementation, assessment, and monitoring of privacy controls deployed in federal information systems, programs, and organizations; and
- Promote closer cooperation between privacy and security officials within the federal government to help achieve the objectives of senior leaders/executives in enforcing the requirements in federal privacy legislation, policies, regulations, directives, standards, and guidance.

There is a strong similarity in the structure of the privacy controls in Appendix J and the security controls in Appendices F and G. Moreover, the use of privacy plans in conjunction with security plans provides an opportunity for organizations to select the appropriate set of security and privacy controls in accordance with organizational mission/business requirements and the environments in which the organizations operate. Incorporating the same concepts used in managing information security risk, helps organizations implement privacy controls in a more cost-effective, risked-based manner while simultaneously protecting individual privacy and meeting compliance requirements. Standardized privacy controls provide a more disciplined and structured approach for satisfying federal privacy requirements and demonstrating compliance to those requirements.

Cautionary Note

IMPLEMENTING CHANGES BASED ON REVISIONS TO SPECIAL PUBLICATION 800-53

When NIST publishes revisions to Special Publication 800-53, there are four primary types of changes made to the document: (i) security controls or control enhancements are added to or withdrawn from Appendices F and G and/or to the low, moderate, and high baselines; (ii) supplemental guidance is modified; (iii) material in the main chapters or appendices is modified; and (iv) language is clarified and/or updated throughout the document.

When modifying existing tailored security control baselines at Tier 3 in the risk management hierarchy (as described in Special Publication 800-39) and updating security controls at any tier as a result of Special Publication 800-53 revisions, organizations should take a measured, risk-based approach in accordance with organizational risk tolerance and current risk assessments. Unless otherwise directed by OMB policy, the following activities are recommended to implement changes to Special Publication 800-53:

- First, organizations determine if any added security controls/control enhancements are applicable to organizational information systems or environments of operation following tailoring guidelines in this publication.
- Next, organizations review changes to the supplemental guidance, guidance in the main chapters and appendices, and updated/clarified language throughout the publication to determine if changes apply to any organizational information systems and if any immediate actions are required.
- Finally, once organizations have determined the entirety of changes necessitated by the revisions to the publication, the changes are integrated into the established continuous monitoring process to the greatest extent possible. The implementation of new or modified security controls to address specific, active threats is always the highest priority for sequencing and implementing changes. Modifications such as changes to templates or minor language changes in policy or procedures are generally the lowest priority and are made in conjunction with the established review cycle.

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Prologue

"*…Through the process of risk management, leaders must consider risk to US interests from adversaries using cyberspace to their advantage and from our own efforts to employ the global nature of cyberspace to achieve objectives in military, intelligence, and business operations… "*

"…For operational plans development, the combination of threats, vulnerabilities, and impacts must be evaluated in order to identify important trends and decide where effort should be applied to eliminate or reduce threat capabilities; eliminate or reduce vulnerabilities; and assess, coordinate, and deconflict all cyberspace operations…"

"…Leaders at all levels are accountable for ensuring readiness and security to the same degree as in any other domain…"

-- THE NATIONAL STRATEGY FOR CYBERSPACE OPERATIONS
OFFICE OF THE CHAIRMAN, JOINT CHIEFS OF STAFF, U.S. DEPARTMENT OF DEFENSE

CHAPTER ONE

INTRODUCTION

THE NEED TO PROTECT INFORMATION AND INFORMATION SYSTEMS

The selection and implementation of *security controls* for organizations and information systems[5] are important tasks that can have major implications on the operations[6] and assets of organizations[7] as well as the welfare of individuals and the Nation. Security controls are the safeguards/countermeasures employed within organizational information systems to protect the confidentiality, integrity, and availability of the information systems and the information that is processed, stored, and transmitted by those systems. There are several important questions that should be answered by organizations when addressing the information security considerations for information systems:

- What security controls are needed to adequately mitigate risk incurred by using information and information systems in the execution of organizational missions and business functions?
- Have the selected security controls been implemented or is there a realistic implementation plan in place?
- What is the desired or required level of assurance that the selected security controls, as implemented, are effective in their application?[8]

The answers to these questions are not given in isolation but rather in the context of an effective *risk management process* for the organization that identifies, mitigates as deemed necessary, and monitors on an ongoing basis, risks[9] arising from its information and information systems. NIST Special Publication 800-39 provides guidance on risk management describing three tiers of risk management with respect to information security—organization level (Tier 1), mission/business process level (Tier 2), and information system level (Tier 3). The security controls defined in this publication and recommended for use by organizations in achieving their information protection needs should be employed as part of a well-defined and documented risk management process that supports organizational information security programs.[10]

[5] An information system is a discrete set of *information resources* organized expressly for the collection, processing, maintenance, use, sharing, dissemination, or disposition of information. Information systems also include specialized systems such as industrial/process controls systems, telephone switching/private branch exchange (PBX) systems, and environmental control systems. Information systems can be viewed from a logical and physical perspective as complex *system-of-systems* when there are multiple systems involved with a high degree of connectivity and interaction among the systems.

[6] Organizational operations include mission, functions, image, and reputation.

[7] The term *organization* describes an entity of any size, complexity, or positioning within an organizational structure (e.g., a federal agency or, as appropriate, any of its operational elements).

[8] Security control *effectiveness* addresses the extent to which the controls are implemented correctly, operating as intended, and producing the desired outcome with respect to meeting the security requirements for the information system in its operational environment or enforcing/mediating established security policies.

[9] Information security-related risks are those risks that arise from the loss of confidentiality, integrity, or availability of information or information systems and consider the potential adverse impacts to organizational operations and assets, individuals, other organizations, and the Nation.

[10] The program management controls (Appendix G) complement the security controls for an information system (Appendix F) by focusing on the organization-wide information security requirements that are independent of any particular information system and are essential for managing information security programs.

It is of paramount importance that responsible officials understand the risks and other factors that could adversely affect organizational operations and assets, individuals, other organizations, and the Nation.[11] These officials must also understand the current status of their security programs and the security controls planned or in place to protect their information and information systems in order to make informed judgments and investments that mitigate risks to an acceptable level. The ultimate objective is to conduct the day-to-day operations of the organization and accomplish the organization's stated missions and business functions with what the OMB Circular A-130 defines as *adequate security*, or security commensurate with risk resulting from the unauthorized access, use, disclosure, disruption, modification, or destruction of information.

1.1 PURPOSE AND APPLICABILITY

The purpose of this publication is to provide guidelines for selecting and specifying security controls for organizations and information systems supporting the executive agencies of the federal government to meet the requirements of FIPS 200, *Minimum Security Requirements for Federal Information and Information Systems*. The guidelines apply to all components[12] of an information system that process, store, or transmit federal information. The guidelines have been developed to achieve more secure information systems and effective risk management within the federal government by:

- Facilitating a more consistent, comparable, and repeatable approach for selecting and specifying security controls for information systems and organizations;
- Providing a stable, yet flexible catalog of security controls to meet current information protection needs and the demands of future protection needs based on changing threats, requirements, and technologies;
- Providing a recommendation for minimum security controls for information systems categorized in accordance with FIPS 199, *Standards for Security Categorization of Federal Information and Information Systems*;
- Creating a foundation for the development of assessment methods and procedures for determining security control effectiveness; and
- Improving communication among organizations by providing a common lexicon that supports discussion of risk management concepts.

The guidelines in this special publication are applicable to all federal information systems[13] other than those systems designated as national security systems as defined in 44 U.S.C., Section 3542. The guidelines have been broadly developed from a technical perspective to complement similar guidelines for national security systems and may be used for such systems with the approval of appropriate federal officials exercising policy authority over such systems.[14] State, local, and tribal governments, as well as private sector organizations are encouraged to consider using these guidelines, as appropriate.

[11] Includes risk to U.S. critical infrastructure/key resources as described in Homeland Security Presidential Directive 7.

[12] Information system components include, for example, mainframes, workstations, servers (e.g., database, electronic mail, authentication, web, proxy, file, domain name), input/output devices (e.g., scanners, copiers, printers), network components (e.g., firewalls, routers, gateways, voice and data switches, wireless access points, network appliances, sensors), operating systems, middleware, and applications.

[13] A federal information system is an information system used or operated by an executive agency, by a contractor of an executive agency, or by another organization on behalf of an executive agency.

[14] CNSS Instruction 1253 provides implementing guidance for *national security systems.*

1.2 TARGET AUDIENCE

This publication is intended to serve a diverse audience of information system and information security professionals including:

- Individuals with information system, security, and/or risk management and oversight responsibilities (e.g., authorizing officials, chief information officers, senior information security officers,[15] information system managers, information security managers);
- Individuals with information system development responsibilities (e.g., program managers, system designers and developers, information security engineers, systems integrators);
- Individuals with information security implementation and operational responsibilities (e.g., mission/business owners, information system owners, common control providers, information owners/stewards, information security engineers, system administrators, information system security officers);
- Individuals with information security assessment and monitoring responsibilities (e.g., auditors, Inspectors General, system evaluators, assessors, independent verifiers/validators, analysts, information system owners); and
- Commercial companies producing information technology products and systems, creating information security-related technologies, and providing information security services.

1.3 RELATIONSHIP TO OTHER SECURITY CONTROL PUBLICATIONS

To create a technically sound and broadly applicable set of security controls for information systems and organizations, a variety of sources were considered during the development of this special publication. The sources included security controls from the defense, audit, financial, healthcare, industrial/process control, and intelligence communities as well as controls defined by national and international standards organizations. The objective of NIST Special Publication 800-53 is to provide a set of security controls that can satisfy the breadth and depth of security requirements[16] levied on organizations, mission/business processes, and information systems and that is consistent with and complementary to other established information security standards.

The catalog of security controls in Special Publication 800-53 can be effectively used to protect information and information systems from traditional and advanced persistent threats in varied operational, environmental, and technical scenarios. The controls can also be used to demonstrate compliance with a variety of governmental, organizational, or institutional security requirements. Organizations have the responsibility to select the appropriate security controls, to implement the controls correctly, and to demonstrate the effectiveness of the controls in satisfying established security requirements.[17] The security controls facilitate the development of assessment methods and procedures that can be used to demonstrate control effectiveness in a consistent/repeatable manner—thus contributing to the organization's confidence that security requirements continue to be satisfied on an ongoing basis.

[15] At the *agency* level, this position is known as the Senior Agency Information Security Officer. Organizations may also refer to this position as the *Senior Information Security Officer* or the *Chief Information Security Officer*.

[16] Security requirements are those requirements levied on an information system that are derived from laws, Executive Orders, directives, policies, instructions, regulations, standards, guidelines, or organizational (mission) needs to ensure the confidentiality, integrity, and availability of the information being processed, stored, or transmitted.

[17] NIST Special Publication 800-53A provides guidance on assessing the effectiveness of security controls defined in this publication.

1.4 ORGANIZATIONAL RESPONSIBILITIES

Organizations[18] use FIPS 199 to categorize their information and information systems. Security categorization is accomplished as an organization-wide activity[19] with the involvement of senior-level organizational personnel including, for example, authorizing officials, chief information officers, senior information security officers, information owners/stewards, information system owners, and risk executive (function). Information is categorized at Tier 1 (organization level) and at Tier 2 (mission/business process level). As required by FIPS 200, organizations use the security categorization results from Tiers 1 and 2 to designate organizational information systems at Tier 3 (information system level) as low-impact, moderate-impact, or high-impact systems. For each information system at Tier 3, the recommendation for security controls from the *baseline* controls defined in Appendix D is the starting point for the security control *tailoring* process. While the security control selection process is generally focused on information systems at Tier 3, the process is generally applicable across all three tiers of risk management.

FIPS 199 security categorization associates information and the operation/use of organizational information systems with the potential worst-case adverse impact on organizational operations and assets, individuals, other organizations, and the Nation.[20] Organizational assessments of risk, including the use of specific and credible threat information, vulnerability information, and the likelihood of such threats exploiting vulnerabilities to cause adverse impacts, guide and inform the tailoring process and the final selection of security controls.[21] The final, agreed-upon set of security controls addressing specific organizational mission/business needs and tolerance for risk is documented with appropriate rationale in the security plan for the information system.[22] The use of security controls from Special Publication 800-53 (including the baseline controls as a starting point in the control selection process), facilitates a more consistent level of security for federal information systems and organizations, while simultaneously preserving the flexibility and agility organizations need to address an increasingly sophisticated and hostile threat space, specific organizational missions/business functions, rapidly changing technologies, and in some cases, unique environments of operation.

Achieving adequate information security for organizations, mission/business processes, and information systems is a multifaceted undertaking that requires:

- Clearly articulated security requirements and security specifications;
- Well-designed and well-built information technology products based on state-of-the-practice hardware, firmware, and software development processes;
- Sound systems/security engineering principles and practices to effectively integrate information technology products into organizational information systems;

[18] Organizations typically exercise managerial, operational, and financial control over their information systems and the security provided to those systems, including the authority and capability to implement or require the security controls deemed necessary to protect organizational operations and assets, individuals, other organizations, and the Nation.

[19] See FIPS Publication 200, footnote 7.

[20] Considerations for potential national-level impacts and impacts to other organizations in categorizing organizational information systems derive from the USA PATRIOT Act and Homeland Security Presidential Directives (HSPDs).

[21] Risk assessments can be accomplished in a variety of ways depending on the specific needs of organizations. NIST Special Publication 800-30 provides guidance on the assessment of risk as part of an overall risk management process.

[22] Authorizing officials or designated representatives, by accepting the completed security plans, agree to the set of security controls proposed to meet the security requirements for organizations (including mission/business processes) and/or designated information systems.

- Continuous monitoring of organizations and information systems to determine the ongoing effectiveness of deployed security controls, changes in information systems and environments of operation, and compliance with legislation, directives, policies, and standards;[23] and
- Comprehensive information security planning and system development life cycle management.[24]

From an engineering viewpoint, information security is just one of many required operational capabilities for information systems that support organizational mission/business processes—capabilities that must be funded by organizations throughout the system development life cycle in order to achieve mission/business success. It is important that organizations *realistically* assess the risk to organizational operations and assets, individuals, other organizations, and the Nation arising from implemented mission/business processes and by placing information systems into operation or continuing current system operations. Finally, information security requirements for organizational information systems must be satisfied with the full knowledge and consideration of the risk management strategy[25] of the organization, in light of the potential cost, schedule, and performance issues associated with the acquisition, deployment, and operation of the information systems.[26]

1.5 ORGANIZATION OF THIS SPECIAL PUBLICATION

The remainder of this special publication is organized as follows:

- **Chapter Two** describes the fundamental concepts associated with security control selection and specification including: (i) multitiered risk management; (ii) the structure of security controls and how the controls are organized into families; (iii) security control baselines as starting points for the tailoring process; (iv) the use of common controls and inheritance of security capabilities; (v) external environments and service providers; (vi) assurance and trustworthiness; and (vii) revisions and extensions to security controls and control baselines.
- **Chapter Three** describes the process of selecting and specifying security controls for organizational information systems including: (i) selecting appropriate security control baselines; (ii) tailoring the baseline controls and developing overlays; (iii) documenting the security control selection process; and (iv) applying the selection process to new and legacy systems.
- **Supporting appendices** provide essential security control selection and specification-related information including: (i) general references; (ii) definitions and terms; (iii) acronyms; (iv) baseline security controls for low-impact, moderate-impact, and high-impact information systems; (v) guidance on assurance and trustworthiness; (vi) a master catalog of security controls; (vii) information security program management controls; (viii) two-way mappings to international security standards; (ix) an overlay template for baseline tailoring; and (x) a master catalog of privacy controls.

[23] NIST Special Publication 800-137 provides guidance on continuous monitoring of organizational information systems and environments of operation.

[24] NIST Special Publication 800-64 provides guidance on the information security considerations in the system development life cycle.

[25] NIST Special Publication 800-39 provides guidance on information security risk management applied at multiple tiers including the organization level, mission/business process level, and information system level.

[26] In addition to information security requirements, organizations must also address privacy requirements that derive from federal legislation and policies. Organizations can employ the privacy controls in Appendix J in conjunction with the security controls in Appendix F to achieve comprehensive security and privacy protection.

CHAPTER TWO

THE FUNDAMENTALS

SECURITY CONTROL STRUCTURE, ORGANIZATION, BASELINES, AND ASSURANCE

This chapter presents the fundamental concepts associated with security control selection and specification including: (i) three-tier risk management; (ii) the structure of security controls and the organization of the controls in the control catalog; (iii) security control baselines; (iv) the identification and use of common security controls; (v) security controls in external environments; (vi) security control assurance; and (vii) future revisions to the security controls, the control catalog, and baseline controls.

2.1 MULTITIERED RISK MANAGEMENT

The selection and specification of security controls for an information system is accomplished as part of an organization-wide information security program for the management of risk—that is, the risk to organizational operations and assets, individuals, other organizations, and the Nation associated with the operation of information systems. Risk-based approaches to security control selection and specification consider effectiveness, efficiency, and constraints due to applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidelines. To integrate the risk management process throughout the organization and more effectively address mission/business concerns, a three-tiered approach is employed that addresses risk at the: (i) *organization* level; (ii) *mission/business process* level; and (iii) *information system* level. The risk management process is carried out seamlessly across the three tiers with the overall objective of continuous improvement in the organization's risk-related activities and effective inter-tier and intra-tier communication among all stakeholders having a shared interest in the mission/business success of the organization. Figure 1 illustrates the three-tiered approach to risk management along with some of its key characteristics.

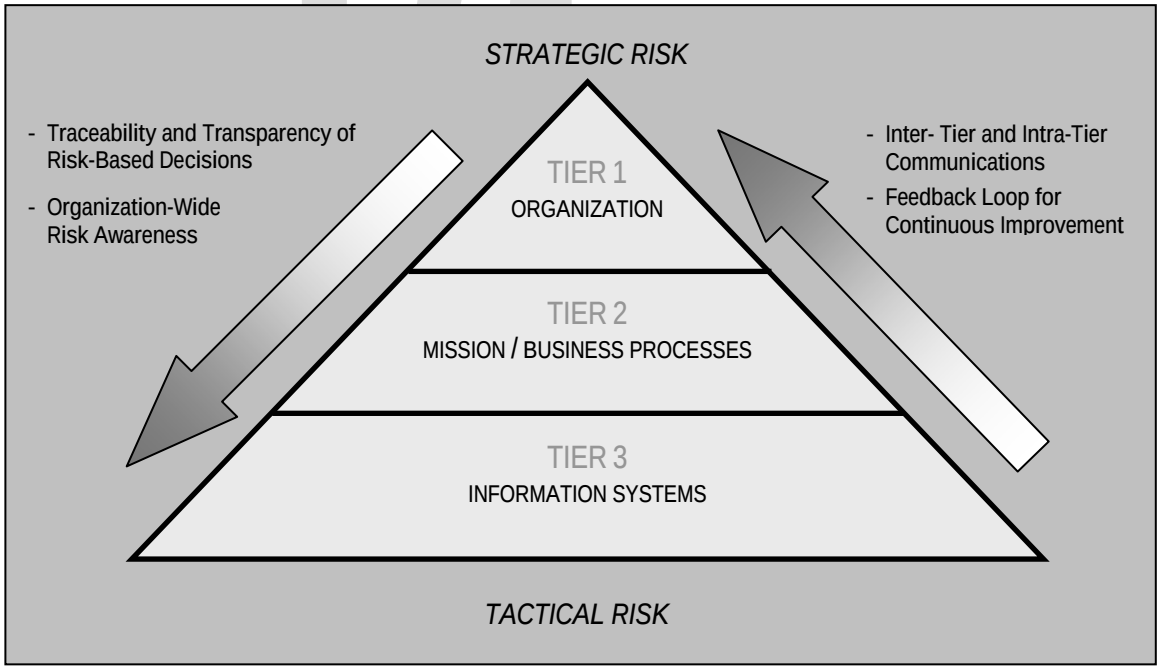

FIGURE 1: THREE-TIERED RISK MANAGEMENT APPROACH

Tier 1 provides a prioritization of organizational missions/business functions which in turn drives investment strategies and funding decisions—promoting cost-effective, efficient information technology solutions consistent with the strategic goals and objectives of the organization and measures of performance. Tier 2 includes: (i) defining the mission/business processes needed to support the organizational missions/business functions; (ii) determining the security categories of the information systems needed to execute the mission/business processes; (iii) incorporating information security requirements into the mission/business processes; and (iv) establishing an enterprise architecture (including an embedded information security architecture) to facilitate the allocation of security controls to organizational information systems and the environments in which those systems operate. The Risk Management Framework (RMF), depicted at Figure 2, is the primary means for addressing risk at Tier 3.[27] This publication focuses on Step 2 of the RMF, the security control selection process, in the context of the three tiers in the organizational risk management hierarchy.

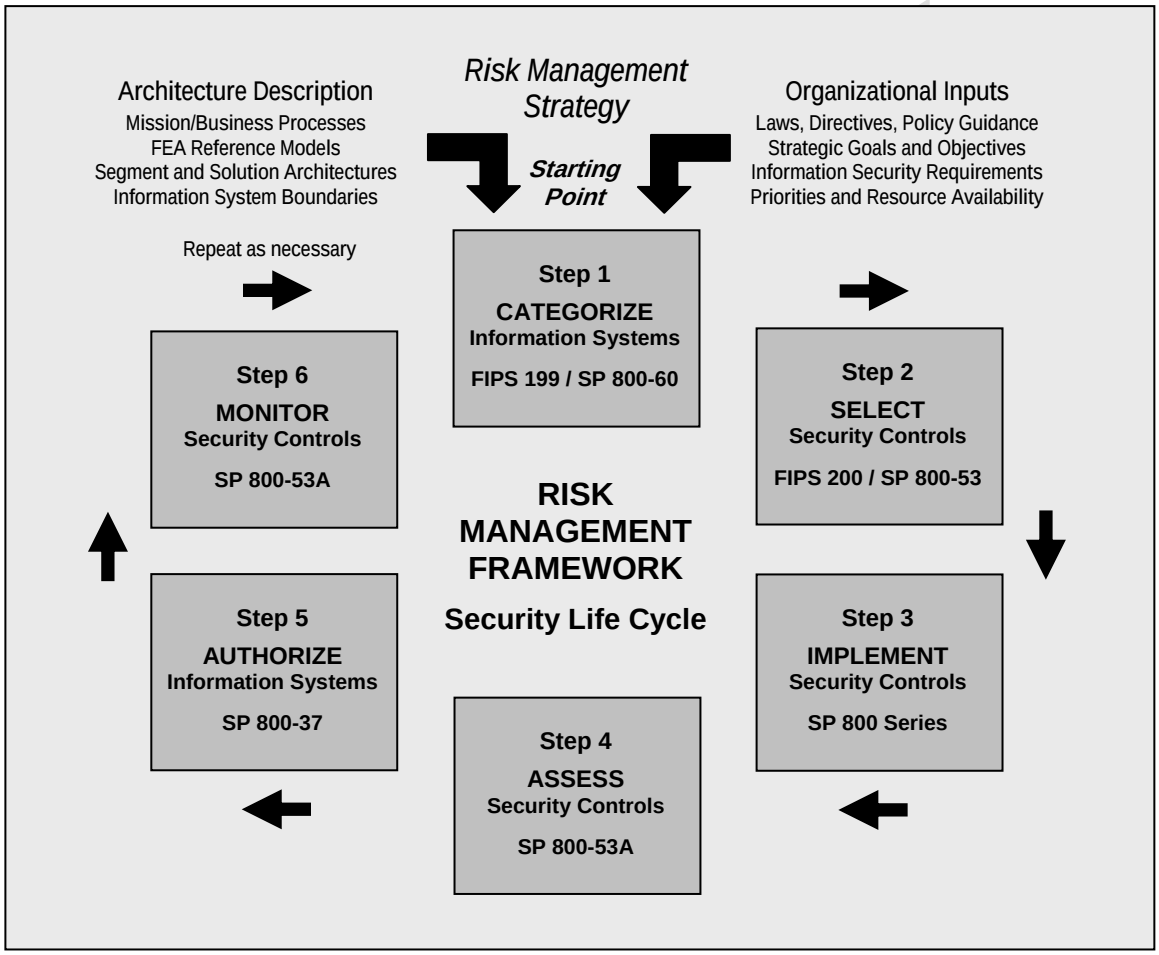

FIGURE 2: RISK MANAGEMENT FRAMEWORK

The RMF addresses the security concerns of organizations related to the design, development, implementation, operation, and disposal of information systems and the environments in which those systems operate. The RMF consists of the following six steps:

[27] NIST Special Publication 800-37 provides guidance on the implementation of the Risk Management Framework. A complete listing of all publications supporting the RMF and referenced in Figure 2 is provided in Appendix A.

- ***Categorize*** the information system based on a FIPS 199 impact analysis;[28]
- ***Select*** an initial set of baseline security controls for the information system based on system impact level and apply tailoring guidance, as needed;
- ***Implement*** the security controls and document the design, development, and implementation details for the controls;
- ***Assess*** the security controls to determine the extent to which the controls are implemented correctly, operating as intended, and producing the desired outcome with respect to meeting the security requirements for the system;[29]
- ***Authorize*** information system operation based on a determination of risk to organizational operations and assets, individuals, other organizations, and the Nation resulting from the operation and use of the information system and the decision that this risk is acceptable; and
- ***Monitor*** the security controls in the information system and environment of operation on an ongoing basis to determine control effectiveness, changes to the system/environment, and compliance to legislation, Executive Orders, directives, policies, regulations, and standards.

2.2 SECURITY CONTROL STRUCTURE

Security controls described in this publication have a well-defined organization and structure. For ease of use in the security control selection and specification process, controls are organized into eighteen *families*.[30] Each family contains security controls related to the general security topic of the family. A two-character identifier uniquely identifies security control families, for example, PS (Personnel Security). Security controls may involve aspects of policy, oversight, supervision, manual processes, actions by individuals, or automated mechanisms implemented by information systems/devices. Table 1 lists the security control families and the associated family identifiers in the security control catalog.

TABLE 1: SECURITY CONTROL IDENTIFIERS AND FAMILY NAMES

ID	FAMILY	ID	FAMILY
AC	Access Control	MP	Media Protection
AT	Awareness and Training	PE	Physical and Environmental Protection
AU	Audit and Accountability	PL	Planning
CA	Security Assessment and Authorization	PS	Personnel Security
CM	Configuration Management	RA	Risk Assessment
CP	Contingency Planning	SA	System and Services Acquisition
IA	Identification and Authentication	SC	System and Communications Protection
IR	Incident Response	SI	System and Information Integrity
MA	Maintenance	PM	Program Management

[28] CNSS Instruction 1253 provides security categorization guidance for national security systems.

[29] NIST Special Publication 800-53A provides guidance on assessing the effectiveness of security controls.

[30] Of the eighteen security control families in NIST Special Publication 800-53, seventeen families are described in the security control catalog in Appendix F, and are closely aligned with the seventeen minimum security requirements for federal information and information systems in FIPS 200. One additional family (Program Management [PM] family) in Appendix G provides controls for information security programs. This family, while not referenced in FIPS 200, provides security controls at the organization level rather than the information system level.

The security control structure consists of the following components: (i) a *control* section; (ii) a *supplemental guidance* section; (iii) a *control enhancements* section; (iv) a *references* section; and (v) a *priority* and *baseline allocation* section. The following example from the Auditing and Accountability family illustrates the structure of a typical security control.

AU-3 CONTENT OF AUDIT RECORDS

Control: The information system produces audit records that contain sufficient information to, at a minimum, establish what type of event occurred, when the event occurred, where the event occurred, the source of the event, the outcome of the event, and the identity of any user or subject associated with the event.

Supplemental Guidance: Audit record content that may be necessary to satisfy the requirement of this control includes, for example, time stamps, source and destination addresses, user/process identifiers, event descriptions, success/fail indications, filenames involved, and access control or flow control rules invoked. Event outcomes can include indicators of event success or failure and event-specific results (e.g., the security state of the information system after the event occurred). Related controls: AU-2, AU-8, AU-12, SI-11.

Control Enhancements:

(1) *CONTENT OF AUDIT RECORDS | ADDITIONAL AUDIT INFORMATION*

The information system includes [*Assignment: organization-defined additional, more detailed information*] in the audit records for audit events identified by type, location, or subject.

Supplemental Guidance: Detailed information that organizations may consider in audit records includes, for example, full-text recording of privileged commands or the individual identities of group account users. Organizations consider limiting the additional audit information to only that information explicitly needed for specific audit requirements. This facilitates the use of the audit trails by not including information that could potentially be misleading or could make it more difficult to locate information of interest.

(2) *CONTENT OF AUDIT RECORDS | CENTRAL MANAGEMENT OF AUDIT RECORDS*

The organization centrally manages the content of audit records generated by [*Assignment: organization-defined information system components*].

Supplemental Guidance: This control enhancement requires that the content to be captured in audit records be configured from a central location (necessitating automation). Related controls: AU-6, AU-7.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-3	**MOD** AU-3 (1)	**HIGH** AU-3 (1) (2)

The control section describes specific security-related activities or actions to be carried out by organizations or by information systems. The term *information system* refers to those functions in selected security controls that generally involve the implementation of information technology (e.g., hardware, software, and firmware). Conversely, the term *organization* refers to activities in security controls that are likely to be process-driven or entity-driven—that is, at least some part of the security control is likely to be implemented through human/procedural-based actions. Security controls that use the term organization may still require some degree of automation to be fulfilled. Similarly, security controls that use the term information system may have some elements that are process-driven or entity-driven. Using the terms organization and/or information system does not preclude the application of security controls at any of the tiers in the risk management hierarchy (i.e., organization level, mission/business process level, information system level), as appropriate.

For some security controls in the control catalog, a degree of flexibility is provided by allowing organizations to define input values for certain parameters associated with the controls. This flexibility is achieved through the use of *assignment* and *selection* statements embedded within the security controls and control enhancements. Assignment and selection statements provide organizations with the capability to tailor security controls and control enhancements based on: (i) organizational security requirements to support specific missions, business functions, or operational needs; and (ii) requirements originating in federal laws, Executive Orders, directives, policies, regulations, standards, or guidelines.[31] For example, organizations can specify additional information needed for audit records to support audit event processing by information systems (see AU-3 example above), particular actions to be taken by information systems in the event of audit failures, the frequency of conducting system backups, restrictions on password use, or the distribution list for organizational policies and procedures.[32] Once specified,[33] the organization-defined values for assignment/selection statements become part of the security control, and the control implementation is assessed against the completed control statement. Selection statements narrow the potential input values by providing a specific list of items from which organizations must choose.[34]

The supplemental guidance section provides additional information related to a specific security control, but contains no additional requirements. Organizations can apply the supplemental guidance as appropriate, when defining, developing, and/or implementing security controls. The supplemental guidance provides important considerations for implementing security controls in the context of operational environments, mission/business requirements, or assessments of risk. Security control enhancements may also contain supplemental guidance, typically provided in situations where the guidance is not generally applicable to the entire control but instead focused on the particular control enhancement. The supplemental guidance sections for security controls and control enhancements may contain a list of *related controls*. Related controls: (i) directly impact or support the implementation of a particular security control or control enhancement; (ii) address a closely related security capability; or (iii) are referenced in the supplemental guidance. Security control enhancements are by definition related to the base control. Related controls that are listed in the supplemental guidance for the base controls are not repeated in the supplemental guidance for the control enhancements. However, there may be related controls identified for control enhancements that are not listed in the base control.

The security control enhancements section provides statements of security capability to: (i) add functionality/specificity to a control; and/or (ii) increase the strength of a control. In both cases, control enhancements are used in information systems and environments of operation requiring greater protection than provided by the base control due to the potential adverse organizational impacts or when organizations seek additions to the base control functionality/specificity based on organizational assessments of risk. Security control enhancements are numbered sequentially within each control so that the enhancements can be easily identified when selected to supplement

[31] In general, organization-defined *parameters* used in assignment and selection statements in the basic security controls apply also to all control enhancements associated with those controls.

[32] Organizations determine whether specific assignment or selection statements are completed at Tier 1 (organization level), Tier 2 (mission/business process level), Tier 3 (information system level), or combination thereof.

[33] Organizations may choose to define specific values for security control parameters in policies, procedures, or guidance (which may be applicable to more than one information system) referencing the source documents in the security plan in lieu of explicitly completing the assignment/selection statements within the control as part of the plan.

[34] Security controls are generally designed to be *technology*- and *implementation*-independent and therefore do not contain specific requirements in these areas. Organizations provide such requirements as deemed necessary in the security plan for the information system.

the base control. Each security control enhancement has a short subtitle to indicate the intended security capability provided by the control enhancement. In the AU-3 example, if the first control enhancement is selected, the control designation becomes AU-3 (1). The numerical designation of a control enhancement is used only to identify the particular enhancement within the control. The designation is not indicative of either the strength of the control enhancement or any hierarchical relationship among the enhancements. If a security control enhancement is selected, then the base security control must also be selected.

The references section includes a list of applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidelines (e.g., OMB Circulars/Memoranda, Homeland Security Presidential Directives, FIPS Publications, and NIST Special Publications) that are relevant to a particular security control.[35] The references provide appropriate federal legislative and policy mandates as well as specific supporting information for the implementation of security controls and control enhancements. The references section also contains pertinent websites for organizations to use in obtaining additional information for security control implementation and assessment.

The priority and baseline allocation section provides: (i) the recommended priority codes used for sequencing decisions during security control implementation; and (ii) the initial allocation of security controls and control enhancements to the baselines for low-impact, moderate-impact, and high-impact information systems. Organizations can use the *priority code* designation associated with each security control to assist in making sequencing decisions for control implementation (i.e., a Priority Code 1 [P1] control has a higher priority for implementation than a Priority Code 2 [P2] control, and a Priority Code 2 [P2] control has a higher priority for implementation than a Priority Code 3 [P3] control). This recommended sequencing prioritization helps to ensure that the foundational security controls upon which other controls depend are implemented first, thus enabling organizations to deploy controls in a more structured and timely manner in accordance with available resources. The implementation of security controls by sequence priority code does not imply the achievement of any defined level of risk mitigation until *all* of the security controls in the security plan have been implemented. The priority codes are used only for implementation sequencing, not for making security control selection decisions.

2.3 SECURITY CONTROL BASELINES

Organizations are required to adequately mitigate the risk arising from use of information and information systems in the execution of missions and business functions. A significant challenge for organizations is to determine the most cost-effective, appropriate set of security controls, which if implemented and determined to be effective, would mitigate risk while complying with security requirements defined by applicable federal laws, Executive Orders, regulations, policies, directives, or standards (e.g., FISMA, OMB Circular A-130, HSPD-12, FIPS Publication 200). There is no one correct set of security controls that addresses all organizational security concerns in all situations. Selecting the most appropriate set of security controls for a specific situation or information system to adequately mitigate risk is an important task that requires a fundamental understanding of organizational mission/business priorities, the mission and business functions the information systems will support, and the environments of operation where the systems will reside. With that understanding, organizations can demonstrate how to most effectively assure the confidentiality, integrity, and availability of organizational information and information systems in a manner that supports mission/business needs while demonstrating due diligence. Selecting,

[35] Publications listed in the *references section* refer to the most recent versions of the publications. References are provided to assist organizations in applying the security controls and are not intended to be inclusive or complete.

implementing, and maintaining an appropriate set of security controls to adequately protect the information systems employed by organizations requires strong collaboration with system owners to understand ongoing changes to missions/business functions, the environments of operations, and how the systems are used.

To assist organizations in making the appropriate selection of security controls for information systems, the concept of *baseline* controls is introduced. Baseline controls are the starting point for the security control selection process described in this document and are chosen based on the security category and associated impact level of information systems determined in accordance with FIPS 199 and FIPS 200, respectively.[36] Appendix D provides a listing of baseline security controls. Three sets of baseline controls have been identified corresponding to the low-impact, moderate-impact, and high-impact information systems using the high water mark defined in FIPS 200 and used in Section 3.1 of this document to provide an initial set of security controls for each impact level.[37]

Appendix F provides a comprehensive catalog of security controls for information systems and organizations, arranged by control families. Chapter Three provides additional information on how to use FIPS 199 security categories and FIPS 200 impact levels in applying the tailoring guidance to the baseline security controls to achieve adequate risk mitigation. Tailoring guidance, described in Section 3.2, allows organizations to customize the initial security control baselines selected using the results from organizational assessments of risk. Tailoring actions include: (i) identifying and designating common controls in initial security control baselines; (ii) applying scoping considerations; (iii) selecting compensating controls; (iv) assigning specific values to organization-defined security control parameters; (v) supplementing baselines with additional security controls or control enhancements; and (vi) providing additional specification information for control implementation.

Implementation Tip

There are additional security controls and control enhancements that appear in the security control catalog (Appendix F) that are found in only higher-impact baselines or not used in any of the baselines. These additional security controls and control enhancements for information systems are available to organizations and can be used in tailoring security control baselines to achieve the needed level of protection in accordance with organizational assessments of risk. Moreover, the security controls and control enhancements contained in higher-level baselines can also be used to strengthen the level of protection provided in lower-level baselines, if deemed appropriate. At the end of the security control selection process, the agreed-upon set of controls in the security plan must be sufficient to adequately mitigate risks to organizational operations and assets, individuals, other organizations, and the Nation based on the organizational risk tolerance.

[36] CNSS Instruction 1253 provides guidance on security control baselines for national security systems.

[37] The baseline security controls contained in Appendix D are not necessarily absolutes in that the tailoring guidance described in Section 3.2 provides organizations with the ability to eliminate certain controls or specify compensating controls in accordance with the terms and conditions established by authorizing officials.

2.4 COMMON CONTROLS

Common controls are security controls that are *inheritable* by one or more organizational information systems. Security controls are inheritable by information systems or information system components when the systems/components receive protection from controls but the controls are developed, implemented, assessed, authorized, and monitored by entities other than those responsible for the systems/components—entities internal or external to the organizations where the systems/components reside. Common controls can be inherited from many sources including, for example, the organization, organizational mission/business lines, sites, enclaves, environments of operations, or other information systems. Many of the controls needed to protect organizational information systems (e.g., security awareness training, incident response plans, physical access to facilities, rules of behavior) are excellent candidates for common control status. In addition, there can also be a variety of technology-based common controls (e.g., Public Key Infrastructure [PKI], authorized secure standard configurations for clients/servers, access control systems, boundary protection, cross-domain solutions). By centrally managing and documenting the development, implementation, assessment, authorization, and monitoring of common controls, security costs can be amortized across multiple information systems.

The organization assigns responsibility for common controls to appropriate organizational officials (i.e., common control providers) and coordinates the development, implementation, assessment, authorization, and monitoring of the controls.[38] The identification of common controls at the organization level is most effectively accomplished as an organization-wide exercise with the active involvement of chief information officers, senior information security officers, the risk executive (function), authorizing officials, information owners/stewards, information system owners, and information system security officers. The organization-wide exercise considers the security categories of the information systems within the organization and the security controls necessary to adequately mitigate the risks arising from the use of those systems (see *baseline* security controls in Section 2.3).[39] Common control identification for those controls that impact multiple information systems, but not all systems across the organization could benefit from taking a similar approach. Key stakeholders associated with those controls including, but not limited to, authorizing officials, information system owners, and information system security officers, collaborate to identify opportunities to effectively employ common controls at the mission/business line, site, or enclave level.

When common controls protect multiple organizational information systems of differing impact levels, the controls are implemented with regard to the highest impact level among the systems. If the common controls are not implemented at the highest impact level of the information systems, system owners will need to factor this situation into their assessments of risk and take appropriate risk mitigation actions (e.g., adding security controls or control enhancements, changing assigned values of security control parameters, implementing compensating controls, or changing certain aspects of mission/business processes). Implementing common controls that are less than effective or that provide insufficient security capability for higher-impact information systems can have a significant adverse impact on organizational missions or business functions.

[38] The Chief Information Officer, Senior Information Security Officer, or other designated organizational officials at the senior leadership level assign responsibility for the development, implementation, assessment, authorization, and monitoring of common controls to appropriate entities (either internal or external to the organization).

[39] Each common control identified by the organization is reviewed for applicability to each specific organizational information system, typically by information system owners and authorizing officials.

Common controls are generally documented in the organization-wide *information security program plan* unless implemented as part of a specific information system, in which case the controls are documented in the security plan for that system.[40] Organizations have the flexibility to describe common controls in a single document or in multiple documents with references or pointers, as appropriate. In the case of multiple documents, the documents describing common controls are included as attachments to the information security program plan. If the information security program plan contains multiple documents, organizations specify in each document the organizational officials responsible for development, implementation, assessment, authorization, and monitoring of the respective common controls. For example, the organization may require that the Facilities Management Office develop, implement, assess, authorize, and continuously monitor physical and environmental protection controls from the PE family when such controls are not associated with a particular information system but instead, support multiple systems. When common controls are included in a separate security plan for an information system (e.g., security controls employed as part of an intrusion detection system providing boundary protection inherited by one or more organizational information systems), the information security program plan indicates which separate security plan contains a description of the common controls.

Implementation Tip

Maintaining a record of security control selection and control status can be addressed in one or multiple documents or security plans. If using multiple documents, consider providing pointers or references to the necessary information in the relevant documents rather than requiring duplication of information. Using references to relevant documentation reduces the amount of time and resources needed by organizations to generate such information. Other benefits include greater security awareness and understanding of the overall information system capabilities. Increased awareness and understanding supports better integration of information security into organizational information systems, components, and services.

Security controls not designated as common controls are considered *system-specific* or *hybrid* controls. System-specific controls are the primary responsibility of information system owners and their respective authorizing officials. Organizations assign a *hybrid* status to security controls when one part of the control is common and another part of the control is system-specific. For example, an organization may choose to implement the Incident Response Policy and Procedures security control (IR-1) as a hybrid control with the policy portion of the control designated as common and the procedures portion of the control designated as system-specific. Hybrid controls may also serve as predefined templates for further control refinement. Organizations may choose, for example, to implement the Contingency Planning security control (CP-2) as a predefined template for a generalized contingency plan for all organizational information systems with individual information system owners tailoring the plan, where appropriate, for system-specific uses. Partitioning security controls into common, hybrid, and system-specific controls can result in significant savings to organizations in implementation and assessment costs as well as a more consistent application of security controls organization-wide. While security control partitioning into common, hybrid, and system-specific controls is straightforward and intuitive conceptually, the actual application within organizations takes a significant amount of planning and coordination. At the information system level, determination of common, hybrid, or system-specific security controls follows the development of a tailored baseline. It is necessary to first determine what security capability is needed before organizations assign responsibility for how security controls are implemented, operated, and maintained.

[40] Information security program plans are described in Appendix G.

Implementation Tip

The selection of common controls is most effectively accomplished on an organization-wide basis with the involvement of the organization's senior leadership (i.e., authorizing officials, chief information officer, senior information security officer, information system owners, mission/business owners, information owners/stewards, risk executive [function]). These individuals have the collective corporate knowledge to understand the organization's priorities, the importance of the organization's operations and assets, and the relative importance of the organizational information systems that support those operations/assets. The organization's senior leaders are also in the best position to select the common controls for each security control baseline and assign specific organizational responsibilities for developing, implementing, assessing, authorizing, and monitoring those controls.

Security plans for individual information systems identify which security controls required for those systems have been designated by organizations as common controls and which controls have been designated as system-specific or hybrid controls. Information system owners are responsible for any system-specific implementation details associated with common controls. These implementation details are identified and described in the security plans for the individual information systems. Senior information security officers for organizations coordinate with *common control providers* (e.g., facility/site managers, human resources managers, intrusion detection system owners) to ensure that the required controls are developed, implemented, and assessed for effectiveness. Collectively, the security plans for individual information systems and the organization-wide information security program plans provide complete coverage for all security controls employed within organizations.

Common controls, whether employed in organizational information systems or environments of operation, are authorized by senior officials with at least the same level of authority/responsibility for managing risk as the authorization officials for information systems inheriting the controls. Authorization results for common controls are shared with the appropriate information system owners and authorizing officials. A plan of action and milestones is developed and maintained for common controls that have been determined through independent assessments, to be less than effective. Information system owners dependent on common controls that are less than effective consider whether they are willing to accept the associated risk or if additional tailoring is required to address the weaknesses or deficiencies in the controls. Such risk-based decisions are influenced by available resources, the trust models employed by the organization, and the risk tolerance of authorizing officials and the organization.[41] Common controls are subject to the same assessment and monitoring requirements as system-specific controls employed in individual organizational information systems. Because common controls impact more than one system, a higher degree of confidence regarding the effectiveness of those controls may be required.

The determination as to whether a security control is a common, hybrid, or system-specific is context-based. Security controls cannot be determined to be common, hybrid, or system-specific simply based on reviewing the language of the control. For example, a control may be system-specific for a particular information system, but at the same time that control could be a common control for another system, which would inherit the control from the first system. One indicator of whether a system-specific control may also be a common control for other information systems is to consider who or what depends on the functionality of that particular control. If a certain part of an information system or solution external to the system boundary depends on the control, then that control may be a candidate for common control identification.

[41] NIST Special Publication 800-39 provides guidance on trust models, including validated, direct historical, mediated, and mandated trust models.

2.5 EXTERNAL ENVIRONMENTS AND PROVIDERS

Organizations are becoming increasingly reliant on information system services provided by external providers to conduct important missions and business functions. External information system services are computing and information technology services implemented outside of the traditional security authorization boundaries established by organizations for their information systems. Those traditional authorization boundaries linked to physical space and control of assets, are being extended (both physically and logically) with the growing use of external services. In this context, external services can be provided by: (i) entities within the organization but outside of the security authorization boundaries established for organizational information systems; (ii) entities outside of the organization either in the public sector (e.g., federal agencies) or private sector (e.g., commercial service providers); or (iii) some combination of the public and private sector options. External information system services include, for example, the use of service-oriented architectures (SOAs), cloud-based services (infrastructure, platform, software), or data center operations. External information system services may be used by, but are typically not part of, organizational information systems. In some situations, external information system services may completely replace or heavily augment the routine functionality of internal organizational information systems.

FISMA and OMB policy require that external providers processing, storing, or transmitting federal information or operating information systems on behalf of the federal government meet the same security requirements that federal agencies are required to meet. Security requirements for external service providers including the security controls for external information systems are expressed in contracts or other formal agreements. Organizations are responsible and accountable for the information security risk incurred by the use of information system services provided by external providers. Such risk is addressed by incorporating the Risk Management Framework (RMF) as part of the terms and conditions of the contracts with external providers. Organizations can require external providers to implement all steps in the RMF except the security authorization step, which remains an inherent federal responsibility directly linked to managing the information security risk related to the use of external information system services.[42] Organizations can also require external providers to provide appropriate evidence to demonstrate that they have complied with the RMF in protecting federal information.

Relationships with external service providers are established in a variety of ways, for example, through joint ventures, business partnerships, outsourcing arrangements (i.e., through contracts, interagency agreements, lines of business arrangements), licensing agreements, and/or supply chain exchanges. The growing use of external service providers and new relationships being forged with those providers present new and difficult challenges for organizations, especially in the area of information system security. These challenges include:

- Defining the types of external information system services provided to organizations;
- Describing how those external services are protected in accordance with the information security requirements of organizations; and
- Obtaining the necessary assurances that the risk to organizational operations and assets, individuals, other organizations, and the Nation arising from the use of the external services is acceptable.

[42] To effectively manage information security risk, organizations can *authorize* the information systems of external providers that are part of the information technologies or services (e.g., infrastructure, platform, or software) provided to the federal government. Security authorization requirements are expressed in the terms and conditions of contracts with external providers of those information technologies and services.

The degree of confidence that the risk from using external services is at an acceptable level depends on the trust[43] that organizations place in external service providers. In some cases, the level of trust is based on the amount of direct control organizations are able to exert on external service providers with regard to employment of security controls necessary for the protection of the service/information and the evidence brought forth as to the effectiveness of those controls. The level of control is usually established by the terms and conditions of the contracts or service-level agreements with the external service providers and can range from extensive control (e.g., negotiating contracts or agreements that specify detailed security requirements for the providers) to very limited control (e.g., using contracts or service-level agreements to obtain commodity services[44] such as commercial telecommunications services). In other cases, levels of trust are based on factors that convince organizations that required security controls have been employed and that determinations of control effectiveness exist. For example, separately authorized external information system services provided to organizations through well-established lines of business relationships may provide degrees of trust in such services within the tolerable risk range of the authorizing officials and organizations using the services.

The provision of services by external providers may result in certain services without explicit agreements between organizations and the providers. Whenever explicit agreements are feasible and practical (e.g., through contracts, service-level agreements), organizations develop such agreements and require the use of the security controls in Appendix F of this publication. When organizations are not in a position to require explicit agreements with external service providers (e.g., services are imposed on organizations, services are commodity services), organizations establish explicit assumptions about service capabilities with regard to security. In situations where organizations are procuring information system services or information technologies through centralized acquisition vehicles (e.g., governmentwide contracts by the General Services Administration or other preferred and/or mandatory acquisition organizations), it may be more efficient and cost-effective for contract originators to establish and maintain stated levels of trust with external service providers (including the definition of required security controls and level of assurance with regard to the provision of such controls). Organizations subsequently acquiring information system services or technologies from centralized contracts can take advantage of the negotiated trust levels established by the procurement originators and thus avoid costly repetition of activities necessary to establish such trust.[45] Centralized acquisition vehicles (e.g., contracts) may also require the active participation of organizations. For example, organizations may be required by provisions in contracts or agreements to install public key encryption-enabled client software recommended by external service providers.

[43] The level of trust that organizations place in external service providers can vary widely, ranging from those who are highly trusted (e.g., business partners in a joint venture that share a common business model and common goals) to those who are less trusted and represent greater sources of risk (e.g., business partners in one endeavor who are also competitors in another market sector).

[44] Commercial providers of commodity-type services typically organize their business models and services around the concept of shared resources and devices for a broad and diverse customer base. Therefore, unless organizations obtain fully dedicated services from commercial service providers, there may be a need for greater reliance on compensating security controls to provide the necessary protections for the information system that relies on those external services. Organizational assessments of risk and risk mitigation activities reflect this situation.

[45] For example, procurement originators could authorize information systems providing external services to the federal government under the specific terms and conditions of the contracts. Federal agencies requesting such services under the terms of the contracts would not be required to reauthorize the information systems when acquiring such services (unless the request included services outside the scope of the original contracts).

Ultimately, the responsibility for adequately mitigating unacceptable risks arising from the use of external information system services remains with authorizing officials. Organizations require that appropriate *chains of trust* be established with external service providers when dealing with the many issues associated with information system security. Organizations establish and retain a level of trust that participating service providers in the potentially complex consumer-provider relationship provide adequate protection for the services rendered to organizations. The chain of trust can be complicated due to the number of entities participating in the consumer-provider relationship and the types of relationships between the parties. External service providers may also outsource selected services to other external entities, making the chain of trust more difficult and complicated to manage. Depending on the nature of the services, organizations may find it impossible to place significant trust in external providers. This situation is due not to any inherent untrustworthiness on the part of providers, but to the intrinsic level of risk in the services.[46] Where a sufficient level of trust cannot be established in the external services and/or providers, organizations can: (i) mitigate the risk by employing compensating controls; (ii) accept the risk within the level of organizational risk tolerance; (iii) transfer risk by obtaining insurance to cover potential losses; or (iv) avoid risk by choosing not to obtain the services from certain providers (resulting in performance of missions/business operations with reduced levels of functionality or possibly no functionality at all).[47] For example, in the case of cloud-based information systems and/or services, organizations might require as a compensating control, that all information stored in the cloud be encrypted because there is insufficient confidence in the security implemented by cloud providers. Alternatively, organizations may require encrypting some of the information stored in the cloud (depending on the criticality/sensitivity of such information)—accepting additional risk but limiting the risk by not storing all information in an unencrypted form.

2.6 ASSURANCE AND TRUSTWORTHINESS

Whether information systems are deployed to support the operations of the national air traffic control system, a nuclear power plant providing electricity for a large city, a major financial institution, or the military services and warfighters, the systems must be reliable, trustworthy, and resilient. Reliability, trustworthiness, resilience are also important characteristics for the day-to-day mission/business operations of organizations supported, for example, by email systems and web servers. Trustworthiness with respect to information systems, expresses the degree to which the systems (including the information technology products that are used to build those systems) can be expected to preserve the confidentiality, integrity, and availability of the information being processed, stored, or transmitted by the systems across the full range of threats. Trustworthy information systems are systems that are believed to be capable of operating within defined levels of risk despite the environmental disruptions, human errors, structural failures, and purposeful attacks that are expected to occur in their environments of operation. Information security plays an important part in achieving trustworthy information systems—systems that have the reliability to successfully carry out assigned missions/business functions under conditions of stress and uncertainty and in specified environments.

Two key components of information security affecting the trustworthiness of information systems are *security functionality* and *security assurance*. Security functionality is typically defined in terms of the security features, functions, mechanisms, services, procedures, and architectures implemented within organizational information systems or the environments in which those systems operate. Security assurance is the measure of confidence that the security functionality is

[46] There may also be risk in disallowing certain functionality because of security concerns. Security is merely one of multiple considerations in an overall risk determination.

[47] Alternative providers offering a higher basis for trust, usually at a higher cost, may be available.

implemented correctly, operating as intended, and producing the desired outcome with respect to meeting the security requirements for the system—thus, accurately mediating and enforcing established security policies. Together, the security functionality and security assurance combine to provide a *security capability* for organizations, mission/business processes, and information systems—a capability necessary to respond to ongoing risks to organizational operations and assets, individuals, other organizations, and the Nation. With regard to increasingly sophisticated and hostile cyber attacks, organizations need an adequate security capability to prevent attacks, deter attacks, respond to attacks (i.e., limiting harm), and restore/recover from attacks. Figure 3 illustrates the relationship of security functionality and security assurance to security capability and the concept of trustworthiness in information systems.

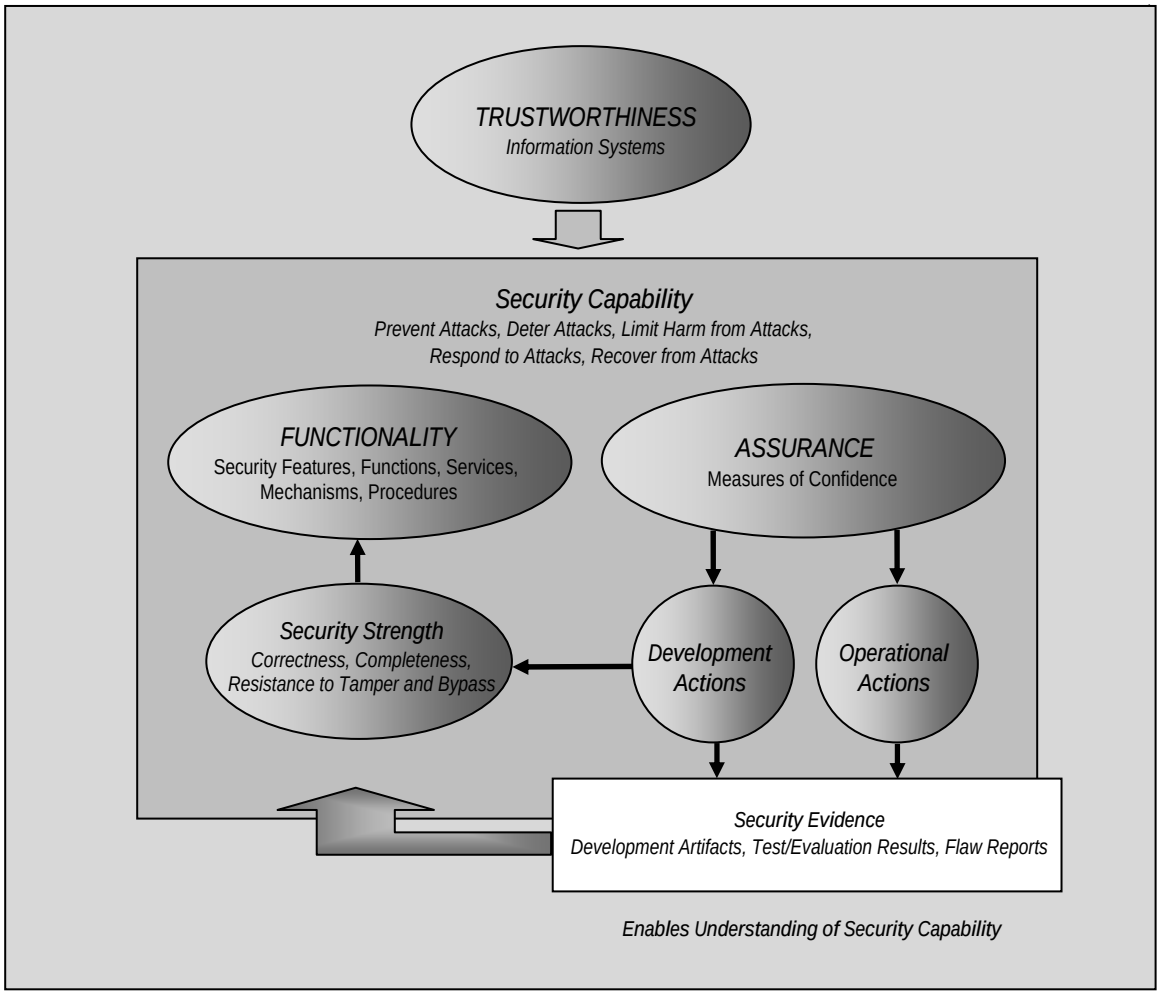

FIGURE 3: TRUSTWORTHINESS MODEL

To achieve the needed security capability and to meet stated security requirements, organizations select and employ security controls from Appendix F. Security controls address both security functionality and assurance. Some controls focus primarily on functionality (e.g., PE-3, Physical Access Control; IA-2, Identification and Authentication; SC-13, Cryptographic Protection; and AC-2, Account Management). Other controls focus primarily on assurance (e.g., CA-2, Security Assessment; SA-17, Developer Security Architecture and Design; and CM-3, Configuration Change Control). Finally, certain security controls can support both security functionality and assurance (e.g., RA-5, Vulnerability Scanning; SC-3, Security Function Isolation; and AC-25,

Reference Monitor Function). Focusing on assurance-related controls during system development and acquisition can help organizations develop and obtain information systems and information system components (including hardware, software, and firmware) that are more reliable and less likely to fail based on *developmental actions*. These actions include, for example, ensuring that developers employ configuration management/control and security engineering principles. Once information systems are deployed, assurance-related controls can help organizations continue to have confidence in the reliability of the systems based on *operational actions*. These actions include, for example, conducting integrity checks on software/firmware components, monitoring established secure configuration settings, or conducting penetration testing to find vulnerabilities in the information systems and organizations.

Thus, organizations can obtain security assurance by the *actions* taken by information system developers, implementers, operators, maintainers, and assessors with regard to the development, implementation, operation, maintenance, and assessment of the security functionality needed to achieve a stated security capability, satisfy security requirements, and enforce/mediate security policies. Actions by individuals and/or groups during the development/operation of information systems produce security evidence that contributes to the assurance, or measures of confidence, in the security capability. The depth and coverage of these actions (as described in Appendix E) also contribute to the efficacy of the evidence and measures of confidence. The evidence produced by developers, implementers, operators, assessors, and maintainers during the system development life cycle (e.g., developmental artifacts, assessment results, warranties, and evaluation/validation certificates) contributes to the understanding of the security capability achieved by organizations.

As shown in Figure 3, the *strength* of security functionality[48] plays an important part in being able to achieve the needed security capability. Information system developers can increase the strength of security functionality by employing as part of the hardware/software/firmware development process: (i) well-defined security policies and policy models; (ii) structured/rigorous design and development techniques; and (iii) sound system/security engineering principles. The development artifacts generated by these development activities (e.g., functional specifications, high/low-level designs, implementation representations [source code], and the results from static/dynamic testing and code analysis) can provide important evidence that the information systems (including the components composing those systems) will be more reliable and trustworthy. Security evidence can also be generated from testing conducted by independent, accredited, third-party assessment organizations (e.g., ISO/IEC 15408 evaluations by Common Criteria Testing Laboratories, FIPS 140 cryptographic module testing by Cryptographic and Security Testing Laboratories, and other assessment activities by government and private sector organizations).

The Compelling Argument for Assurance

Organizations do not implement assurance requirements just to create documentation and paperwork. Rather, organizations implement such requirements to achieve a needed *security capability*—ensuring that the required strength of security features, functions, services, and mechanisms is present in critical information system components, and that organizations have an appropriate degree of confidence through the generation of *security evidence*, that the capability will be there when needed.

[48] The *security strength* of an information system component (i.e., hardware, software, or firmware) is determined by the degree to which the security functionality implemented within that component is correct, complete, resistant to direct attacks (strength of mechanism), and resistant to by-pass or tampering.

In addition to the evidence produced in the development environment, organizations can produce evidence from the operational environment that contributes to the assurance of functionality and ultimately, security capability. Operational evidence includes, for example, flaw reports, records of remediation actions, the results of security incident reporting, and the results of organizational continuous monitoring activities[49] that determine the effectiveness of deployed security controls, changes to information systems and environments of operation, and current compliance to federal legislation, policies, directives, regulations, and standards. Security evidence, whether obtained from development or operational activities, enables a better understanding of the actual security capability achieved by organizations. Together, the actions taken during the system development life cycle by developers, implementers, operators, maintainers, and assessors and the evidence produced as part of those actions, help organizations determine the extent to which the security functionality within their information systems is implemented correctly, operating as intended, and producing the desired outcome with respect to meeting stated security requirements and enforcing or mediating established security policies—thus providing greater confidence in the security capability.

Appendix E provides more detailed information on minimum assurance requirements, assurance-related controls in the security control baselines in Appendix D, and specific recommendations for additional developmental and operational actions organizations can employ to increase the level of assurance in critical information systems or system components.[50]

Why Assurance Matters

The importance of security assurance can be described by using the example of a light switch on a wall in the living room of your house. Individuals can observe that by simply turning the switch on and off, the switch appears to be performing according to its functional specification. This is analogous to conducting black-box testing of security functionality in an information system or system component. However, the more important question might be—what does the light switch look like from behind the wall? What types of components were used to construct the switch, how was the switch assembled, and did the switch manufacturer follow industry best practices in the development process? This is analogous to the many developmental activities that address the quality of the security functionality in the system or component, including, for example, design principles, coding techniques, code analysis, testing, and evaluation.

The security assurance requirements in Appendix E address the light switch problem from the *front of the wall perspective*, and potentially from the *behind the wall perspective*, depending on the measure of confidence needed about the component in question. For organizational missions/business functions that are less critical (i.e., low impact), lower levels of assurance of functionality might be appropriate. However, as missions/business functions become more important (i.e., moderate or high impact) and information systems and organizations become more susceptible to advanced persistent threats (APT) by high-end adversaries, increased levels of assurance of functionality not only might make sense but actually be required. In addition, as organizations become more dependent on external information system services and providers, assurance becomes more important—providing insight and measures of confidence to organizations in understanding and verifying the security capability of external providers and the services provided to the federal government. Thus, when the potential impact to organizational operations and assets, individuals, other organizations, and the Nation is great, an increasing level of effort must be directed at what is happening behind the wall.

[49] Continuous monitoring activities occur at all three tiers in the risk management hierarchy described in NIST Special Publication 800-39.

[50] *Security requirements* are a subset of the overall functional requirements established for organizational information systems and environments of operation. Minimum security requirements for information and information systems are established in FIPS Publication 200. Assurance requirements are a subset of security requirements. Minimum assurance requirements for low-, moderate-, and high-impact information systems and the associated assurance-related controls needed to satisfy those requirements are listed in Appendix E.

2.7 REVISIONS AND EXTENSIONS

The security controls listed in this publication represent the state-of-the-practice safeguards and countermeasures for federal information systems and organizations. The security controls[51] will be carefully reviewed and revised periodically to reflect:

- Experience gained from using the controls;
- Changing security requirements;
- Emerging threats, vulnerabilities, and attack methods; and
- Availability of new technologies.

The security controls in the security control catalog are expected to change over time, as controls are withdrawn, revised, and added. The security controls defined in the low, moderate, and high baselines are also expected to change over time as the level of security and due diligence for mitigating risks within organizations changes. In addition to the need for change, the need for stability is addressed by requiring that proposed modifications to security controls go through a rigorous public review process to obtain both public and private sector feedback and to build consensus for such change. This provides over time, a stable, flexible, and technically sound set of security controls for the federal government, contractors, and any other organizations using the security control catalog.

Implementation Tip

New security controls and control enhancements will be developed on a regular basis using state-of-the-practice information from national-level threat and vulnerability databases as well as information on the tactics, techniques, and procedures employed by adversaries in launching cyber attacks. The proposed modifications to security controls and security control baselines will be carefully weighed during each revision cycle, considering the desire for stability of the security control catalog and the need to respond to changing threats, vulnerabilities, attack methods, and information technologies. The overall objective is to raise the foundational level of information security over time. Organizations may choose to develop new security controls when there is a specific security capability required and the appropriate controls are not available in Appendices F or G.

[51] The privacy controls listed in Appendix J will also be updated on a regular basis using similar criteria.

CHAPTER THREE

THE PROCESS

SELECTION AND SPECIFICATION OF SECURITY CONTROLS

This chapter describes the process of selecting and specifying security controls and control enhancements for organizational information systems to include: (i) selecting appropriate security control baselines; (ii) tailoring the baselines; (iii) documenting the security control selection process; and (iv) developing community-wide tailored baselines, based on specialized missions, business functions, and environments of operation.

3.1 SELECTING SECURITY CONTROL BASELINES

In preparation for selecting and specifying the appropriate security controls for organizational information systems and their respective environments of operation, organizations first determine the criticality and sensitivity of the information to be processed, stored, or transmitted by those systems. This process, known as security categorization, is described in FIPS Publication 199.[52] The security categorization standard is based on a simple and well-established concept—that is, determining the security priorities for organizational information systems. Security categorization results facilitate the selection of appropriate security controls (i.e., safeguards/countermeasures) to adequately protect those information systems. The security controls selected for information systems are commensurate with the potential adverse impact on organizational operations and assets, individuals, other organizations, or the Nation if there is a loss of confidentiality, integrity, or availability. FIPS Publication 199 requires organizations to categorize information systems as low-impact, moderate-impact, or high-impact for the stated security objectives of confidentiality, integrity, and availability. The potential impact values assigned to the security objectives are the highest values (i.e., high water mark) from the security categories that have been determined for each type of information processed, stored, or transmitted by those information systems.[53] The generalized format for expressing the security category (SC) of an information system is:

$$\mathbf{SC}_{\text{information system}} = \{(\textbf{confidentiality}, \textit{impact}), (\textbf{integrity}, \textit{impact}), (\textbf{availability}, \textit{impact})\},$$

where the acceptable values for potential impact are low, moderate, or high.

Since the potential impact values for confidentiality, integrity, and availability may not always be the same for a particular information system, the high water mark concept (introduced in FIPS Publication 199) is used in FIPS Publication 200 to determine the impact level of the information system for the express purpose of selecting an initial set of security controls from one of the three security control baselines.[54] Thus, a *low-impact* system is defined as an information system in which all three of the security objectives are low. A *moderate-impact* system is an information system in which at least one of the security objectives is moderate and no security objective is greater than moderate. Finally, a *high-impact* system is an information system in which at least one security objective is high.

[52] CNSS Instruction 1253 provides security categorization guidance for national security systems.

[53] NIST Special Publication 800-60, *Guide for Mapping Types of Information and Information Systems to Security Categories*, provides guidance on the assignment of security categories to information systems.

[54] The high water mark concept is employed because there are significant dependencies among the security objectives of confidentiality, integrity, and availability. In most cases, a compromise in one security objective ultimately affects the other security objectives as well. Accordingly, security controls are not categorized by security objective. Rather, the security controls are grouped into baselines to provide a general protection capability for classes of information systems based on impact level.

Implementation Tip

To determine the impact level of an information system:

- First, determine the different types of information that are processed, stored, or transmitted by the information system. NIST Special Publication 800-60 provides common information types.
- Second, using the impact levels in FIPS 199 and the recommendations of NIST Special Publication 800-60, categorize the confidentiality, integrity, and availability of each information type.
- Third, determine the information system security categorization, that is, the highest impact level for each security objective (confidentiality, integrity, availability) from among the categorizations for the information types associated with the information system.
- Fourth, determine the overall impact level of the information system from the highest impact level among the three security objectives in the system security categorization.

Note: *For national security systems, organizations use CNSSI 1253 for security categorization*.

Once the impact level of the information system is determined, organizations begin the security control selection process.[55] The first step in selecting and specifying security controls for the information system is to choose an appropriate set of baseline controls. The selection of the initial security control baseline is based on the impact level of the information system as determined by the security categorization process described above. The organization selects one of three sets of baseline security controls from Appendix D corresponding to the low-impact, moderate-impact, or high-impact rating of the information system.[56] Note that not all security controls are assigned to baselines, as indicated by the phrase *not selected*. Similarly, not all control enhancements are assigned to baselines, as indicated by the security control being not selected or the enhancement number enclosed in parenthesis, not appearing in any baseline. The use of the term *baseline* is intentional. The security controls and control enhancements listed in the initial baselines are not a minimum, but rather a proposed starting point from which controls and controls enhancements may be removed or added based on the tailoring guidance in Section 3.2.

The security control baselines in Appendix D address the security needs of a broad and diverse set of constituencies (including individual users and organizations). The baselines reflect some underlying *assumptions* including, for example: (i) the environments in which organizational information systems operate; (ii) the nature of operations conducted by organizations; (iii) the functionality employed within information systems; (iv) the types of threats facing organizations, missions/business processes, and information systems; and (v) the type of information processed, stored, or transmitted by information systems. Articulating the underlying assumptions is a key element in the initial *risk framing* step of the risk management process described in NIST Special Publication 800-39. Some of the assumptions that underlie the baselines in Appendix D include:

- Information systems are located in fixed, physical facilities, complexes, or locations;
- User data/information in organizational information systems is relatively persistent;[57]
- Information systems are multi-user (either serially or concurrently) in operation;

[55] The general security control selection process may be augmented or further detailed by additional sector-specific guidance as described in Section 3.4 and Appendix I, baseline tailoring using *overlays*.

[56] CNSS Instruction 1253 provides security control baselines for national security systems.

[57] Persistent data/information refers to data/information with utility for a relatively long duration (e.g., days, weeks).

- Some user data/information in organizational information systems is not shareable with other users who have authorized access to the same systems;
- Information systems exist in networked environments;
- Information systems are general purpose in nature; and
- Organizations have the necessary structure, resources, and infrastructure to implement the controls.[58]

If one or more of these assumptions is not valid, then some of the security controls assigned to the initial baselines in Appendix D may not be applicable—a situation that can be readily addressed by applying the tailoring guidance in Section 3.2 and the results of organizational assessments of risk. Conversely, there are also some underlying assumptions that are specifically not reflected in the baselines. These include:

- Insider threats exist within organizations;
- Classified data/information is processed, stored, or transmitted by information systems;
- Advanced persistent threats (APTs) exist within organizations;
- Selected data/information requires specialized protection based on federal legislation, directives, regulations, or policies; and
- Information systems need to communicate with other systems across different policy domains.

If any of the above assumptions apply, then additional security controls from Appendix F would likely be needed to ensure adequate protection—a situation that can also be effectively addressed by applying the tailoring guidance in Section 3.2 (specifically, security control supplementation) and the results of organizational assessments of risk.

3.2 TAILORING BASELINE SECURITY CONTROLS

After selecting the initial set of baseline security controls from Appendix D, organizations initiate the tailoring process to modify appropriately and align the controls more closely with the specific conditions within the organization (i.e., conditions related to organizational missions/business functions, information systems, or environments of operation). The tailoring process includes:

- Identifying and designating common controls in initial security control baselines;
- Applying scoping considerations to the remaining baseline security controls;
- Selecting compensating security controls, if needed;
- Assigning specific values to organization-defined security control parameters via explicit assignment and selection statements;
- Supplementing baselines with additional security controls and control enhancements, if needed; and
- Providing additional specification information for control implementation.

[58] In general, federal departments and agencies will satisfy this assumption. The assumption becomes more of an issue for nonfederal entities such as municipalities, first responders, and small (business) contractors. Such entities may not be large enough or sufficiently resourced to have elements dedicated to providing the range of security capabilities that are assumed by the baselines. Organizations consider such factors in their risk-based decisions.

The tailoring process, as an integral part of security control selection and specification, is part of a comprehensive organizational risk management process—framing, assessing, responding to, and monitoring information security risk. Organizations use risk management guidance to facilitate risk-based decision making regarding the applicability of security controls in the security control baselines. Ultimately, organizations use the tailoring process to achieve cost-effective, risk-based security that supports organizational mission/business needs. Tailoring activities are coordinated with and approved by selected organizational officials (e.g., authorizing officials, risk executive [function], chief information officers, senior information security officers, information system owners, or common control providers) prior to implementing the security controls. Organizations have the flexibility to perform the tailoring process at the organization level for all information systems (either as a required tailored baseline or as the starting point for system-specific tailoring activities), in support of a particular line of business or mission/business process, at the individual information system level, or by using a combination of the above.[59]

Conversely, organizations do not remove security controls for operational convenience. Tailoring decisions regarding security controls should be defensible based on mission/business needs and accompanied by explicit risk-based determinations. Tailoring decisions, including the specific rationale for those decisions, are documented in the security plans for organizational information systems. Every security control from the initial set of security controls must be accounted for either by the organization or by the information system owner. If particular security controls are not implemented or tailored out, then the associated rationale is recorded in security plans (or references/pointers to other relevant documentation are provided) for the information systems and approved by appropriate organizational officials as part of the security plan approval process.[60]

Documenting significant risk management decisions in the security control selection process is imperative in order for authorizing officials to have the necessary information to make credible, risk-based decisions with regard to the authorization of information systems. Since information systems, environments of operation, and personnel associated with the system development life cycle are subject to change, providing the assumptions, constraints, and rationale supporting those important risk decisions allows for a better understanding in the future of the security state of the information systems or environments of operation at the time the original risk decisions were made and facilitates identifying changes, when previous risk decisions are revisited.

Identifying and Designating Common Controls

Common controls are controls that are inheritable by one or more organizational information systems. If an information system inherits a common control, then that system does not need to explicitly implement that control—that is, the security capability is being provided by another entity. Therefore, when the security controls in Appendix F call for an information system to implement or perform a particular security function, it should not be interpreted to mean that all systems that are part of larger, more complex systems or all components of a particular system need to implement the control or function. Organizational decisions on which security controls are designated as common controls may greatly affect the responsibilities of individual system owners with regard to the implementation of controls in a particular baseline. Common control selection can also affect the overall resource expenditures by organizations (i.e., the greater the number of common controls implemented, the greater potential cost savings).

[59] See also Section 3.4 and Appendix I, security control baseline tailoring using *overlays*.

[60] The level of detail required in documenting tailoring decisions in the security control selection process is at the discretion of organizations and reflects the FIPS 199 impact levels of the respective information systems implementing or inheriting the controls.

Applying Scoping Considerations

Scoping considerations, when applied in conjunction with risk management guidance, provide organizations with a more granular foundation with which to make risk-based decisions.[61] The application of scoping considerations can eliminate unnecessary security controls from the initial security control baselines and help to ensure that organizations select *only* those controls that are needed to provide the appropriate level of protection for organizational information systems—protection based on the missions and business functions being supported by those systems and the environments in which the systems operate. Organizations may apply the scoping considerations described below to assist with making risk-based decisions regarding security control selection and specification—decisions that can potentially affect how the baseline security controls are applied and implemented by organizations:

- CONTROL ALLOCATION AND PLACEMENT CONSIDERATIONS—

  The term *information system* can refer to systems at multiple levels of abstraction ranging from system-of-systems to individual single-user systems. The growing complexity of many information systems requires careful analysis in the allocation/placement of security controls within the three tiers in the risk management hierarchy (organization level, mission/business process level, and information system level) without imposing any specific architectural views or solutions.[62] Security controls in the initial baselines represent an information system-wide set of controls that may not be applicable to every component in the system. Security controls are applicable only to information system components that provide or support the information security capability addressed by the controls.[63] Organizations make explicit risk-based decisions about where to apply or allocate specific security controls in organizational information systems in order to achieve the needed security capability and to satisfy security requirements.[64] An example of this type of allocation is applying the requirement from AC-17 (5) (i.e., protecting wireless access to information systems using authentication/encryption) to all wireless access except for wireless access to visitor sub-networks which are not connected to other system components.

- OPERATIONAL/ENVIRONMENTAL-RELATED CONSIDERATIONS—

  Several of the security controls in the baselines are based on the assumption of the existence of certain operational/environmental factors. Where these factors are absent or significantly diverge from the baseline assumptions, it is justifiable to tailor the baseline. Some of the more common operational/environmental factors include:

  - *Mobility*

    The mobility of physical hosting environments can impact the set of security controls selected for organizational information systems. As noted above, the initial set of security

[61] The scoping considerations listed in this section are exemplary and *not* intended to limit organizations in rendering risk-based decisions based on other organization-defined considerations with appropriate rationale.

[62] This is especially true with the advent of service-oriented architectures where specific services are provided to implement a single function.

[63] For example, auditing controls are typically applied to components of an information system that provide auditing capability (e.g., servers, etc.) and are not necessarily applied to every user-level workstation within the organization. Organizations should carefully assess the inventory of components that compose their information systems to determine which security controls are applicable to the various components.

[64] As information technology advances, more powerful and diverse functionality can be found in smart phones, tablets, and other types of mobile devices. While tailor guidance may support not allocating a particular security control to a specific technology or device, any residual risk associated with the absence of that control must be addressed in risk assessments to adequately protect organizational operations and assets, individuals, other organizations, and the Nation.

controls assigned to the baselines in Appendix D assumes the operation of information systems in fixed facilities and non-mobile locations. If those information systems operate primarily in mobile environments, the initial set of security controls should be tailored appropriately to account for the differences in mobility and accessibility of the locations where the systems reside. For example, many of the security controls in the Physical and Environmental Protection (PE) family that are selected in all initial baselines reflect the belief that the information systems reside in physical facilities/complexes that require appropriate physical protections. Such controls would likely not provide added value for mobile environments such as ships, aircraft, automobiles, vans, or space-based systems.[65]

- *Single-User Operations*

  For information systems that are designed to operate as single-user systems (e.g., smart phones, personal digital assistants, tablets, laboratory equipment), several of the security controls that address sharing among users may not be needed. Thus, security controls such as SC-4 (Information in Shared Resources), AC-10 (Concurrent Session Control), and AC-3 (Access Enforcement)[66] would not be required in single-user operations and could reasonably be tailored out of the baseline at the discretion of organizations.

- *Data Connectivity and Bandwidth*

  While many information systems are interconnected, there are some systems which for security or operational reasons, lack networking capabilities—that is, the systems are considered standalone systems. For non-networked systems, security controls such as AC-17 (Remote Access), SC-8 (Transmission Confidentiality), AC-18 (Wireless Access), SC-9 (Transmission Integrity), and SC-7 (Boundary Protection), are not applicable and may be tailored out of the security control baselines at the discretion of organizations. In addition to standalone systems, there are information systems that have very limited or sporadic bandwidth (e.g., tactical systems supporting DoD warfighter missions and law enforcement missions). For such systems, the application of the security controls would need to be examined carefully as the limited and/or sporadic bandwidth could impact the practicality of implementing those controls and the viability of adversaries staging cyber attacks over the limited bandwidth.

- *Limited Functionality Systems*

  What constitutes an information system under the E-Government Act of 2002 is quite broad. Fax machines, printers, scanners, pagers, cellular telephones, digital cameras, and telephone answering machines can all be categorized as information systems. These types of systems often lack some of the general processing capabilities assumed in the baselines. The nature of these constraints may limit the types of threats that these systems face, and hence the appropriateness of some of the security controls. Thus, a control such as SI-3, Malicious Code Protection (required in all baselines) may not be very practical for information systems that are not capable of executing code (e.g., text-only pagers). However, because there is often no clear delineation between these types of systems (e.g., smart phones combine the digital capabilities of telephones, cameras, and computers), it is important that the application of security controls to limited functionality systems be done judiciously and always take into account the intended use of the systems, system capabilities, and the risk of compromise.

[65] The mobile nature of devices means that it is possible that for some period of time the devices may reside in fixed facilities or complexes in fixed locations. During that time, the PE controls would likely apply.

[66] Organizations consider for single-user systems, whether individual users have administrator privileges before removing AC-3 from security control baselines.

- *Information and System Non-Persistence*

  There is often an assumption that user information within organizational information systems is persistent for a considerable period of time. However, for some applications and environments of operation (e.g., tactical systems, industrial control systems), the persistence of user information is often very limited in duration. For information systems processing, storing, or transmitting such non-persistent information, several security controls in the Contingency Planning (CP) family such as CP-6, Alternate Storage Site, CP-9, Alternate Processing Site, and CP-10, Information System Backup, may not be practical and can be tailored out at the discretion of organizations. For similar reasons, controls such as MP-6, Media Sanitization, and SC-28, Protection of Information at Rest, are good candidates for removal through tailoring. In addition to the non-persistence of information, the information systems/services may be non-persistent as well. This can be achieved by the use of virtualization techniques to establish non-persistent instantiations of operating systems and applications. Depending on the duration of the instantiations, some baseline controls might not be applicable. For example, patching requirements, such as those specified in CM-2, Baseline Configuration, may not be applicable if the duration of the system instantiation or use is shorter than the period of time required for achieving patch compliance.

- *Public Access*

  When public access to organizational information systems is allowed, security controls should be applied with discretion since some security controls from the specified control baselines (e.g., identification and authentication, personnel security controls) may not be applicable for public access. Thus, in the case of the general public accessing government websites (e.g., to download publically accessible information such as forms, emergency preparedness information), security controls such as AC-7, Unsuccessful Login Attempts, AC-17, Remote Access, IA-2, Identification and Authentication (organizational users), IA-4, Identifier Management, and IA-5, Authentication Management typically would not be relevant for validating access authorizations or privileges. However, many of these controls would still be needed for identifying and authenticating organizational personnel that maintain and support information systems providing such public access websites and services. Similarly, many of the security controls may still be required for users accessing nonpublic information systems through such public interfaces, for example, to access or change personal information.

- TECHNOLOGY-RELATED CONSIDERATIONS—

  Security controls that refer to specific technologies (e.g., wireless, cryptography, public key infrastructure) are applicable only if those technologies are employed or are required to be employed within organizational information systems. Security controls that can be explicitly or implicitly supported by automated mechanisms do not require the development of such mechanisms if the mechanisms do not already exist or are not readily available in commercial or government off-the-shelf products. If automated mechanisms are not readily available, cost-effective, or technically feasible, compensating security controls, implemented through nonautomated mechanisms or procedures, are used to satisfy specified security controls or control enhancements (see terms and conditions for applying compensating controls below).

- SECURITY OBJECTIVE-RELATED CONSIDERATIONS—

  Security controls that support only one or two of the confidentiality, integrity, or availability security objectives may be downgraded to the corresponding control in a lower baseline (or modified or eliminated if not defined in a lower baseline) only if, the downgrading action: (i) reflects the FIPS 199 security category for the supported security objective(s) before moving

to the FIPS 200 impact level (i.e., high water mark);[67] (ii) is supported by an organizational assessment of risk; and (iii) does not adversely affect the level of protection for the security-relevant information within the information system.[68] For example, if an information system is categorized as moderate impact using the high water mark concept because confidentiality and/or integrity are moderate but availability is low, there are several controls that only support the availability security objective and that potentially could be downgraded to low baseline requirements—that is, it may be appropriate *not* to implement CP-2(1) because the control enhancement supports only availability and is selected in the moderate baseline but not in the low baseline. The following security controls and control enhancements are potential candidates for downgrading:

- *Confidentiality:* AC-21, MA-3 (3), MP-2 (1), MP-3, MP-4, MP-5, MP-5 (3), MP-5 (4), MP-6 (1), MP-6 (2), PE-4, PE-5, SC-4, SC-9, SC-9 (1);
- *Integrity:* CM-5, CM-5 (1), CM-5 (3), SC-8, SC-8 (1), SI-7, SI-7 (1), SI-7 (5), SI-10; and
- *Availability:* CP-2 (1), CP-2 (2), CP-2 (3), CP-2 (4), CP-2 (5), CP-2 (8), CP-3 (1), CP-4 (1), CP-4 (2), CP-4 (4), CP-6, CP-6 (1), CP-6 (2), CP-6 (3), CP-7, CP-7 (1), CP-7 (2), CP-7 (3), CP-7 (4), CP-8, CP-8 (1), CP-8 (2), CP-8 (3), CP-8 (4), CP-9 (1), CP-9 (2), CP-9 (3), CP-9 (5), CP-10 (2), CP-10 (3), CP-10 (4), CP-10 (5), CP-11, MA-6, PE-9, PE-10, PE-11, PE-11 (1), PE-13 (1), PE-13 (2), PE-13 (3), PE-15 (1).[69]

- POLICY/REGULATORY-RELATED CONSIDERATIONS—

  Security controls that address matters governed by applicable federal laws, Executive Orders, directives, policies, standards, or regulations are required only if the employment of those controls reflects the types of information and information systems covered by the applicable laws, Executive Orders, directives, policies, standards, or regulations.

- MISSION REQUIREMENTS-RELATED CONSIDERATIONS—

  Some security controls may not be applicable (or appropriate) if implementing those controls has the potential to degrade, debilitate, or otherwise hamper critical organizational missions and/or business functions. For example, if the mission requires that an uninterrupted display of mission-critical information be available at an operator console (e.g., air traffic controller console), the implementation of AC-11 (Session Lock) or SC-10 (Network Disconnect) may not be appropriate.

[67] When applying the high water mark in Section 3.1, some of the original FIPS 199 confidentiality, integrity, or availability security objectives may have been upgraded to a higher security control baseline. As part of this process, security controls that uniquely support the confidentiality, integrity, or availability security objectives may have been upgraded unnecessarily. Consequently, it is recommended that organizations consider appropriate and allowable downgrading actions to ensure cost-effective, risk-based application of security controls.

[68] Information that is security-relevant at the information system level (e.g., password files, network routing tables, cryptographic key management information) is distinguished from user-level information within the same system. Certain security controls are used to support the security objectives of confidentiality and integrity for both user-level and system-level information. Caution should be exercised in downgrading confidentiality or integrity-related security controls to ensure that downgrading actions do not result in insufficient protection for the security-relevant information within the information system. Security-relevant information must be protected at the high water mark in order to achieve a similar level of protection for any of the security objectives related to user-level information.

[69] Downgrading actions apply only to the moderate and high baselines. Security controls that are uniquely attributable to confidentiality, integrity, or availability that would ordinarily be considered as potential candidates for downgrading (e.g., AC-16, AU-10, IA-7, PE-12, PE-14, AR-2 [previously PL-5], SC-5, SC-13, SC-14, SC-16) are eliminated from consideration because the controls are either selected for use in all baselines and have no enhancements that could be downgraded, or the controls are optional and not selected for use in any baseline. Organizations should exercise caution when considering downgrading security controls that do not appear in the list in Section 3.2 to ensure that downgrading actions do not affect security objectives other than the objectives targeted for downgrading.

Selecting Compensating Security Controls

With the diverse nature of today's information systems, organizations may find it necessary on occasion to employ compensating security controls. Compensating controls are alternative security controls employed by organizations in lieu of specific controls in the low, moderate, or high baselines described in Appendix D—controls that provide equivalent/comparable protection for organizational information systems and the information processed, stored, or transmitted by those systems.[70] This may occur, for example, when organizations are unable to effectively implement specific security controls in the baselines or when, due to the specific nature of the information systems or environments of operation, the controls in the baselines are not a cost-effective means of obtaining the needed risk mitigation. Compensating controls are typically selected after applying the scoping considerations in the tailoring guidance to the initial set of baseline security controls. Compensating controls may be employed by organizations only under the following conditions:

- Organizations select compensating controls from Appendix F; if appropriate compensating controls are not available, organizations adopt suitable compensating controls from other sources;[71]
- Organizations provide supporting rationale for how compensating controls provide equivalent security capabilities for organizational information systems and why the baseline security controls could not be employed; and
- Organizations assess and accept the risk associated with implementing compensating controls in organizational information systems.

Assigning Security Control Parameter Values

Security controls and control enhancements containing embedded parameters (i.e., assignment and selection statements) give organizations the flexibility to define certain portions of controls and enhancements to support specific organizational requirements. After the initial application of scoping considerations and the selection of compensating controls, organizations review the security controls and control enhancements for assignment/selection statements and determine appropriate organization-defined values for the identified parameters. Parameter values may be prescribed by applicable federal laws, Executive Orders, directives, regulations, policies, or standards. Once organizations define the parameter values for security controls and control enhancements, the assignments and selections become a part of the control and enhancement.[72] Organizations may choose to specify the values for security control parameters before selecting compensating controls since the specification of the parameters completes the control definitions and may affect compensating control requirements. There can also be significant benefits in collaborating on the development of parameter values. For organizations that work together on a frequent basis, it may be useful for those organizations to develop a mutually agreeable set of uniform values for security control parameters. Doing so may assist organizations in achieving a greater degree of reciprocity when depending upon the information systems and/or services offered by other organizations.

[70] More than one compensating control may be required to provide the equivalent protection for a particular security control in Appendix F. For example, organizations with significant staff limitations may compensate for the separation of duty security control by strengthening the audit, accountability, and personnel security controls.

[71] Organizations should make every attempt to select compensating controls from the security control catalog in Appendix F. Organization-defined compensating controls are employed *only* when organizations determine that the security control catalog does not contain suitable compensating controls.

[72] Parameter values can also be defined as part of overlay development described in Section 3.4.

Supplementing Security Control Baselines

The final determination of the appropriate set of security controls necessary to provide adequate security for organizational information systems and the environments in which those systems operate is a function of the assessment of risk and what is required to sufficiently mitigate the risks to organizational operations and assets, individuals, other organizations, and the Nation.[73] In many cases, additional security controls or control enhancements (beyond those controls and enhancements contained in the baselines in Appendix D) will be required to address specific threats to and vulnerabilities in organizations, mission/business processes, and/or information systems and to satisfy the requirements of applicable federal laws, Executive Orders, directives, policies, standards, or regulations. The risk assessment in the security control selection process provides important inputs to determine the necessity and sufficiency of the security controls and control enhancements in the initial baselines. Organizations are encouraged to make maximum use of Appendix F to facilitate the process of supplementing the baselines with additional security controls and/or control enhancements.[74]

Situations Requiring Potential Baseline Supplementation

Organizations may be subject to conditions that, from an operational, environmental, or threat perspective, warrant the selection and implementation of additional (supplemental) controls to achieve adequate protection of organizational missions/business functions and the supporting information systems. Examples of conditions and additional controls that might be required are provided below.

- ADVANCED PERSISTENT THREAT

  Security control baselines do not assume that the current threat environment is one where adversaries have achieved a significant foothold and presence within organizations and organizational information systems—that is, organizations are dealing with an advanced persistent threat. Adversaries continue to attack organizational information systems and the information technology infrastructure and are successful in some aspects of such attacks. To more fully address the advanced persistent threat, concepts such as insider threat protection (CM-5 (4)), diversity/heterogeneity (SC-27 and SC-29), deception (SC-26 and SC-30), non-persistence (SC-25 and SC-34), and segmentation (SC-7 (13)) can be considered.

- CROSS-DOMAIN SERVICES

  Security control baselines do not assume that information systems have to operate across multiple security policy domains. The baselines assume a flat view of information flows (i.e., the same security policies in different domains when information moves across authorization boundaries). To address cross-domain services and transactions, some subset of the AC-4 security control enhancements can be considered to ensure adequate protection of information when transferred between information systems with different security policies.

- MOBILITY

  The use of mobile devices might result in the need for additional security controls and control enhancements not selected in the initial baselines. For example, AC-7 (2), which requires the purging of information after an organization-defined number of unsuccessful login attempts, could be selected in order to address the threat of theft or loss of mobile devices.

[73] Considerations for potential national-level impacts and impacts to other organizations in categorizing organizational information systems derive from the USA PATRIOT Act and Homeland Security Presidential Directives.

[74] Security controls and control enhancements selected to supplement baselines are allocated to appropriate information system components in the same manner as the control allocations carried out by organizations in the initial baselines.

- HIGHLY SENSITIVE INFORMATION AND INFORMATION SHARING

  In some environments, highly sensitive information (e.g., classified information,[75] Controlled Unclassified Information) may be resident on organizational information systems without all users having the necessary privileges and authorizations to access all of the information. In those situations, additional security controls and/or control enhancements would be required to ensure that sensitive information is not accessed by unauthorized users (or processes acting on behalf of users). More stringent access controls/identification and authentication controls include, for example, AC-3 (3), AC-3 (4), AC-16, and IA-4 (4). When classified information is being processed, stored, or transmitted on information systems that are jointly owned by multiple entities (e.g., coalition partners in political and military alliances), more restrictive controls for maintenance personnel may be required including, for example, MA-5 (4).

- APPLICATION-LAYER SECURITY

  Organizations can employ security controls at multiple layers within information systems. For example, operating systems typically provide access control capability that includes the identification and authentication of users. Applications can also provide an access control capability requiring users to go through a second level of identification and authentication, thus rendering an additional level of protection for organizational information systems.

Processes for Identifying Additional Needed Security Controls

Organizations can employ a *requirements definition* approach or a *gap analysis* approach in selecting security controls and control enhancements to supplement initial baselines. In the requirements definition approach, organizations obtain specific and credible threat[76] information (or make reasonable assumptions) about the activities of adversaries with certain capabilities or attack potential (e.g., skill levels, expertise, available resources). To effectively withstand cyber attacks from adversaries with the stated capabilities or attack potential, organizations strive to achieve a certain level of defensive capability or cyber preparedness. Organizations can select additional security controls and control enhancements from Appendix F to obtain such defensive capability or level of preparedness. In contrast to the requirements definition approach, the gap analysis approach begins with an organizational assessment of its current defensive capability or level of cyber preparedness. From that initial capability assessment, organizations determine the types of threats they can reasonably expect to counter. If the current organizational defensive capabilities or levels of cyber preparedness are insufficient, the gap analysis determines the required capabilities and levels of preparedness. Organizations subsequently define the security controls and control enhancements from Appendix F needed to achieve the desired capabilities or cyber-preparedness levels.

Enhancing Information Security without Changing Control Selection

There may be situations in which organizations cannot apply sufficient security controls within their information systems to adequately reduce or mitigate risk (e.g., when using certain types of information technologies or employing certain computing paradigms). Therefore, alternative strategies are needed to prevent organizational missions/business functions from being adversely affected— strategies that consider the mission and business risks resulting from an aggressive use of information technology. Restrictions on the types of technologies used and how organizational information systems are employed provide an alternative method to reduce or mitigate risk that

[75] The example is illustrative only. CNSS Instruction 1253 provides specific guidance regarding security controls required for national security systems, including those systems containing classified information.

[76] While this example focuses on threats to information systems from purposeful attacks, the threat space of concern to organizations also includes environmental disruptions and human errors.

may be used in conjunction with, or instead of, supplemental security controls. Restrictions on the use of information systems and specific information technologies may be, in some situations, the only practical or reasonable actions organizations can take in order to have the capability to carry out assigned missions/business functions in the face of determined adversaries. Examples of use restrictions include:

- Limiting the information that information systems can process, store, or transmit or the manner in which organizational missions/business functions are automated;
- Prohibiting external access to organizational information by removing selected information system components from networks (i.e., air gapping); and
- Prohibiting moderate- or high-impact information on organizational information system components to which the public has access, unless an explicit risk determination is made authorizing such access.

Providing Additional Specification Information for Control Implementation

Since security controls are statements of security capability at higher levels of abstraction, the controls may lack sufficient information for successful implementation. Therefore, additional detail may be necessary to fully define the intent of a given security control for implementation purposes and to ensure that the security requirements related to that control are satisfied. Organizations ensure that, where existing security control information (e.g., selections and assignments) is not sufficient to fully define the intended application of the control, such information is provided. Organizations have the flexibility to determine whether additional detail is included as a part of the control statement (e.g., in supplemental guidance) or in a separate control addendum section. Providing additional detail does *not* allow organizations to change the intent of the security control or modify in any manner, the original language in the control. The additional implementation information can be documented either in security plans or systems and security engineering plans. The type of additional detail that might be necessary for a security control to be fully specified for implementation purposes is provided in the SI-7 (7) example below:

SI-7 SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY

(7) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CRYPTOGRAPHIC PROTECTION*

The information system employs cryptographic mechanisms to detect unauthorized changes to software, firmware, and information.

Supplemental Guidance: Cryptographic mechanisms used for the protection of integrity include, for example, digital signatures and the computation and application of signed hashes using asymmetric cryptography, protecting the confidentiality of the key used to generate the hash, and using the public key to verify the hash information. Related control: SC-13.

Additional implementation detail for SI-7 (7):

Digital signatures are applied to all traffic for which non-repudiation is required employing SHA-256 or another approved NIST algorithm demonstrably of at least the same strength of mechanism.

Baseline Tailoring Using Overlays

The previous sections described the process of tailoring a set of initial baseline security controls to achieve a more focused and relevant security capability for organizations. In certain situations, it may be necessary for organizations to apply tailoring guidance to the baselines to develop a set of security controls for community-wide use or to address specialized requirements, technologies,

or unique missions/environments of operation.[77] For example, the federal government may decide to establish a governmentwide set of security controls and implementation guidance for: (i) public key infrastructure (PKI) systems that could be uniformly applied to all PKI systems implemented within federal agencies; or (ii) cloud-based information systems that are uniformly applied to all federal agencies procuring or implementing cloud services. Alternatively, to address particular communities of interest with specialized requirements, the Department of Defense, for example, may decide to establish a set of security controls and implementation guidance for its tactical operations and environments by applying the tailoring guidance to the standard security control baselines for national security systems to achieve more specialized solutions. In each of the above examples, tailored baselines can be developed for each information technology area or for the unique circumstances/environments and promulgated to large communities of interest—thus achieving standardized security capabilities, consistency of implementation, and cost-effective security solutions.

To address the need for developing community-wide and specialized sets of security controls for information systems and organizations, the concept of *overlay* is introduced. An overlay is a fully specified set of security controls, control enhancements, and supplemental guidance derived from the application of tailoring guidance in Section 3.2 to security control baselines in Appendix D.[78] Overlays complement the initial security control baselines by: (i) providing the opportunity to add or eliminate controls; (ii) providing security control applicability and interpretations for specific information technologies, computing paradigms, environments of operation, types of information systems, types of missions/operations, operating modes, industry sectors, and statutory/regulatory requirements; (iii) establishing community-wide parameter values for assignment and/or selection statements in security controls and control enhancements; and (iv) extending the supplemental guidance for security controls, where necessary. Organizations typically use the overlay concept when there is divergence from the basic assumptions used to create the initial security control baselines (see Section 3.1). If organizations are not divergent from the basic assumptions for the initial baselines, then there is likely no need to create an overlay. Alternatively, the baselines may be missing key assumptions which would then justify creating an overlay with the additional assumptions.

The full range of tailoring activities are available to organizations to provide a disciplined and structured approach for developing tailored baselines supporting the areas described above. Overlays provide an opportunity to build consensus across communities of interest and develop security plans for organizational information systems that have broad-based support for very specific circumstances, situations, and/or conditions. Categories of overlays that may be useful include, for example:

- Communities of interest (e.g., healthcare, intelligence, financial, law enforcement);
- Information technologies/computing paradigms (e.g., cloud/mobile, PKI, Smart Grid);
- Industry sectors (e.g., nuclear power, transportation);
- Environments of operation (e.g., space, tactical);
- Types of information systems (e.g., industrial/process control systems, weapons systems);
- Types of missions/operations (e.g., counter terrorism, first responders, research, development, test, and evaluation);

[77] This type of tailoring can be conducted at the federal level or by individual organizations.

[78] CNSS Instruction 1253 provides tailoring guidance and security control baselines for national security systems.

- Operating modes (e.g., single-user systems, standalone systems);
- Coalitions and partnerships (e.g., allied collaboration/sharing, cross-domain solutions); and
- Statutory/regulatory requirements (e.g., Foreign Intelligence Surveillance Act, Health Insurance Portability and Accountability Act, Privacy Act).

Organizations can effectively use the risk management concepts defined in NIST Special Publication 800-39 when developing overlays. The successful development of overlays requires the involvement of: (i) information security professionals who understand the specific subject area that is the focus of the overlay development effort; and (ii) subject matter experts in the overlay area who understand the security controls in Appendix F and the initial baselines in Appendix D. The format and structure for developing overlays is provided in Appendix I. Multiple overlays can be applied to a single security control baseline. The tailored baselines that result from the overlay development process may be more or less stringent than the original security control baselines. Risk assessments can help determine if the risk from implementing the tailored baselines falls within the risk tolerance of the organizations/communities of interest developing the overlays. In general, overlays are intended to reduce the need for ad hoc tailoring of baselines by organizations through the selection of a set of controls and control enhancements that more closely correspond to common circumstances, situations, and/or conditions. However, the use of overlays does not in any way preclude organizations from performing further tailoring (i.e., overlays can also be subject to tailoring) to reflect organization-specific needs, assumptions, or constraints. But it is anticipated that the use of overlays would greatly reduce the number and extent of organization-specific ad hoc tailoring.

Implementation Tip

Many organizations operate complex information systems, often referred to as a system-of-systems. Enterprise architecture plays a key part in the security control selection process for these types of information systems. Organizations can address the complex system problem by dividing the system into two or more subsystems and applying the FIPS 199 security categorization and FIPS 200 impact level determination to each subsystem. Applying separate impact levels to each subsystem does not change the overall impact level of the information system; rather, it allows constituent subsystems to receive a separate allocation of security controls instead of deploying higher impact controls across every subsystem. It is not valid to treat the subsystems as entirely independent entities, however, since the subsystems are interdependent and interconnected. Organizations develop security architectures to allocate security controls among subsystems including monitoring and controlling communications at key internal boundaries within the system-of-systems and provide system-wide controls that meet or exceed the highest information system impact level of the constituent subsystems inheriting security capabilities from those system-wide controls. Organizations also consider that replicated subsystems within complex systems may exhibit common vulnerabilities that can be exploited by common threat sources—thereby negating the redundancy that might be relied upon as a risk mitigation measure. The impact due to a security incident against one constituent subsystem might cascade and impact many subsystems at the same time.

3.3 DOCUMENTING THE CONTROL SELECTION PROCESS

Organizations document the relevant decisions taken during the security control selection process, providing a sound rationale for those decisions. This documentation is essential when examining the security considerations for organizational information systems with respect to the potential mission/business impact. The resulting set of security controls and the supporting rationale for the selection decisions (including any information system use restrictions required by organizations),

are documented in the security plans. Documenting significant risk management decisions in the security control selection process is imperative so that authorizing officials can have access to the necessary information to make informed authorization decisions for organizational information systems.[79] Without such information, the understanding, assumptions, constraints, and rationale supporting those important risk management decisions will, in all likelihood, not be available when the state of the information systems or environments of operation change, and the original risk decisions are revisited. Figure 3 summarizes the security control selection process, including the selection of initial baselines and the tailoring of the baselines by applying the guidance in Section 3.2.

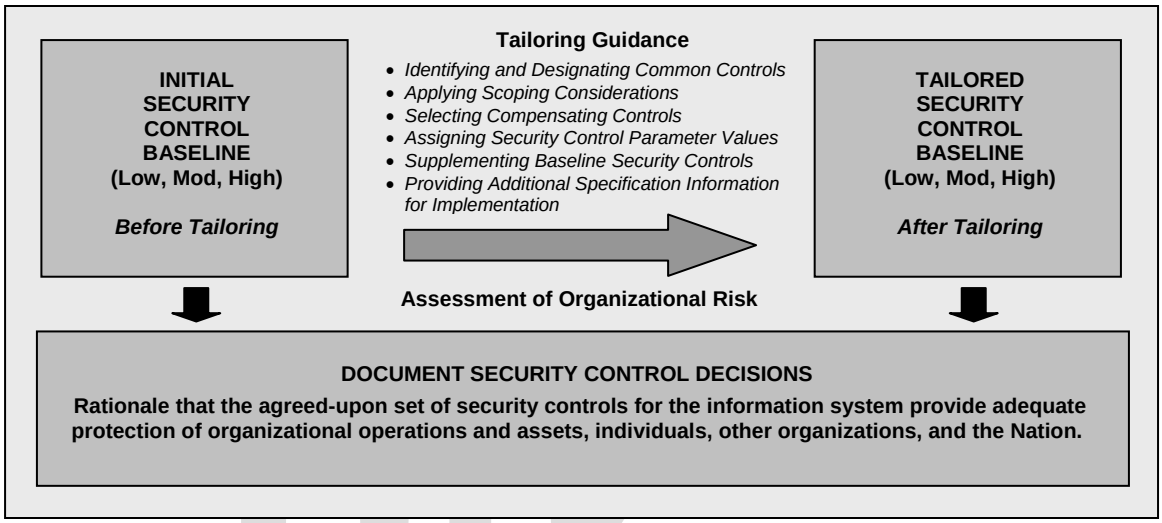

FIGURE 3: SECURITY CONTROL SELECTION PROCESS

Iterative Nature of Security Control Tailoring

The security control tailoring process described above, while appearing to be sequential in nature, can also have an iterative aspect. Organizations may choose to execute the tailoring steps in any order based on organizational needs and the information generated from risk assessments. For example, some organizations may establish the parameter values for security controls in the initial baselines prior to selecting compensating controls. Other organizations may delay completing assignment and selection statements in the controls until after the supplementation activities have been completed. Organizations may also discover that when fully specifying security controls for the intended environments of operation, there may be difficulties that arise which may trigger the need for additional (supplemental) controls. Finally, the security control tailoring process is not static—that is, organizations revisit the tailoring step as often as needed based on ongoing organizational assessments of risk.

In addition to the iterative and dynamic nature of the security control tailoring process, there may also be side effects as controls are added and removed from the baselines. Security controls in Appendix F can have some degree of dependency and functional overlap with other controls. In many cases, security controls work together to achieve a security capability. Thus, removing a particular security control from a baseline during the tailoring process may have unintended side effects (and potentially adverse impacts) on the remaining controls. Alternatively, adding a new

[79] The security control selection process also applies to common control providers and the authorizing officials rendering authorization decisions for common controls deployed within organizations.

security control to a baseline during the tailoring process may eliminate or reduce the need for certain specific controls because the new control provides a better security capability than the capability provided by other controls. For example, if organizations implement SC-30 (1) and SC-30 (2) using virtualization techniques to randomly/frequently deploy diverse and changing operating systems and applications, this approach could potentially limit the requirement to update the security configurations in CM-2 (2). Therefore, the addition or removal of security controls is viewed with regard to the totality of the information security needs of the organization and its information systems, and not simply with regard to the controls being added or removed.

Other Considerations

Organizational tailoring decisions are not carried out in a vacuum. While such decisions are rightly focused on information security considerations, it is important that the decisions be aligned with other risk factors that organizations address routinely. Risk factors such as cost, schedule, and performance are considered in the overall determination of which security controls to employ in organizational information systems and environments of operation. For example, in military command and control systems in which lives may be at stake, the adoption of security controls is balanced with operational necessity. With respect to the air traffic control system and consoles used by air traffic controllers, the need to access the consoles in real time to control the air space far outweighs the security need for an AC-11 (Session Lock) capability. In short, the security control selection process (to include tailoring activities described in Section 3.2) should be integrated into the overall risk management process as described in NIST Special Publication 800-39.

Finally, organizations factor scalability into the security control selection process—that is, controls are scalable with regard to the extent/rigor of the implementation. Scalability is guided by the FIPS 199 security categorizations and the associated FIPS 200 impact levels of the information systems where the controls are to be applied. For example, contingency plans for high-impact information systems may contain significant amounts of implementation detail and be quite lengthy. In contrast, contingency plans for low-impact systems may contain considerably less detail and be quite succinct. Organizations use discretion in applying the security controls to organizational information systems, giving consideration to the scalability factors in particular operational environments. Scaling controls to the appropriate impact level facilitates a more cost-effective, risk-based approach to security control implementation—expending only the level of resources necessary to achieve sufficient risk mitigation and adequate security.

Implementation Tip

In diverging from the security control baselines during the tailoring process, organizations should consider some very important linkages between various controls and control enhancements. These linkages are captured in the selection of controls and enhancements in the baselines and are especially significant when developing overlays (described in Section 3.2 and Appendix I). In some instances, the linkages are such that it is not meaningful to include a specific security control or control enhancement without some other control or enhancement. In essence, the totality of the controls and enhancements provide a required *security capability*. Some linkages are fairly obvious such as that between Access Control | Mandatory Access Control enhancement (AC-3 (7)) and Security Attributes (AC-16). But other linkages may be more subtle. This is especially true in the case where the linkage is between security functionality-related controls and security assurance-related controls as described in Appendix E. For example, is it not particularly meaningful to implement Access Control | MAC enhancement AC-3 (7) without also implementing a Reference Monitor Function (AC-25). Organizations are encouraged to pay careful attention to the *related controls* section of the *Supplemental Guidance* for the security controls to help in identifying such linkages.

3.4 NEW DEVELOPMENT AND LEGACY SYSTEMS

The security control selection process described in this section can be applied to organizational information systems from two different perspectives: (i) new development; and (ii) legacy. For new development systems, the security control selection process is applied from a *requirements definition* perspective since the systems do not yet exist and organizations are conducting initial security categorizations. The security controls included in the security plans for the information systems serve as a security specification and are expected to be incorporated into the systems during the development and implementation phases of the system development life cycle. In contrast, for legacy information systems, the security control selection process is applied from a *gap analysis* perspective when organizations are anticipating significant changes to the systems (e.g., during major upgrades, modifications, or outsourcing). Since the information systems already exist, organizations in all likelihood have completed the security categorization and security control selection processes resulting in the establishment of previously agreed-upon security controls in the respective security plans and the implementation of those controls within the information systems. Therefore, the gap analysis can be applied in the following manner:

- First, *reconfirm* or *update* as necessary, the FIPS 199 security category and FIPS 200 impact level for the information system based on the different types of information that are *currently* being processed, stored, or transmitted by the system.
- Second, *review* the existing security plan that describes the security controls that are currently employed considering any updates to the security category and information system impact level as well as any changes to the organization, mission/business processes, the system, or the operational environment. Reassess the risk and revise the security plan as necessary, including documenting any additional security controls that *would* be needed by the system to ensure that the risk to organizational operations, organizational assets, individuals, other organizations, and the Nation, remains at an acceptable level.
- Third, *implement* the security controls described in the updated security plan, document in the plan of action and milestones any controls not implemented, and continue with the remaining steps in the Risk Management Framework in the same manner as a new development system.

Applying Gap Analyses to External Service Providers

The gap analysis perspective is also applied when interacting with external service providers. As described in Section 2.6, organizations are becoming increasingly reliant on external providers for information system services. Using the steps in the gap analysis described above, organizations can effectively use the acquisition process and appropriate contractual vehicles to require external providers to carry out the security categorization and security control selection steps in the RMF. The resulting information can help determine what security controls the external provider either has in place or intends to implement for the information system services that are to be provided. If a security control deficit exists, the responsibility for adequately mitigating unacceptable risks arising from the use of external information system services remains with authorizing officials. In such situations, organizations can reduce the organizational risk to an acceptable level by:

- Using the existing contractual vehicle to require the external provider to meet the additional security control requirements established by the organization;
- Negotiating with the provider for additional security controls if the existing contractual vehicle does not provide for such added requirements;
- Approving the use of compensating controls by the provider; or

- Employing alternative risk mitigation actions[80] within the organizational information system when a contract either does not exist or the contract does not provide the necessary leverage for organizations to obtain the needed security controls.

Implementation Tip

Security controls are typically deployed as a unified set to achieve a desired *security capability*. The loss of one security objective (e.g., integrity) can adversely affect the other objectives (e.g., confidentiality and availability). When selecting security controls for nondisclosure purposes, organizations consider the security categorization of user data and system-level data—where system data may require stronger protection in the form of additional security controls.

[80] For example, local policies, procedures, and/or compensating controls could be established by organizations to serve as alternative mitigation actions for risks identified in a gap analysis.

APPENDIX A

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APPENDIX B

GLOSSARY

COMMON TERMS AND DEFINITIONS

Appendix B provides definitions for security terminology used within Special Publication 800-53. Unless specifically defined in this glossary, all terms used in this publication are consistent with the definitions contained in CNSS Instruction 4009, *National Information Assurance Glossary*.

Adequate Security [OMB Circular A-130, Appendix III]	Security commensurate with the risk and the magnitude of harm resulting from the loss, misuse, or unauthorized access to or modification of information.
Advanced Persistent Threat	An adversary that possesses sophisticated levels of expertise and significant resources which allow it to create opportunities to achieve its objectives by using multiple attack vectors (e.g., cyber, physical, and deception). These objectives typically include establishing and extending footholds within the information technology infrastructure of the targeted organizations for purposes of exfiltrating information, undermining or impeding critical aspects of a mission, program, or organization; or positioning itself to carry out these objectives in the future. The advanced persistent threat: (i) pursues its objectives repeatedly over an extended period of time; (ii) adapts to defenders' efforts to resist it; and (iii) is determined to maintain the level of interaction needed to execute its objectives.
Agency	See *Executive Agency*.
All Source Intelligence [Department of Defense, Joint Publication 1-02]	Intelligence products and/or organizations and activities that incorporate all sources of information, most frequently including human resources intelligence, imagery intelligence, measurement and signature intelligence, signals intelligence, and open source data in the production of finished intelligence.
Assessment	See *Security Control Assessment*.
Assessor	See *Security Control Assessor*.
Assurance [CNSSI 4009]	Measure of confidence that the security features, practices, procedures, and architecture of an information system accurately mediates and enforces the security policy.
Assurance Case [Software Engineering Institute, Carnegie Mellon University]	A structured set of arguments and a body of evidence showing that an information system satisfies specific claims with respect to a given quality attribute.
Attribute-Based Access Control	Access control based on attributes associated with and about subjects, objects, targets, initiators, resources, or the environment. An access control rule set defines the combination of attributes under which an access may take place.

Audit Log [CNSSI 4009]	A chronological record of information system activities, including records of system accesses and operations performed in a given period.
Audit Reduction Tools [CNSSI 4009]	Preprocessors designed to reduce the volume of audit records to facilitate manual review. Before a security review, these tools can remove many audit records known to have little security significance. These tools generally remove records generated by specified classes of events, such as records generated by nightly backups.
Audit Trail [CNSSI 4009]	A chronological record that reconstructs and examines the sequence of activities surrounding or leading to a specific operation, procedure, or event in a security-relevant transaction from inception to final result.
Authentication [FIPS 200]	Verifying the identity of a user, process, or device, often as a prerequisite to allowing access to resources in an information system.
Authenticator	The means used to confirm the identity of a user, processor, or device (e.g., user password or token).
Authenticity	The property of being genuine and being able to be verified and trusted; confidence in the validity of a transmission, a message, or message originator. See *Authentication*.
Authorization (to operate)	The official management decision given by a senior organizational official to authorize operation of an information system and to explicitly accept the risk to organizational operations (including mission, functions, image, or reputation), organizational assets, individuals, other organizations, and the Nation based on the implementation of an agreed-upon set of security controls.
Authorization Boundary	All components of an information system to be authorized for operation by an authorizing official and excludes separately authorized systems, to which the information system is connected.
Authorize Processing	See *Authorization*.
Authorizing Official	A senior (federal) official or executive with the authority to formally assume responsibility for operating an information system at an acceptable level of risk to organizational operations (including mission, functions, image, or reputation), organizational assets, individuals, other organizations, and the Nation.
Availability [44 U.S.C., Sec. 3542]	Ensuring timely and reliable access to and use of information.

Baseline Configuration	A documented set of specifications for an information system, or a configuration item within a system, that has been formally reviewed and agreed on at a given point in time, and which can be changed only through change control procedures. The baseline configuration is used as a basis for future builds, releases, and/or changes.
Boundary Protection	Monitoring and control of communications at the external boundary of an information system to prevent and detect malicious and other unauthorized communications, through the use of boundary protection devices (e.g., gateways, routers, firewalls, guards, encrypted tunnels).
Boundary Protection Device	A device with appropriate mechanisms that: (i) facilitates the adjudication of different interconnected system security policies (e.g., controlling the flow of information into or out of an interconnected system); and/or (ii) provides information system boundary protection.
Chief Information Officer [PL 104-106, Sec. 5125(b)]	Agency official responsible for: (i) Providing advice and other assistance to the head of the executive agency and other senior management personnel of the agency to ensure that information technology is acquired and information resources are managed in a manner that is consistent with laws, Executive Orders, directives, policies, regulations, and priorities established by the head of the agency; (ii) Developing, maintaining, and facilitating the implementation of a sound and integrated information technology architecture for the agency; and (iii) Promoting the effective and efficient design and operation of all major information resources management processes for the agency, including improvements to work processes of the agency. Note: Organizations subordinate to federal agencies may use the term *Chief Information Officer* to denote individuals filling positions with similar security responsibilities to agency-level Chief Information Officers.
Chief Information Security Officer	See *Senior Agency Information Security Officer*.
Classified Information	Information that has been determined: (i) pursuant to Executive Order 12958 as amended by Executive Order 13292, or any predecessor Order, to be classified national security information; or (ii) pursuant to the Atomic Energy Act of 1954, as amended, to be Restricted Data (RD).
Commodity Service	An information system service (e.g., telecommunications service) provided by a commercial service provider typically to a large and diverse set of consumers. The organization acquiring and/or receiving the commodity service possesses limited visibility into the management structure and operations of the provider, and while the organization may be able to negotiate service-level agreements, the organization is typically not in a position to require that the provider implement specific security controls.

Common Carrier	In a telecommunications context, a telecommunications company that holds itself out to the public for hire to provide communications transmission services. Note: In the United States, such companies are usually subject to regulation by federal and state regulatory commissions.
Common Control [NIST SP 800-37; CNSSI 4009]	A security control that is inherited by one or more organizational information systems. See *Security Control Inheritance*.
Common Control Provider [NIST SP 800-37]	An organizational official responsible for the development, implementation, assessment, and monitoring of common controls (i.e., security controls inherited by information systems).
Common Criteria [CNSSI 4009]	Governing document that provides a comprehensive, rigorous method for specifying security function and assurance requirements for products and systems.
Common Secure Configuration	A recognized standardized and established benchmark that stipulates specific secure configuration settings for a given information technology platform.
Compensating Security Controls [CNSSI 4009, Adapted]	The security controls employed in lieu of the recommended controls in the security control baselines described in NIST Special Publication 800-53 and CNSS Instruction 1253 that provide equivalent or comparable protection for an information system or organization.
Confidentiality [44 U.S.C., Sec. 3542]	Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information.
Configuration Control [CNSSI 4009]	Process for controlling modifications to hardware, firmware, software, and documentation to protect the information system against improper modifications before, during, and after system implementation.
Configuration Item	An aggregation of information system components that is designated for configuration management and treated as a single entity in the configuration management process.
Controlled Area	Any area or space for which an organization has confidence that the physical and procedural protections provided are sufficient to meet the requirements established for protecting the information and/or information system.
Controlled Unclassified Information [E.O. 13556]	A categorical designation that refers to unclassified information that does not meet the standards for National Security Classification under Executive Order 12958, as amended, but is (i) pertinent to the national interests of the United States or to the important interests of entities outside the federal government, and (ii) under law or policy requires protection from unauthorized disclosure, special handling safeguards, or prescribed limits on exchange or dissemination. Henceforth, the designation CUI replaces *Sensitive But Unclassified (SBU)*.

Countermeasures [CNSSI 4009]	Actions, devices, procedures, techniques, or other measures that reduce the vulnerability of an information system. Synonymous with security controls and safeguards.
Covert Channel Analysis [CNSSI 4009]	Determination of the extent to which the security policy model and subsequent lower-level program descriptions may allow unauthorized access to information.
Covert Storage Channel [CNSSI 4009]	Covert channel involving the direct or indirect writing to a storage location by one process and the direct or indirect reading of the storage location by another process. Covert storage channels typically involve a finite resource (e.g., sectors on a disk) that is shared by two subjects at different security levels.
Covert Timing Channel [CNSSI 4009]	Covert channel in which one process signals information to another process by modulating its own use of system resources (e.g., central processing unit time) in such a way that this manipulation affects the real response time observed by the second process.
Cyber Attack [CNSSI 4009]	An attack, via cyberspace, targeting an enterprise's use of cyberspace for the purpose of disrupting, disabling, destroying, or maliciously controlling a computing environment/infrastructure; or destroying the integrity of the data or stealing controlled information.
Cyber Security [CNSSI 4009]	The ability to protect or defend the use of cyberspace from cyber attacks.
Cyberspace [CNSSI 4009]	A global domain within the information environment consisting of the interdependent network of information systems infrastructures including the Internet, telecommunications networks, computer systems, and embedded processors and controllers.
Defense-in-Breadth [CNSSI 4009]	A planned, systematic set of multidisciplinary activities that seek to identify, manage, and reduce risk of exploitable vulnerabilities at every stage of the system, network, or subcomponent life cycle (system, network, or product design and development; manufacturing; packaging; assembly; system integration; distribution; operations; maintenance; and retirement).
Defense-in-depth	Information security strategy integrating people, technology, and operations capabilities to establish variable barriers across multiple layers and missions of the organization.
Developer	See *Information System Developer*.
Discretionary Access Control	A type of access control that restricts access to objects based on the identity of subjects or groups to which subjects belong. The access controls are discretionary because subjects with certain privileges are capable of passing those privileges on to any other subjects, either directly or indirectly. Nondiscretionary access controls restrict this capability.

Domain [CNSSI 4009]	An environment or context that includes a set of system resources and a set of system entities that have the right to access the resources as defined by a common security policy, security model, or security architecture. See *Security Domain*.
Enterprise [CNSSI 4009]	An organization with a defined mission/goal and a defined boundary, using information systems to execute that mission, and with responsibility for managing its own risks and performance. An enterprise may consist of all or some of the following business aspects: acquisition, program management, financial management (e.g., budgets), human resources, security, and information systems, information and mission management. See *Organization*.
Enterprise Architecture [CNSSI 4009]	The description of an enterprise's entire set of information systems: how they are configured, how they are integrated, how they interface to the external environment at the enterprise's boundary, how they are operated to support the enterprise mission, and how they contribute to the enterprise's overall security posture.
Environment of Operation [NIST SP 800-37]	The physical surroundings in which an information system processes, stores, and transmits information.
Executive Agency [41 U.S.C., Sec. 403]	An executive department specified in 5 U.S.C., Sec. 101; a military department specified in 5 U.S.C., Sec. 102; an independent establishment as defined in 5 U.S.C., Sec. 104(1); and a wholly owned Government corporation fully subject to the provisions of 31 U.S.C., Chapter 91.
Exfiltration	The unauthorized transfer of information from an information system.
External Information System (or Component)	An information system or component of an information system that is outside of the authorization boundary established by the organization and for which the organization typically has no direct control over the application of required security controls or the assessment of security control effectiveness.
External Information System Service	An information system service that is implemented outside of the authorization boundary of the organizational information system (i.e., a service that is used by, but not a part of, the organizational information system) and for which the organization typically has no direct control over the application of required security controls or the assessment of security control effectiveness.
External Information System Service Provider	A provider of external information system services to an organization through a variety of consumer-producer relationships including but not limited to: joint ventures; business partnerships; outsourcing arrangements (i.e., through contracts, interagency agreements, lines of business arrangements); licensing agreements; and/or supply chain exchanges.
External Network	A network not controlled by the organization.

Failover	The capability to switch over automatically (typically without human intervention or warning) to a redundant or standby information system upon the failure or abnormal termination of the previously active system.
Federal Agency	See *Executive Agency*.
Federal Enterprise Architecture [FEA Program Management Office]	A business-based framework for governmentwide improvement developed by the Office of Management and Budget that is intended to facilitate efforts to transform the federal government to one that is citizen-centered, results-oriented, and market-based.
Federal Information System [40 U.S.C., Sec. 11331]	An information system used or operated by an executive agency, by a contractor of an executive agency, or by another organization on behalf of an executive agency.
FIPS-Validated Cryptography	A cryptographic module validated by the Cryptographic Module Validation Program (CMVP) to meet requirements specified in FIPS 140-2 (as amended). As a prerequisite to CMVP validation, the cryptographic module is required to employ a cryptographic algorithm implementation that has successfully passed validation testing by the Cryptographic Algorithm Validation Program (CAVP). See *NSA-Approved Cryptography*.
Guard (System) [CNSSI 4009, Adapted]	A mechanism limiting the exchange of information between information systems or subsystems.
High-Impact System [FIPS 200]	An information system in which at least one security objective (i.e., confidentiality, integrity, or availability) is assigned a FIPS 199 potential impact value of high.
Hybrid Security Control [CNSSI 4009]	A security control that is implemented in an information system in part as a common control and in part as a system-specific control. See *Common Control* and *System-Specific Security Control*.
Identity-Based Access Control	Access control based on the identity of the user (typically relayed as a characteristic of the process acting on behalf of that user) where access authorizations to specific objects are assigned based on user identity.
Impact	The effect on organizational operations, organizational assets, individuals, other organizations, or the Nation (including the national security interests of the United States) of a loss of confidentiality, integrity or availability of information or an information system.
Impact Value	The assessed potential impact resulting from a compromise of the confidentiality, integrity, or availability of information expressed as a value of low, moderate or high.
Incident [FIPS 200]	An occurrence that actually or potentially jeopardizes the confidentiality, integrity, or availability of an information system or the information the system processes, stores, or transmits or that constitutes a violation or imminent threat of violation of security policies, security procedures, or acceptable use policies.

Industrial Control System	An information system used to control industrial processes such as manufacturing, product handling, production, and distribution. Industrial control systems include supervisory control and data acquisition (SCADA) systems used to control geographically dispersed assets, as well as distributed control systems (DCSs) and smaller control systems using programmable logic controllers to control localized processes.
Information [CNSSI 4009]	Any communication or representation of knowledge such as facts, data, or opinions in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual.
[FIPS 199]	An instance of an information type.
Information Owner [CNSSI 4009]	Official with statutory or operational authority for specified information and responsibility for establishing the controls for its generation, collection, processing, dissemination, and disposal.
Information Resources [44 U.S.C., Sec. 3502]	Information and related resources, such as personnel, equipment, funds, and information technology.
Information Security [44 U.S.C., Sec. 3542]	The protection of information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide confidentiality, integrity, and availability.
Information Security Architecture	An embedded, integral part of the enterprise architecture that describes the structure and behavior for an enterprise's security processes, information security systems, personnel and organizational sub-units, showing their alignment with the enterprise's mission and strategic plans.
Information Security Policy [CNSSI 4009]	Aggregate of directives, regulations, rules, and practices that prescribes how an organization manages, protects, and distributes information.
Information Security Program Plan	Formal document that provides an overview of the security requirements for an organization-wide information security program and describes the program management controls and common controls in place or planned for meeting those requirements.
Information Steward [CNSSI 4009]	An agency official with statutory or operational authority for specified information and responsibility for establishing the controls for its generation, collection, processing, dissemination, and disposal.
Information System [44 U.S.C., Sec. 3502]	A discrete set of information resources organized for the collection, processing, maintenance, use, sharing, dissemination, or disposition of information. [Note: Information systems also include specialized systems such as industrial/process controls systems, telephone switching and private branch exchange (PBX) systems, and environmental control systems.]

Information System Boundary	See *Authorization Boundary*.
Information System Developer	A general term that includes developers or manufacturers of information technology products (including hardware, software, firmware), systems integrators, vendors, and product resellers.
Information System Owner (or Program Manager)	Official responsible for the overall procurement, development, integration, modification, or operation and maintenance of an information system.
Information System Resilience	The ability of an information system to continue to: (i) operate under adverse conditions or stress, even if in a degraded or debilitated state, while maintaining essential operational capabilities; and (ii) recover to an effective operational posture in a time frame consistent with mission needs.
Information System Security Officer [CNSSI 4009]	Individual with assigned responsibility for maintaining the appropriate operational security posture for an information system or program.
Information Security Risk	The risk to organizational operations (including mission, functions, image, reputation), organizational assets, individuals, other organizations, and the Nation due to the potential for unauthorized access, use, disclosure, disruption, modification, or destruction of information and/or information systems.
Information System-Related Security Risks	Risks that arise through the loss of confidentiality, integrity, or availability of information or information systems and consider impacts to the organization (including assets, mission, functions, image, or reputation), individuals, other organizations, and the Nation. See *Risk*.
Information Technology [40 U.S.C., Sec. 1401]	Any equipment or interconnected system or subsystem of equipment that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the executive agency. For purposes of the preceding sentence, equipment is used by an executive agency if the equipment is used by the executive agency directly or is used by a contractor under a contract with the executive agency which: (i) requires the use of such equipment; or (ii) requires the use, to a significant extent, of such equipment in the performance of a service or the furnishing of a product. The term *information technology* includes computers, ancillary equipment, software, firmware, and similar procedures, services (including support services), and related resources.
Information Type [FIPS 199]	A specific category of information (e.g., privacy, medical, proprietary, financial, investigative, contractor sensitive, security management) defined by an organization or in some instances, by a specific law, Executive Order, directive, policy, or regulation.

Integrity [44 U.S.C., Sec. 3542]	Guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity.
Internal Network	A network where: (i) the establishment, maintenance, and provisioning of security controls are under the direct control of organizational employees or contractors; or (ii) cryptographic encapsulation or similar security technology implemented between organization-controlled endpoints, provides the same effect (at least with regard to confidentiality and integrity). An internal network is typically organization-owned, yet may be organization-controlled while not being organization-owned.
Label	See *Security Label*.
Line of Business	The following OMB-defined process areas common to virtually all federal agencies: Case Management, Financial Management, Grants Management, Human Resources Management, Federal Health Architecture, Information Systems Security, Budget Formulation and Execution, Geospatial, and IT Infrastructure.
Local Access	Access to an organizational information system by a user (or process acting on behalf of a user) communicating through a direct connection without the use of a network.
Low-Impact System [FIPS 200]	An information system in which all three security objectives (i.e., confidentiality, integrity, and availability) are assigned a FIPS 199 potential impact value of low.
Malicious Code	Software or firmware intended to perform an unauthorized process that will have adverse impact on the confidentiality, integrity, or availability of an information system. A virus, worm, Trojan horse, or other code-based entity that infects a host. Spyware and some forms of adware are also examples of malicious code.
Malware	See *Malicious Code*.
Managed Interface	An interface within an information system that provides boundary protection capability using automated mechanisms or devices.
Marking	See *Security Marking*.
Media [FIPS 200]	Physical devices or writing surfaces including, but not limited to, magnetic tapes, optical disks, magnetic disks, Large-Scale Integration (LSI) memory chips, and printouts (but not including display media) onto which information is recorded, stored, or printed within an information system.
Metadata	Information describing the characteristics of data including, for example, structural metadata describing data structures (e.g., data format, syntax, and semantics) and descriptive metadata describing data contents (e.g., information security labels).

Mobile Code	Software programs or parts of programs obtained from remote information systems, transmitted across a network, and executed on a local information system without explicit installation or execution by the recipient.
Mobile Code Technologies	Software technologies that provide the mechanisms for the production and use of mobile code (e.g., Java, JavaScript, ActiveX, VBScript).
Mobile Device	Portable cartridge/disk-based, removable storage media (e.g., floppy disks, compact disks, USB flash drives, external hard drives, and other flash memory cards/drives that contain non-volatile memory). Portable computing and communications device with information storage capability (e.g., notebook/laptop computers, personal digital assistants, cellular telephones, digital cameras, and audio recording devices).
Moderate-Impact System [FIPS 200]	An information system in which at least one security objective (i.e., confidentiality, integrity, or availability) is assigned a FIPS 199 potential impact value of moderate and no security objective is assigned a FIPS 199 potential impact value of high.
Multifactor Authentication	Authentication using two or more factors to achieve authentication. Factors include: (i) something you know (e.g. password/PIN); (ii) something you have (e.g., cryptographic identification device, token); or (iii) something you are (e.g., biometric). See *Authenticator*.
National Security Emergency Preparedness Telecommunications Services [47 C.F.R., Part 64, App A]	Telecommunications services that are used to maintain a state of readiness or to respond to and manage any event or crisis (local, national, or international) that causes or could cause injury or harm to the population, damage to or loss of property, or degrade or threaten the national security or emergency preparedness posture of the United States.
National Security System [44 U.S.C., Sec. 3542]	Any information system (including any telecommunications system) used or operated by an agency or by a contractor of an agency, or other organization on behalf of an agency—(i) the function, operation, or use of which involves intelligence activities; involves cryptologic activities related to national security; involves command and control of military forces; involves equipment that is an integral part of a weapon or weapons system; or is critical to the direct fulfillment of military or intelligence missions (excluding a system that is to be used for routine administrative and business applications, for example, payroll, finance, logistics, and personnel management applications); or (ii) is protected at all times by procedures established for information that have been specifically authorized under criteria established by an Executive Order or an Act of Congress to be kept classified in the interest of national defense or foreign policy.

Network [CNSSI 4009]	Information system(s) implemented with a collection of interconnected components. Such components may include routers, hubs, cabling, telecommunications controllers, key distribution centers, and technical control devices.
Network Access	Access to an information system by a user (or a process acting on behalf of a user) communicating through a network (e.g., local area network, wide area network, Internet).
Nondiscretionary Access Control	A type of access control that restricts access to objects based on the identity of subjects or groups to which the subjects belong. The access controls are nondiscretionary because subjects with certain privileges are restricted from passing those privileges on to any other subjects, either directly or indirectly—that is, the information system strictly enforces the access control policy based on the rule set established by the policy.
Non-Local Maintenance	Maintenance activities conducted by individuals communicating through a network; either an external network (e.g., the Internet) or an internal network.
Non-Organizational User	A user who is not an organizational user (including public users).
Non-repudiation	Protection against an individual falsely denying having performed a particular action. Provides the capability to determine whether a given individual took a particular action such as creating information, sending a message, approving information, and receiving a message.
NSA-Approved Cryptography	Cryptography that consists of: (i) an approved algorithm; (ii) an implementation that has been approved for the protection of classified information in a particular environment; and (iii) a supporting key management infrastructure.
Object	Passive information system-related entity (e.g., devices, files, records, tables, processes, programs, domains) containing or receiving information. Access to an object (by a subject) implies access to the information it contains. See *Subject*.
Operations Security [CNSSI 4009]	Systematic and proven process by which potential adversaries can be denied information about capabilities and intentions by identifying, controlling, and protecting generally unclassified evidence of the planning and execution of sensitive activities. The process involves five steps: identification of critical information, analysis of threats, analysis of vulnerabilities, assessment of risks, and application of appropriate countermeasures.
Organization [FIPS 200, Adapted]	An entity of any size, complexity, or positioning within an organizational structure (e.g., a federal agency or, as appropriate, any of its operational elements).
Organizational User	An organizational employee or an individual the organization deems to have equivalent status of an employee (e.g., contractor, guest researcher, individual detailed from another organization, individual from allied nation).

Overlay	A specification of security controls, control enhancements, and supplemental guidance derived from the application of tailoring guidance to security control baselines. The overlay specification may be more stringent or less stringent than the original security control baseline specification.
Penetration Testing	A test methodology in which assessors, typically working under specific constraints, attempt to circumvent or defeat the security features of an information system.
Plan of Action and Milestones [OMB Memorandum 02-01]	A document that identifies tasks needing to be accomplished. It details resources required to accomplish the elements of the plan, any milestones in meeting the tasks, and scheduled completion dates for the milestones.
Potential Impact [FIPS 199]	The loss of confidentiality, integrity, or availability could be expected to have: (i) a *limited* adverse effect (FIPS 199 low); (ii) a *serious* adverse effect (FIPS 199 moderate); or (iii) a *severe* or *catastrophic* adverse effect (FIPS 199 high) on organizational operations, organizational assets, or individuals.
Privacy Impact Assessment [OMB Memorandum 03-22]	An analysis of how information is handled: (i) to ensure handling conforms to applicable legal, regulatory, and policy requirements regarding privacy; (ii) to determine the risks and effects of collecting, maintaining, and disseminating information in identifiable form in an electronic information system; and (iii) to examine and evaluate protections and alternative processes for handling information to mitigate potential privacy risks.
Privileged Account	An information system account with authorizations of a privileged user.
Privileged Command	A human-initiated command executed on an information system involving the control, monitoring, or administration of the system including security functions and associated security-relevant information.
Privileged User [CNSSI 4009]	A user that is authorized (and therefore, trusted) to perform security-relevant functions that ordinary users are not authorized to perform.
Protective Distribution System	Wire line or fiber optic system that includes adequate safeguards and/or countermeasures (e.g., acoustic, electric, electromagnetic, and physical) to permit its use for the transmission of unencrypted information.
Reciprocity	Mutual agreement among participating organizations to accept each other's security assessments in order to reuse information system resources and/or to accept each other's assessed security posture in order to share information.

Records	The recordings (automated and/or manual) of evidence of activities performed or results achieved (e.g., forms, reports, test results), which serve as a basis for verifying that the organization and the information system are performing as intended. Also used to refer to units of related data fields (i.e., groups of data fields that can be accessed by a program and that contain the complete set of information on particular items).
Red Team Exercise	An exercise, reflecting real-world conditions, that is conducted as a simulated adversarial attempt to compromise organizational missions and/or business processes to provide a comprehensive assessment of the security capability of the information system and organization.
Remote Access	Access to an organizational information system by a user (or a process acting on behalf of a user) communicating through an external network (e.g., the Internet).
Remote Maintenance	Maintenance activities conducted by individuals communicating through an external network (e.g., the Internet).
Removable Media	Portable electronic storage media such as magnetic, optical, and solid state devices, which can be inserted into and removed from a computing device, and that is used to store text, video, audio, and image information. Examples include hard disks, floppy disks, zip drives, compact disks, thumb drives, pen drives, and similar USB storage devices.
Resilience	See *Information System Resilience.*
Restricted Data [Atomic Energy Act of 1954]	All data concerning (i) design, manufacture, or utilization of atomic weapons; (ii) the production of special nuclear material; or (iii) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the Restricted Data category pursuant to Section 142 [of the Atomic Energy Act of 1954].
Risk [FIPS 200, Adapted]	A measure of the extent to which an entity is threatened by a potential circumstance or event, and typically a function of: (i) the adverse impacts that would arise if the circumstance or event occurs; and (ii) the likelihood of occurrence. Information system-related security risks are those risks that arise from the loss of confidentiality, integrity, or availability of information or information systems and reflect the potential adverse impacts to organizational operations (including mission, functions, image, or reputation), organizational assets, individuals, other organizations, and the Nation.

Risk Assessment	The process of identifying risks to organizational operations (including mission, functions, image, reputation), organizational assets, individuals, other organizations, and the Nation, resulting from the operation of an information system. Part of risk management, incorporates threat and vulnerability analyses, and considers mitigations provided by security controls planned or in place. Synonymous with risk analysis.
Risk Executive (Function) [CNSSI 4009]	An individual or group within an organization that helps to ensure that: (i) security risk-related considerations for individual information systems, to include the authorization decisions for those systems, are viewed from an organization-wide perspective with regard to the overall strategic goals and objectives of the organization in carrying out its missions and business functions; and (ii) managing risk from individual information systems is consistent across the organization, reflects organizational risk tolerance, and is considered along with other organizational risks affecting mission/business success.
Risk Management [CNSSI 4009, adapted]	The program and supporting processes to manage information security risk to organizational operations (including mission, functions, image, reputation), organizational assets, individuals, other organizations, and the Nation, and includes: (i) establishing the context for risk-related activities; (ii) assessing risk; (iii) responding to risk once determined; and (iv) monitoring risk over time.
Risk Mitigation [CNSSI 4009]	Prioritizing, evaluating, and implementing the appropriate risk-reducing controls/countermeasures recommended from the risk management process.
Risk Monitoring	Maintaining ongoing awareness of an organization's risk environment, risk management program, and associated activities to support risk decisions.
Risk Response	Accepting, avoiding, mitigating, sharing, or transferring risk to organizational operations (i.e., mission, functions, image, or reputation), organizational assets, individuals, other organizations, or the Nation.
Role-Based Access Control	Access control based on user roles (i.e., a collection of access authorizations a user receives based on an explicit or implicit assumption of a given role). Role permissions may be inherited through a role hierarchy and typically reflect the permissions needed to perform defined functions within an organization. A given role may apply to a single individual or to several individuals.
Safeguards [CNSSI 4009]	Protective measures prescribed to meet the security requirements (i.e., confidentiality, integrity, and availability) specified for an information system. Safeguards may include security features, management constraints, personnel security, and security of physical structures, areas, and devices. Synonymous with security controls and countermeasures.

Sanitization	A general term referring to the actions taken to render data written on media unrecoverable by both ordinary and, for some forms of sanitization, extraordinary means.
Scoping Considerations	A part of tailoring guidance providing organizations with specific policy/regulatory-related, technology-related, system component allocation-related, operational/environmental-related, physical infrastructure-related, public access-related, scalability-related, common control-related, and security objective-related considerations on the applicability and implementation of individual security controls in the security control baseline.
Security [CNSSI 4009]	A condition that results from the establishment and maintenance of protective measures that enable an enterprise to perform its mission or critical functions despite risks posed by threats to its use of information systems. Protective measures may involve a combination of deterrence, avoidance, prevention, detection, recovery, and correction that should form part of the enterprise's risk management approach.
Security Assurance	See *Assurance*.
Security Attribute	An abstraction representing the basic properties or characteristics of an entity with respect to safeguarding information; typically associated with internal data structures (e.g., records, buffers, files) within the information system and used to enable the implementation of access control and flow control policies, reflect special dissemination, handling or distribution instructions, or support other aspects of the information security policy.
Security Authorization	See *Authorization*.
Security Authorization Boundary	See *Authorization Boundary*.
Security Capability	The set of mutually-reinforcing security controls that provides the requisite level of trustworthiness for organizational information systems.
Security Categorization	The process of determining the security category for information or an information system. Security categorization methodologies are described in CNSS Instruction 1253 for national security systems and in FIPS 199 for other than national security systems. See *Security Category*.
Security Category [FIPS 199, Adapted; CNSSI 4009]	The characterization of information or an information system based on an assessment of the potential impact that a loss of confidentiality, integrity, or availability of such information or information system would have on organizational operations, organizational assets, individuals, other organizations, and the Nation.

Security Control [FIPS 199, Adapted]	The safeguards or countermeasures prescribed for an information system or an organization to protect the confidentiality, integrity, and availability its information.
Security Control Assessment [CNSSI 4009, Adapted]	The testing or evaluation of security controls to determine the extent to which the controls are implemented correctly, operating as intended, and producing the desired outcome with respect to meeting the security requirements for an information system or organization.
Security Control Assessor	The individual, group, or organization responsible for conducting a security control assessment.
Security Control Baseline [FIPS 200]	The set of minimum security controls defined for a low-impact, moderate-impact, or high-impact information system.
Security Control Enhancements	Statements of security capability to: (i) build in additional, but related, functionality to a security control; and/or (ii) increase the strength of the control.
Security Control Inheritance [CNSSI 4009]	A situation in which an information system or application receives protection from security controls (or portions of security controls) that are developed, implemented, assessed, authorized, and monitored by entities other than those responsible for the system or application; entities either internal or external to the organization where the system or application resides. See *Common Control*.
Security Domain [CNSSI 4009]	A domain that implements a security policy and is administered by a single authority.
Security Functionality	The security-related features, functions, mechanisms, services, procedures, and architectures implemented within organizational information systems or the environments in which those systems operate.
Security Functions	The hardware, software, and/or firmware of the information system responsible for enforcing the system security policy and supporting the isolation of code and data on which the protection is based.
Security Impact Analysis [CNSSI 4009]	The analysis conducted by an organizational official to determine the extent to which changes to the information system have affected the security state of the system.
Security Incident	See *Incident*.
Security Label	The means used to associate a set of security attributes with a specific information object as part of the data structure for that object.
Security Marking	Human-readable information affixed to information system components, removable media, or output indicating the distribution limitations, handling caveats and applicable security markings.

Security Objective [FIPS 199]	Confidentiality, integrity, or availability.
Security Plan	Formal document that provides an overview of the security requirements for an information system or an information security program and describes the security controls in place or planned for meeting those requirements. See *System Security Plan* or *Information Security Program Plan*.
Security Policy [CNSSI 4009]	A set of criteria for the provision of security services.
Security Requirements [FIPS 200]	Requirements levied on an information system that are derived from applicable laws, Executive Orders, directives, policies, standards, instructions, regulations, procedures, or organizational mission/business case needs to ensure the confidentiality, integrity, and availability of the information being processed, stored, or transmitted.
Security Service [CNSSI 4009]	A capability that supports one, or more, of the security requirements (Confidentiality, Integrity, Availability). Examples of security services are key management, access control, and authentication.
Security-Relevant Information	Any information within the information system that can potentially impact the operation of security functions or the provision of security services in a manner that could result in failure to enforce the system security policy or maintain isolation of code and data.
Senior (Agency) Information Security Officer [44 U.S.C., Sec. 3544]	Official responsible for carrying out the Chief Information Officer responsibilities under FISMA and serving as the Chief Information Officer's primary liaison to the agency's authorizing officials, information system owners, and information system security officers. Note: Organizations subordinate to federal agencies may use the term *Senior Information Security Officer* or *Chief Information Security Officer* to denote individuals filling positions with similar responsibilities to Senior Agency Information Security Officers.
Senior Information Security Officer	See *Senior Agency Information Security Officer*.
Sensitive Information [CNSSI 4009]	Information, the loss, misuse, or unauthorized access to or modification of, that could adversely affect the national interest or the conduct of federal programs, or the privacy to which individuals are entitled under 5 U.S.C. Section 552a (the Privacy Act), but that has not been specifically authorized under criteria established by an Executive Order or an Act of Congress to be kept classified in the interest of national defense or foreign policy.

Sensitive Compartmented Information [CNSSI 4009]	Classified information concerning or derived from intelligence sources, methods, or analytical processes, which is required to be handled within formal access control systems established by the Director of National Intelligence.
Spam	The abuse of electronic messaging systems to indiscriminately send unsolicited bulk messages.
Special Access Program [CNSSI 4009]	A program established for a specific class of classified information that imposes safeguarding and access requirements that exceed those normally required for information at the same classification level.
Spyware	Software that is secretly or surreptitiously installed into an information system to gather information on individuals or organizations without their knowledge; a type of malicious code.
Subject	Generally an individual, process, or device causing information to flow among objects or change to the system state. See *Object*.
Subsystem	A major subdivision or component of an information system consisting of information, information technology, and personnel that performs one or more specific functions.
Supplementation	The process of adding security controls or control enhancements to a security control baseline as part of the tailoring process (during security control selection) in order to adequately meet the organization's risk management needs.
Supply Chain	A system of organizations, people, activities, information, and resources, possibly international in scope, that provides products or services to consumers.
System	See *Information System*.
System Security Plan [NIST SP 800-18]	Formal document that provides an overview of the security requirements for an information system and describes the security controls in place or planned for meeting those requirements.
System-Specific Security Control	A security control for an information system that has not been designated as a common security control or the portion of a hybrid control that is to be implemented within an information system.
Tailored Security Control Baseline	A set of security controls resulting from the application of tailoring guidance to a security control baseline. See *Tailoring*.
Tailoring	The process by which security control baselines are modified by: (i) identifying and designating common controls; (ii) applying scoping considerations; (iii) selecting compensating controls; (iv) assigning specific values to organization-defined security control parameters; (v) supplementing baselines with additional security controls or control enhancements; and (vi) providing additional specification information for control implementation.

Threat [CNSSI 4009, Adapted]	Any circumstance or event with the potential to adversely impact organizational operations (including mission, functions, image, or reputation), organizational assets, individuals, other organizations, or the Nation through an information system via unauthorized access, destruction, disclosure, modification of information, and/or denial of service.
Threat Assessment [CNSSI 4009]	Formal description and evaluation of threat to an information system.
Threat Source [FIPS 200]	The intent and method targeted at the intentional exploitation of a vulnerability or a situation and method that may accidentally trigger a vulnerability. Synonymous with threat agent.
Trusted Path	A mechanism by which a user (through an input device) can communicate directly with the security functions of the information system with the necessary confidence to support the system security policy. This mechanism can only be activated by the user or the security functions of the information system and cannot be imitated by untrusted software.
Trustworthiness [CNSSI 4009]	The attribute of a person or enterprise that provides confidence to others of the qualifications, capabilities, and reliability of that entity to perform specific tasks and fulfill assigned responsibilities.
Trustworthiness (Information System)	The degree to which an information system (including the information technology components that are used to build the system) can be expected to preserve the confidentiality, integrity, and availability of the information being processed, stored, or transmitted by the system across the full range of threats. A trustworthy information system is a system that is believed to be capable of operating within defined levels of risk despite the environmental disruptions, human errors, structural failures, and purposeful attacks that are expected to occur in its environment of operation.
User [CNSSI 4009, adapted]	Individual, or (system) process acting on behalf of an individual, authorized to access an information system. See *Organizational User* and *Non-Organizational User*.
Vulnerability [CNSSI 4009]	Weakness in an information system, system security procedures, internal controls, or implementation that could be exploited or triggered by a threat source.
Vulnerability Assessment [CNSSI 4009]	Formal description and evaluation of the vulnerabilities in an information system.

APPENDIX C

ACRONYMS

COMMON ABBREVIATIONS

CFR	Code of Federal Regulations
CIO	Chief Information Officer
CISO	Chief Information Security Officer
CNSS	Committee on National Security Systems
CUI	Controlled Unclassified Information
DNS	Domain Name System
DoD	Department of Defense
FIPS	Federal Information Processing Standards
FISMA	Federal Information Security Management Act
HSPD	Homeland Security Presidential Directive
ICS	Industrial Control System
IEEE	Institute of Electrical and Electronics Engineers
IPsec	Internet Protocol Security
ISO/IEC	International Organization for Standardization/International Electrotechnical Commission
NIST	National Institute of Standards and Technology
NISTIR	National Institute of Standards and Technology Interagency Report
NSA	National Security Agency
NSTISSI	National Security Telecommunications and Information System Security Instruction
ODNI	Office of the Director of National Intelligence
OMB	Office of Management and Budget
OPSEC	Operations Security
PIV	Personal Identity Verification
PKI	Public Key Infrastructure
RD	Restricted Data
RDTE	Research, Development, Test, and Evaluation
SAISO	Senior Agency Information Security Officer
SAMI	Sources And Methods Information
SBU	Sensitive But Unclassified
SCI	Sensitive Compartmented Information

TSP	Telecommunications Service Priority
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network

APPENDIX D

SECURITY CONTROL BASELINES – SUMMARY

LOW-IMPACT, MODERATE-IMPACT, AND HIGH-IMPACT INFORMATION SYSTEMS

This appendix contains the security control baselines that represent the starting point in determining the security controls for low-impact, moderate-impact, and high-impact information systems.[81] The three security control baselines are hierarchical in nature with regard to the security controls employed in those baselines.[82] If a security control is selected for one of the baselines, the family identifier and control number are listed in the appropriate column. If a security control is not used in a particular baseline, the entry is marked *not selected*. Security control enhancements, when used to supplement security controls, are indicated by the number of the enhancement. For example, an IR-2 (1) in the high baseline entry for the IR-2 security control indicates that the second control from the Incident Response family has been selected along with control enhancement (1). Some security controls and enhancements in the security control catalog are not used in any of the baselines in this appendix but are available for use by organizations if needed. This situation occurs, for example, when the results of a risk assessment indicate the need for additional security controls or control enhancements in order to adequately mitigate risk to organizational operations and assets, individuals, other organizations, and the Nation.

Organizations can use the recommended *priority code* designation associated with each security control in the baselines to assist in making sequencing decisions for control implementation (i.e., a Priority Code 1 [P1] control has a higher priority for implementation than a Priority Code 2 [P2] control; a Priority Code 2 [P2] control has a higher priority for implementation than a Priority Code 3 [P3] control). This recommended sequencing prioritization helps ensure that security controls upon which other controls depend are implemented first, thus enabling organizations to deploy controls in a more structured and timely manner in accordance with available resources. The implementation of security controls by sequence priority code does not imply any defined level of risk mitigation until *all* controls in the security plan have been implemented. The priority codes are used only for implementation sequencing, not for making security control selection decisions. Table D-1 summarizes sequence priority codes for the baseline security controls in Table D-2.

TABLE D-1: SECURITY CONTROL PRIORITIZATION CODES

Priority Code	Sequencing	Action
Priority Code 1 (P1)	FIRST	Implement P1 security controls first.
Priority Code 2 (P2)	NEXT	Implement P2 security controls after implementation of P1 controls.
Priority Code 3 (P3)	LAST	Implement P3 security controls after implementation of P1 and P2 controls.
Unspecified Priority Code (P0)	NONE	Security control not selected for baseline.

[81] A complete description of all security controls is provided in Appendices F and G. In addition, separate documents for individual security control baselines (listed as Annexes 1, 2, and 3) are available at http://csrc.nist.gov/publications.

[82] The hierarchical nature applies to the security requirements of each control (i.e., the base control plus all of its enhancements) at the low-impact, moderate-impact, and high-impact level in that the control requirements at a particular impact level (e.g., CP-4 *Contingency Plan Testing*—Moderate: CP-4 (1)) meets a stronger set of security requirements for that control than the next lower impact level of the same control (e.g., CP-4 *Contingency Plan Testing*—Low: CP-4).

In addition to Table D-2, the sequence priority codes and security control baselines are annotated in a priority and baseline allocation summary section below each security control in Appendix F.

TABLE D-2: SECURITY CONTROL BASELINES

CNTL NO.	CONTROL NAME	PRIORITY	CONTROL BASELINES		
			LOW	MOD	HIGH
Access Control					
AC-1	Access Control Policy and Procedures	P1	AC-1	AC-1	AC-1
AC-2	Account Management	P1	AC-2	AC-2 (1) (2) (3) (4)	AC-2 (1) (2) (3) (4) (5) (12) (13)
AC-3	Access Enforcement	P1	AC-3	AC-3	AC-3
AC-4	Information Flow Enforcement	P1	Not Selected	AC-4	AC-4
AC-5	Separation of Duties	P1	Not Selected	AC-5	AC-5
AC-6	Least Privilege	P1	Not Selected	AC-6 (1) (2) (5)	AC-6 (1) (2) (3) (5)
AC-7	Unsuccessful Login Attempts	P2	AC-7	AC-7	AC-7
AC-8	System Use Notification	P1	AC-8	AC-8	AC-8
AC-9	Previous Logon (Access) Notification	P0	Not Selected	Not Selected	Not Selected
AC-10	Concurrent Session Control	P2	Not Selected	Not Selected	AC-10
AC-11	Session Lock	P3	Not Selected	AC-11	AC-11
AC-12	**Withdrawn**	---	---	---	---
AC-13	**Withdrawn**	---	---	---	---
AC-14	Permitted Actions without Identification or Authentication	P1	AC-14	AC-14	AC-14
AC-15	**Withdrawn**	---	---	---	---
AC-16	Security Attributes	P0	Not Selected	Not Selected	Not Selected
AC-17	Remote Access	P1	AC-17	AC-17 (1) (2) (3) (4)	AC-17 (1) (2) (3) (4)
AC-18	Wireless Access	P1	AC-18	AC-18 (1)	AC-18 (1) (4) (5)
AC-19	Access Control for Mobile Devices	P1	AC-19	AC-19 (6)	AC-19 (6)
AC-20	Use of External Information Systems	P1	AC-20	AC-20 (1) (2)	AC-20 (1) (2)
AC-21	Collaboration and Information Sharing	P0	Not Selected	AC-21	AC-21
AC-22	Publicly Accessible Content	P2	AC-22	AC-22	AC-22
AC-23	Data Mining Protection	P0	Not Selected	Not Selected	Not Selected
AC-24	Access Control Decisions	P0	Not Selected	Not Selected	Not Selected
AC-25	Reference Monitor Function	P0	Not Selected	Not Selected	Not Selected
Awareness and Training					
AT-1	Security Awareness and Training Policy and Procedures	P1	AT-1	AT-1	AT-1
AT-2	Security Awareness	P1	AT-2	AT-2 (2)	AT-2 (2)
AT-3	Security Training	P1	AT-3	AT-3	AT-3
AT-4	Security Training Records	P3	AT-4	AT-4	AT-4
AT-5	Contacts with Security Groups and Associations	P3	Not Selected	AT-5	AT-5
Audit and Accountability					
AU-1	Audit and Accountability Policy and Procedures	P1	AU-1	AU-1	AU-1

CNTL NO.	CONTROL NAME	PRIORITY	CONTROL BASELINES		
			LOW	MOD	HIGH
AU-2	Auditable Events	P1	AU-2	AU-2 (3) (4)	AU-2 (3) (4)
AU-3	Content of Audit Records	P1	AU-3	AU-3 (1)	AU-3 (1) (2)
AU-4	Audit Storage Capacity	P1	AU-4	AU-4	AU-4
AU-5	Response to Audit Processing Failures	P1	AU-5	AU-5	AU-5 (1) (2)
AU-6	Audit Review, Analysis, and Reporting	P1	AU-6	AU-6 (1) (3) (9)	AU-6 (1) (3) (5) (6) (9)
AU-7	Audit Reduction and Report Generation	P2	Not Selected	AU-7 (1)	AU-7 (1)
AU-8	Time Stamps	P1	AU-8	AU-8 (1)	AU-8 (1)
AU-9	Protection of Audit Information	P1	AU-9	AU-9 (4)	AU-9 (2) (3) (4)
AU-10	Non-repudiation	P1	Not Selected	Not Selected	AU-10
AU-11	Audit Record Retention	P3	AU-11	AU-11	AU-11
AU-12	Audit Generation	P1	AU-12	AU-12	AU-12 (1) (3)
AU-13	Monitoring for Information Disclosure	P0	Not Selected	Not Selected	Not Selected
AU-14	Session Audit	P0	Not Selected	Not Selected	Not Selected
AU-15	Alternate Audit Capability	P0	Not Selected	Not Selected	Not Selected
AU-16	Cross-Organizational Auditing	P0	Not Selected	Not Selected	Not Selected
Security Assessment and Authorization					
CA-1	Security Assessment and Authorization Policies and Procedures	P1	CA-1	CA-1	CA-1
CA-2	Security Assessments	P2	CA-2	CA-2 (1)	CA-2 (1) (2)
CA-3	Information System Connections	P1	CA-3	CA-3	CA-3
CA-4	**Withdrawn**	---	---	---	---
CA-5	Plan of Action and Milestones	P3	CA-5	CA-5	CA-5
CA-6	Security Authorization	P3	CA-6	CA-6	CA-6
CA-7	Continuous Monitoring	P3	CA-7	CA-7 (1)	CA-7 (1)
Configuration Management					
CM-1	Configuration Management Policy and Procedures	P1	CM-1	CM-1	CM-1
CM-2	Baseline Configuration	P1	CM-2	CM-2 (1) (3)	CM-2 (1) (2) (3) (6)
CM-3	Configuration Change Control	P1	Not Selected	CM-3 (2)	CM-3 (1) (2)
CM-4	Security Impact Analysis	P2	Not Selected	CM-4	CM-4 (1)
CM-5	Access Restrictions for Change	P1	Not Selected	CM-5	CM-5 (1) (2) (3)
CM-6	Configuration Settings	P1	CM-6	CM-6	CM-6 (1) (2)
CM-7	Least Functionality	P1	CM-7	CM-7 (1) (4)	CM-7 (1) (2) (5)
CM-8	Information System Component Inventory	P1	CM-8	CM-8 (1) (5)	CM-8 (1) (2) (3) (4) (5)
CM-9	Configuration Management Plan	P1	Not Selected	CM-9	CM-9
CM-10	Software Usage Restrictions	P1	CM-10	CM-10	CM-10
CM-11	User-Installed Software	P1	CM-11	CM-11	CM-11
Contingency Planning					
CP-1	Contingency Planning Policy and Procedures	P1	CP-1	CP-1	CP-1
CP-2	Contingency Plan	P1	CP-2	CP-2 (1) (3) (8)	CP-2 (1) (2) (3) (4) (5) (8)

CNTL NO.	CONTROL NAME	PRIORITY	CONTROL BASELINES		
			LOW	MOD	HIGH
CP-3	Contingency Training	P2	CP-3	CP-3	CP-3 (1)
CP-4	Contingency Plan Testing	P2	CP-4	CP-4 (1)	CP-4 (1) (2) (4)
CP-5	**Withdrawn**	---	---	---	---
CP-6	Alternate Storage Site	P1	Not Selected	CP-6 (1) (3)	CP-6 (1) (2) (3)
CP-7	Alternate Processing Site	P1	Not Selected	CP-7 (1) (2) (3)	CP-7 (1) (2) (3) (4)
CP-8	Telecommunications Services	P1	Not Selected	CP-8 (1) (2)	CP-8 (1) (2) (3) (4)
CP-9	Information System Backup	P1	CP-9	CP-9 (1)	CP-9 (1) (2) (3) (5)
CP-10	Information System Recovery and Reconstitution	P1	CP-10	CP-10 (2) (3)	CP-10 (2) (3) (4) (5)
CP-11	Predictable Failure Prevention	P1	Not Selected	Not Selected	CP-11
CP-12	Alternate Communications Protocols	P0	Not Selected	Not Selected	Not Selected
CP-13	Safe Mode	P0	Not Selected	Not Selected	Not Selected
Identification and Authentication					
IA-1	Identification and Authentication Policy and Procedures	P1	IA-1	IA-1	IA-1
IA-2	Identification and Authentication (Organizational Users)	P1	IA-2 (1)	IA-2 (1) (2) (3) (8)	IA-2 (1) (2) (3) (4) (8) (9)
IA-3	Device-to-Device Identification and Authentication	P1	Not Selected	IA-3	IA-3
IA-4	Identifier Management	P1	IA-4	IA-4	IA-4
IA-5	Authenticator Management	P1	IA-5 (1)	IA-5 (1) (2) (3)	IA-5 (1) (2) (3)
IA-6	Authenticator Feedback	P1	IA-6	IA-6	IA-6
IA-7	Cryptographic Module Authentication	P1	IA-7	IA-7	IA-7
IA-8	Identification and Authentication (Non-Organizational Users)	P1	IA-8	IA-8	IA-8
IA-9	Service Identification and Authentication	P0	Not Selected	Not Selected	Not Selected
IA-10	Alternative Authentication	P0	Not Selected	Not Selected	Not Selected
IA-11	Adaptive Identification and Authentication	P0	Not Selected	Not Selected	Not Selected
IA-12	Reauthentication	P0	Not Selected	Not Selected	Not Selected
Incident Response					
IR-1	Incident Response Policy and Procedures	P1	IR-1	IR-1	IR-1
IR-2	Incident Response Training	P2	IR-2	IR-2	IR-2 (1) (2)
IR-3	Incident Response Testing	P2	Not Selected	IR-3 (2)	IR-3 (1) (2)
IR-4	Incident Handling	P1	IR-4	IR-4 (1)	IR-4 (1) (4)
IR-5	Incident Monitoring	P1	IR-5	IR-5	IR-5 (1)
IR-6	Incident Reporting	P1	IR-6	IR-6 (1)	IR-6 (1)
IR-7	Incident Response Assistance	P3	IR-7	IR-7 (1)	IR-7 (1)
IR-8	Incident Response Plan	P1	IR-8	IR-8	IR-8
IR-9	Information Spillage Response	P0	Not Selected	Not Selected	Not Selected
Maintenance					
MA-1	System Maintenance Policy and Procedures	P1	MA-1	MA-1	MA-1
MA-2	Controlled Maintenance	P2	MA-2	MA-2	MA-2 (2)
MA-3	Maintenance Tools	P2	Not Selected	MA-3 (1) (2)	MA-3 (1) (2) (3)

CNTL NO.	CONTROL NAME	PRIORITY	CONTROL BASELINES		
			LOW	MOD	HIGH
MA-4	Non-Local Maintenance	P1	MA-4	MA-4 (1) (2)	MA-4 (1) (2) (3)
MA-5	Maintenance Personnel	P1	MA-5	MA-5	MA-5 (1)
MA-6	Timely Maintenance	P1	Not Selected	MA-6	MA-6
Media Protection					
MP-1	Media Protection Policy and Procedures	P1	MP-1	MP-1	MP-1
MP-2	Media Access	P1	MP-2	MP-2 (1)	MP-2 (1)
MP-3	Media Marking	P1	Not Selected	MP-3	MP-3
MP-4	Media Storage	P1	Not Selected	MP-4	MP-4
MP-5	Media Transport	P1	Not Selected	MP-5 (4)	MP-5 (3) (4)
MP-6	Media Sanitization	P1	MP-6	MP-6	MP-6 (1) (2) (3)
MP-7	Media Use	P1	MP-7	MP-7 (1) (2)	MP-7 (1) (2)
MP-8	Media Downgrading	P0	Not Selected	Not Selected	Not Selected
Physical and Environmental Protection					
PE-1	Physical and Environmental Protection Policy and Procedures	P1	PE-1	PE-1	PE-1
PE-2	Physical Access Authorizations	P1	PE-2	PE-2	PE-2
PE-3	Physical Access Control	P1	PE-3	PE-3	PE-3 (1)
PE-4	Access Control for Transmission Medium	P1	Not Selected	PE-4	PE-4
PE-5	Access Control for Output Devices	P1	Not Selected	PE-5	PE-5
PE-6	Monitoring Physical Access	P1	PE-6	PE-6 (1)	PE-6 (1) (2)
PE-7	**Withdrawn**	---	---	---	---
PE-8	Visitor Access Records	P3	PE-8	PE-8	PE-8 (1)
PE-9	Power Equipment and Cabling	P1	Not Selected	PE-9	PE-9
PE-10	Emergency Shutoff	P1	Not Selected	PE-10	PE-10
PE-11	Emergency Power	P1	Not Selected	PE-11	PE-11 (1)
PE-12	Emergency Lighting	P1	PE-12	PE-12	PE-12
PE-13	Fire Protection	P1	PE-13	PE-13 (1) (2) (3)	PE-13 (1) (2) (3)
PE-14	Temperature and Humidity Controls	P1	PE-14	PE-14	PE-14
PE-15	Water Damage Protection	P1	PE-15	PE-15	PE-15 (1)
PE-16	Delivery and Removal	P1	PE-16	PE-16	PE-16
PE-17	Alternate Work Site	P1	Not Selected	PE-17	PE-17
PE-18	Location of Information System Components	P2	Not Selected	PE-18 (1)	PE-18 (1)
PE-19	Information Leakage	P0	Not Selected	Not Selected	Not Selected
PE-20	Port and I/O Device Access	P0	Not Selected	Not Selected	Not Selected
Planning					
PL-1	Security Planning Policy and Procedures	P1	PL-1	PL-1	PL-1
PL-2	System Security Plan	P1	PL-2	PL-2 (3)	PL-2 (3)
PL-3	**Withdrawn**	---	---	---	---
PL-4	Rules of Behavior	P1	PL-4	PL-4 (1)	PL-4 (1)
PL-5	**Withdrawn**	---	---	---	---
PL-6	**Withdrawn**	---	---	---	---
PL-7	Security Concept of Operations	P0	Not Selected	Not Selected	Not Selected
PL-8	Security Architecture	P0	Not Selected	Not Selected	Not Selected

CNTL NO.	CONTROL NAME	PRIORITY	CONTROL BASELINES		
			LOW	MOD	HIGH
Personnel Security					
PS-1	Personnel Security Policy and Procedures	P1	PS-1	PS-1	PS-1
PS-2	Position Categorization	P1	PS-2	PS-2	PS-2
PS-3	Personnel Screening	P1	PS-3	PS-3	PS-3
PS-4	Personnel Termination	P2	PS-4	PS-4	PS-4 (1) (2)
PS-5	Personnel Transfer	P2	PS-5	PS-5	PS-5
PS-6	Access Agreements	P3	PS-6	PS-6	PS-6
PS-7	Third-Party Personnel Security	P1	PS-7	PS-7 (1)	PS-7 (1)
PS-8	Personnel Sanctions	P3	PS-8	PS-8 (1)	PS-8 (1)
Risk Assessment					
RA-1	Risk Assessment Policy and Procedures	P1	RA-1	RA-1	RA-1
RA-2	Security Categorization	P1	RA-2	RA-2	RA-2
RA-3	Risk Assessment	P1	RA-3	RA-3	RA-3
RA-4	**Withdrawn**	---	---	---	---
RA-5	Vulnerability Scanning	P1	RA-5	RA-5 (1)	RA-5 (1) (2) (3) (4) (5) (7)
System and Services Acquisition					
SA-1	System and Services Acquisition Policy and Procedures	P1	SA-1	SA-1	SA-1
SA-2	Allocation of Resources	P1	SA-2	SA-2	SA-2
SA-3	System Development Life Cycle	P1	SA-3	SA-3	SA-3
SA-4	Acquisition Process	P1	SA-4	SA-4 (1) (4)	SA-4 (1) (2) (4)
SA-5	Information System Documentation	P2	SA-5	SA-5 (1) (3) (6)	SA-5 (1) (2) (3) (6)
SA-6	**Withdrawn**	---	---	---	---
SA-7	**Withdrawn**	---	---	---	---
SA-8	Security Engineering Principles	P1	Not Selected	SA-8	SA-8
SA-9	External Information System Services	P1	SA-9	SA-9 (2)	SA-9 (2) (3)
SA-10	Developer Configuration Management	P1	Not Selected	SA-10	SA-10
SA-11	Developer Security Testing	P2	Not Selected	SA-11	SA-11
SA-12	Supply Chain Protection	P1	Not Selected	Not Selected	SA-12
SA-13	**Withdrawn**	---	---	---	---
SA-14	Critical Information System Components	P0	Not Selected	Not Selected	Not Selected
SA-15	Development Process, Standards, and Tools	P2	Not Selected	Not Selected	SA-15
SA-16	Developer-Provided Training	P2	Not Selected	Not Selected	SA-16
SA-17	Developer Security Architecture and Design	P1	Not Selected	Not Selected	SA-17
SA-18	Tamper Resistance and Detection	P0	Not Selected	Not Selected	Not Selected
SA-19	Anti-Counterfeit	P0	Not Selected	Not Selected	Not Selected
System and Communications Protection					
SC-1	System and Communications Protection Policy and Procedures	P1	SC-1	SC-1	SC-1
SC-2	Application Partitioning	P1	Not Selected	SC-2	SC-2
SC-3	Security Function Isolation	P1	Not Selected	Not Selected	SC-3 (6)
SC-4	Information in Shared Resources	P1	Not Selected	SC-4	SC-4

CNTL NO.	CONTROL NAME	PRIORITY	CONTROL BASELINES		
			LOW	MOD	HIGH
SC-5	Denial of Service Protection	P1	SC-5	SC-5	SC-5
SC-6	Resource Availability	P0	Not Selected	Not Selected	Not Selected
SC-7	Boundary Protection	P1	SC-7	SC-7 (1) (3) (4) (5) (7)	SC-7 (1) (3) (4) (5) (6) (7) (8)
SC-8	Transmission Integrity	P1	Not Selected	SC-8 (1)	SC-8 (1)
SC-9	Transmission Confidentiality	P1	Not Selected	SC-9 (1)	SC-9 (1)
SC-10	Network Disconnect	P2	Not Selected	SC-10	SC-10
SC-11	Trusted Path	P0	Not Selected	Not Selected	Not Selected
SC-12	Cryptographic Key Establishment and Management	P1	SC-12	SC-12	SC-12 (1)
SC-13	Cryptographic Protection	P1	SC-13	SC-13	SC-13
SC-14	Public Access Protections	P1	SC-14	SC-14	SC-14
SC-15	Collaborative Computing Devices	P1	SC-15	SC-15	SC-15
SC-16	Transmission of Security Attributes	P0	Not Selected	Not Selected	Not Selected
SC-17	Public Key Infrastructure Certificates	P1	Not Selected	SC-17	SC-17
SC-18	Mobile Code	P1	Not Selected	SC-18	SC-18
SC-19	Voice Over Internet Protocol	P1	Not Selected	SC-19	SC-19
SC-20	Secure Name /Address Resolution Service (Authoritative Source)	P1	SC-20	SC-20	SC-20
SC-21	Secure Name /Address Resolution Service (Recursive or Caching Resolver)	P1	SC-21	SC-21	SC-21
SC-22	Architecture and Provisioning for Name/Address Resolution Service	P1	SC-22	SC-22	SC-22
SC-23	Session Authenticity	P1	Not Selected	SC-23	SC-23
SC-24	Fail in Known State	P1	Not Selected	Not Selected	SC-24
SC-25	Thin Nodes	P0	Not Selected	Not Selected	Not Selected
SC-26	Honeypots	P0	Not Selected	Not Selected	Not Selected
SC-27	Operating System-Independent Applications	P0	Not Selected	Not Selected	Not Selected
SC-28	Protection of Information at Rest	P1	Not Selected	SC-28	SC-28
SC-29	Heterogeneity	P0	Not Selected	Not Selected	Not Selected
SC-30	Concealment and Misdirection	P0	Not Selected	Not Selected	Not Selected
SC-31	Covert Channel Analysis	P0	Not Selected	Not Selected	Not Selected
SC-32	Information System Partitioning	P1	Not Selected	SC-32	SC-32
SC-33	**Withdrawn**	---	---	---	---
SC-34	Non-Modifiable Executable Programs	P0	Not Selected	Not Selected	Not Selected
SC-35	Technical Surveillance Countermeasures Survey	P0	Not Selected	Not Selected	Not Selected
SC-36	Honeyclients	P0	Not Selected	Not Selected	Not Selected
SC-37	Distributed Processing and Storage	P0	Not Selected	Not Selected	Not Selected
SC-38	Malware Analysis	P0	Not Selected	Not Selected	Not Selected
SC-39	Out-of-Band Channels	P0	Not Selected	Not Selected	Not Selected
SC-40	Operations Security	P0	Not Selected	Not Selected	Not Selected
SC-41	Process Isolation	P1	SC-41	SC-41	SC-41
SC-42	Wireless Link Protection	P0	Not Selected	Not Selected	Not Selected

CNTL NO.	CONTROL NAME	PRIORITY	CONTROL BASELINES		
			LOW	MOD	HIGH
System and Information Integrity					
SI-1	System and Information Integrity Policy and Procedures	P1	SI-1	SI-1	SI-1
SI-2	Flaw Remediation	P1	SI-2	SI-2 (2)	SI-2 (1) (2)
SI-3	Malicious Code Protection	P1	SI-3	SI-3 (1) (2) (3)	SI-3 (1) (2) (3)
SI-4	Information System Monitoring	P1	SI-4	SI-4 (2) (4) (5) (6)	SI-4 (2) (4) (5) (6)
SI-5	Security Alerts, Advisories, and Directives	P1	SI-5	SI-5	SI-5 (1)
SI-6	Security Function Verification	P1	Not Selected	Not Selected	SI-6
SI-7	Software, Firmware, and Information Integrity	P1	Not Selected	SI-7 (1) (8)	SI-7 (1) (2) (5) (8) (15)
SI-8	Spam Protection	P1	Not Selected	SI-8 (1) (2)	SI-8 (1) (2)
SI-9	Information Input Restrictions	P2	Not Selected	SI-9	SI-9
SI-10	Information Input Validation	P1	Not Selected	SI-10	SI-10
SI-11	Error Handling	P2	Not Selected	SI-11	SI-11
SI-12	Information Output Handling and Retention	P2	SI-12	SI-12	SI-12
SI-13	**Withdrawn**	---	---	---	---
SI-14	Non-Persistence	P0	Not Selected	Not Selected	Not Selected
Program Management					
PM-1	Information Security Program Plan	P1	**Deployed organization-wide. Supporting all baselines.**		
PM-2	Senior Information Security Officer	P1			
PM-3	Information Security Resources	P1			
PM-4	Plan of Action and Milestones Process	P1			
PM-5	Information System Inventory	P1			
PM-6	Information Security Measures of Performance	P1			
PM-7	Enterprise Architecture	P1			
PM-8	Critical Infrastructure Plan	P1			
PM-9	Risk Management Strategy	P1			
PM-10	Security Authorization Process	P1			
PM-11	Mission/Business Process Definition	P1			
PM-12	Insider Threat Program	P1			
PM-13	Information Security Workforce	P1			
PM-14	Operations Security Program	P1			
PM-15	Testing, Training, and Monitoring	P1			

The following tables (D-3 through D-19) provide a summary of all security controls and control enhancements in Appendix F by family and name. The tables also illustrate: (i) the allocation of security controls and control enhancements to security control baselines: (ii) security controls and control enhancements that have been withdrawn; and (iii) security controls and enhancements that have assurance-related characteristics or properties (i.e., assurance-related controls).

TABLE D-3: SUMMARY — ACCESS CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
AC-1	**Access Control Policy and Procedures**		**A**	x	x	x
AC-2	**Account Management**			x	x	x
AC-2 (1)	*ACCOUNT MANAGEMENT | AUTOMATED SYSTEM ACCOUNT MANAGEMENT*				x	x
AC-2 (2)	*ACCOUNT MANAGEMENT | REMOVAL OF TEMPORARY / EMERGENCY ACCOUNTS*				x	x
AC-2 (3)	*ACCOUNT MANAGEMENT | DISABLE INACTIVE ACCOUNTS*				x	x
AC-2 (4)	*ACCOUNT MANAGEMENT | AUTOMATED AUDIT ACTIONS*				x	x
AC-2 (5)	*ACCOUNT MANAGEMENT | INACTIVITY LOGOUT / TYPICAL USAGE MONITORING*					x
AC-2 (6)	*ACCOUNT MANAGEMENT | DYNAMIC PRIVILEGE MANAGEMENT*					
AC-2 (7)	*ACCOUNT MANAGEMENT | ROLE-BASED SCHEMES*					
AC-2 (8)	*ACCOUNT MANAGEMENT | DYNAMIC ACCOUNT CREATION*					
AC-2 (9)	*ACCOUNT MANAGEMENT | RESTRICTIONS ON USE OF SHARED GROUPS / ACCOUNTS*					
AC-2 (10)	*ACCOUNT MANAGEMENT | SHARED / GROUP ACCOUNT REQUESTS / APPROVALS*					
AC-2 (11)	*ACCOUNT MANAGEMENT | SHARED / GROUP ACCOUNT CREDENTIAL RENEWALS*					
AC-2 (12)	*ACCOUNT MANAGEMENT | USAGE CONDITIONS*					x
AC-2 (13)	*ACCOUNT MANAGEMENT | ACCOUNT REVIEWS*					x
AC-2 (14)	*ACCOUNT MANAGEMENT | ACCOUNT MONITORING / ATYPICAL USAGE*					
AC-2 (15)	*ACCOUNT MANAGEMENT | DISABLE ACCOUNTS FOR HIGH-RISK INDIVIDUALS*					
AC-3	**Access Enforcement**			x	x	x
AC-3 (1)	*ACCESS ENFORCEMENT | RESTRICTED ACCESS TO PRIVILEGED FUNCTIONS*	**W**	Incorporated into AC-6.			
AC-3 (2)	*ACCESS ENFORCEMENT | DUAL AUTHORIZATION*					
AC-3 (3)	*ACCESS ENFORCEMENT | NONDISCRETIONARY ACCESS CONTROL*					
AC-3 (4)	*ACCESS ENFORCEMENT | DISCRETIONARY ACCESS CONTROL*					
AC-3 (5)	*ACCESS ENFORCEMENT | SECURITY-RELEVANT INFORMATION*					
AC-3 (6)	*ACCESS ENFORCEMENT | PROTECTION OF USER AND SYSTEM INFORMATION*	**W**	Incorporated into MP-4 and SC-28.			
AC-3 (7)	*ACCESS ENFORCEMENT | MANDATORY ACCESS CONTROL*					
AC-3 (8)	*ACCESS ENFORCEMENT | ROLE-BASED ACCESS CONTROL*					
AC-3 (9)	*ACCESS ENFORCEMENT | REVOCATION OF ACCESS AUTHORIZATIONS*					
AC-3 (10)	*ACCESS ENFORCEMENT | NETWORK ACCESS SECURITY-RELATED FUNCTIONS*					
AC-4	**Information Flow Enforcement**				x	x
AC-4 (1)	*INFORMATION FLOW ENFORCEMENT | OBJECT SECURITY ATTRIBUTES*					
AC-4 (2)	*INFORMATION FLOW ENFORCEMENT | PROCESSING DOMAINS*					

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
AC-4 (3)	*INFORMATION FLOW ENFORCEMENT | CONDITION / OPERATIONAL CHANGES*					
AC-4 (4)	*INFORMATION FLOW ENFORCEMENT | CONTENT CHECK ENCRYPTED DATA*					
AC-4 (5)	*INFORMATION FLOW ENFORCEMENT | EMBEDDED DATA TYPES*					
AC-4 (6)	*INFORMATION FLOW ENFORCEMENT | METADATA*					
AC-4 (7)	*INFORMATION FLOW ENFORCEMENT | ONE-WAY FLOW MECHANISMS*					
AC-4 (8)	*INFORMATION FLOW ENFORCEMENT | SECURITY POLICY FILTERS*					
AC-4 (9)	*INFORMATION FLOW ENFORCEMENT | HUMAN REVIEWS*					
AC-4 (10)	*INFORMATION FLOW ENFORCEMENT | ENABLE / DISABLE SECURITY POLICY FILTERS*					
AC-4 (11)	*INFORMATION FLOW ENFORCEMENT | CONFIGURATION OF SECURITY POLICY FILTERS*					
AC-4 (12)	*INFORMATION FLOW ENFORCEMENT | DATA TYPES IDENTIFIERS*					
AC-4 (13)	*INFORMATION FLOW ENFORCEMENT | DECOMPOSITION INTO POLICY-RELEVANT SUBCOMPONENTS*					
AC-4 (14)	*INFORMATION FLOW ENFORCEMENT | POLICY FILTER CONSTRAINTS ON DATA STRUCTURES AND CONTENT*					
AC-4 (15)	*INFORMATION FLOW ENFORCEMENT | DETECTION OF UNSANCTIONED INFORMATION*					
AC-4 (16)	*INFORMATION FLOW ENFORCEMENT | INFORMATION TRANSFERS ON INTERCONNECTED SYSTEMS*					
AC-4 (17)	*INFORMATION FLOW ENFORCEMENT | DOMAIN AUTHENTICATION*					
AC-4 (18)	*INFORMATION FLOW ENFORCEMENT | SECURITY ATTRIBUTE BINDING*					
AC-4 (19)	*INFORMATION FLOW ENFORCEMENT | PROTECTION OF METADATA*					
AC-4 (20)	*INFORMATION FLOW ENFORCEMENT | CLASSIFIED INFORMATION*					
AC-4 (21)	*INFORMATION FLOW ENFORCEMENT | PHYSICAL / LOGICAL SEPARATION OF INFORMATION FLOWS*					
AC-5	**Separation of Duties**				X	X
AC-6	**Least Privilege**				X	X
AC-6 (1)	*LEAST PRIVILEGE | AUTHORIZE ACCESS TO SECURITY FUNCTIONS*				X	X
AC-6 (2)	*LEAST PRIVILEGE | NON-PRIVILEGED ACCESS FOR NONSECURITY FUNCTIONS*				X	X
AC-6 (3)	*LEAST PRIVILEGE | NETWORK ACCESS TO PRIVILEGED COMMANDS*					X
AC-6 (4)	*LEAST PRIVILEGE | SEPARATE PROCESSING DOMAINS*					
AC-6 (5)	*LEAST PRIVILEGE | PRIVILEGED ACCOUNTS*				X	X
AC-6 (6)	*LEAST PRIVILEGE | PRIVILEGED ACCESS BY NON-ORGANIZATIONAL USERS*					
AC-6 (7)	*LEAST PRIVILEGE | REVIEW OF USER PRIVILEGES*					
AC-6 (8)	*LEAST PRIVILEGE | PRIVILEGE LEVELS FOR CODE EXECUTION*					
AC-7	**Unsuccessful Login Attempts**			X	X	X
AC-7 (1)	*UNSUCCESSFUL LOGIN ATTEMPTS | AUTOMATIC ACCOUNT LOCK*	**W**	Incorporated into AC-7.			
AC-7 (2)	*UNSUCCESSFUL LOGIN ATTEMPTS | PURGE MOBILE DEVICE*					
AC-8	**System Use Notification**			X	X	X
AC-9	**Previous Logon (Access) Notification**					
AC-9 (1)	*PREVIOUS LOGON NOTIFICATION | UNSUCCESSFUL LOGONS*					
AC-9 (2)	*PREVIOUS LOGON NOTIFICATION | SUCCESSFUL / UNSUCCESSFUL LOGONS*					

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
AC-9 (3)	*PREVIOUS LOGON NOTIFICATION | NOTIFICATION OF ACCOUNT CHANGES*					
AC-9 (4)	*PREVIOUS LOGON NOTIFICATION | ADDITIONAL LOGON INFORMATION*					
AC-10	**Concurrent Session Control**					x
AC-11	**Session Lock**				x	x
AC-11 (1)	*SESSION LOCK | PATTERN-HIDING DISPLAYS*	**W**	Incorporated into AC-11.			
AC-12	**Session Termination**	**W**	Incorporated into SC-10.			
AC-13	**Supervision and Review — Access Control**	**W**	Incorporated into AC-2 and AU-6.			
AC-14	**Permitted Actions without Identification or Authentication**			x	x	x
AC-14 (1)	*PERMITTED ACTIONS WITHOUT IDENTIFICATION OR AUTHENTICATION | NECESSARY USES*	**W**	Incorporated into AC-14.			
AC-15	**Automated Marking**	**W**	Incorporated into MP-3.			
AC-16	**Security Attributes**					
AC-16 (1)	*SECURITY ATTRIBUTES | DYNAMIC ATTRIBUTE ASSOCIATION*					
AC-16 (2)	*SECURITY ATTRIBUTES | ATTRIBUTE VALUE CHANGES BY AUTHORIZED INDIVIDUALS*					
AC-16 (3)	*SECURITY ATTRIBUTES | MAINTENANCE OF ATTRIBUTE ASSOCIATIONS BY INFORMATION SYSTEM*					
AC-16 (4)	*SECURITY ATTRIBUTES | ASSOCIATION OF ATTRIBUTES BY AUTHORIZED INDIVIDUALS*					
AC-16 (5)	*SECURITY ATTRIBUTES | ATTRIBUTE DISPLAYS FOR OUTPUT DEVICES*					
AC-16 (6)	*SECURITY ATTRIBUTES | MAINTENANCE OF ATTRIBUTE ASSOCIATION BY ORGANIZATION*					
AC-16 (7)	*SECURITY ATTRIBUTES | CONSISTENT ATTRIBUTE INTERPRETATION*					
AC-16 (8)	*SECURITY ATTRIBUTES | ASSOCIATION TECHNIQUES / TECHNOLOGIES*					
AC-16 (9)	*SECURITY ATTRIBUTES | ATTRIBUTE REASSIGNMENT*					
AC-16 (10)	*SECURITY ATTRIBUTES | ATTRIBUTE CONFIGURATION BY AUTHORIZED INDIVIDUALS*					
AC-16 (11)	*SECURITY ATTRIBUTES | PERMITTED ATTRIBUTES FOR SPECIFIED INFORMATION SYSTEMS*					
AC-16 (12)	*SECURITY ATTRIBUTES | PERMITTED VALUES AND RANGES FOR ATTRIBUTES*					
AC-17	**Remote Access**			x	x	x
AC-17 (1)	*REMOTE ACCESS | AUTOMATED MONITORING / CONTROL*				x	x
AC-17 (2)	*REMOTE ACCESS | PROTECTION OF CONFIDENTIALITY / INTEGRITY USING ENCRYPTION*				x	x
AC-17 (3)	*REMOTE ACCESS | MANAGED ACCESS CONTROL POINTS*				x	x
AC-17 (4)	*REMOTE ACCESS | PRIVILEGED COMMANDS / ACCESS*				x	x
AC-17 (5)	*REMOTE ACCESS | MONITORING FOR UNAUTHORIZED CONNECTIONS*	**W**	Incorporated into AC-17.			
AC-17 (6)	*REMOTE ACCESS | PROTECTION OF INFORMATION*					
AC-17 (7)	*REMOTE ACCESS | ADDITIONAL PROTECTION FOR SECURITY FUNCTION ACCESS*	**W**	Incorporated into AC-3.			
AC-17 (8)	*REMOTE ACCESS | DISABLE NONSECURE NETWORK PROTOCOLS*	**W**	Incorporated into CM-7.			
AC-17 (9)	*REMOTE ACCESS | DISCONNECT / DISABLE ACCESS*					
AC-18	**Wireless Access**			x	x	x
AC-18 (1)	*WIRELESS ACCESS | AUTHENTICATION AND ENCRYPTION*				x	x
AC-18 (2)	*WIRELESS ACCESS | MONITORING UNAUTHORIZED CONNECTIONS*	**W**	Incorporated into AC-18.			
AC-18 (3)	*WIRELESS ACCESS | DISABLE WIRELESS NETWORKING*					
AC-18 (4)	*WIRELESS ACCESS | RESTRICT CONFIGURATIONS BY USERS*					x

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
AC-18 (5)	*WIRELESS ACCESS | CONFINE WIRELESS COMMUNICATIONS*					x
AC-19	**Access Control for Mobile Devices**			x	x	x
AC-19 (1)	*ACCESS CONTROL FOR MOBILE DEVICES | USE OF WRITABLE / REMOVABLE MEDIA*	**W**	Incorporated into MP-7.			
AC-19 (2)	*ACCESS CONTROL FOR MOBILE DEVICES | USE OF PERSONALLY OWNED REMOVABLE MEDIA*	**W**	Incorporated into MP-7.			
AC-19 (3)	*ACCESS CONTROL FOR MOBILE DEVICES | USE OF REMOVABLE MEDIA WITH NO IDENTIFIABLE OWNER*	**W**	Incorporated into MP-7.			
AC-19 (4)	*ACCESS CONTROL FOR MOBILE DEVICES | RESTRICTIONS FOR CLASSIFIED INFORMATION*					
AC-19 (5)	*ACCESS CONTROL FOR MOBILE DEVICES | PERSONALLY OWNED DEVICES*					
AC-19 (6)	*ACCESS CONTROL FOR MOBILE DEVICES | FULL DISK ENCRYPTION*				x	x
AC-19 (7)	*ACCESS CONTROL FOR MOBILE DEVICES | CENTRAL MANAGEMENT OF MOBILE DEVICES*					
AC-19 (8)	*ACCESS CONTROL FOR MOBILE DEVICES | REMOTE PURGING OF INFORMATION*					
AC-19 (9)	*ACCESS CONTROL FOR MOBILE DEVICES | TAMPER DETECTION*					
AC-20	**Use of External Information Systems**			x	x	x
AC-20 (1)	*USE OF EXTERNAL INFORMATION SYSTEMS | LIMITS ON AUTHORIZED USE*				x	x
AC-20 (2)	*USE OF EXTERNAL INFORMATION SYSTEMS | PORTABLE STORAGE MEDIA*				x	x
AC-20 (3)	*USE OF EXTERNAL INFORMATION SYSTEMS | PERSONALLY OWNED INFORMATION SYSTEMS / DEVICES*					
AC-20 (4)	*USE OF EXTERNAL INFORMATION SYSTEMS | NETWORK ACCESSIBLE STORAGE DEVICES*					
AC-21	**Collaboration and Information Sharing**				x	x
AC-21 (1)	*COLLABORATION AND INFORMATION SHARING | AUTOMATED DECISION SUPPORT*					
AC-21 (2)	*COLLABORATION AND INFORMATION SHARING | INFORMATION SEARCH AND RETRIEVAL*					
AC-22	**Publicly Accessible Content**			x	x	x
AC-23	**Data Mining Protection**					
AC-24	**Access Control Decisions**					
AC-24 (1)	*ACCESS CONTROL DECISIONS | TRANSMIT ACCESS AUTHORIZATION INFORMATION*					
AC-24 (2)	*ACCESS CONTROL DECISIONS | NO USER OR PROCESS IDENTITY*					
AC-25	**Reference Monitor Function**		**A**			

TABLE D-4: SUMMARY — AWARENESS AND TRAINING CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
AT-1	**Security Awareness and Training Policy and Procedures**		**A**	x	x	x
AT-2	**Security Awareness**		**A**	x	x	x
AT-2 (1)	*SECURITY AWARENESS | PRACTICAL EXERCISES*		**A**			
AT-2 (2)	*SECURITY AWARENESS | INSIDER THREAT*		**A**		x	x
AT-3	**Security Training**		**A**	x	x	x
AT-3 (1)	*SECURITY TRAINING | ENVIRONMENTAL CONTROLS*		**A**			
AT-3 (2)	*SECURITY TRAINING | PHYSICAL SECURITY CONTROLS*		**A**			
AT-3 (3)	*SECURITY TRAINING | PRACTICAL EXERCISES*		**A**			
AT-4	**Security Training Records**		**A**	x	x	x
AT-5	**Contacts with Security Groups and Associations**		**A**		x	x

TABLE D-5: SUMMARY — AUDIT AND ACCOUNTABILITY CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
AU-1	**Audit and Accountability Policy and Procedures**		**A**	X	X	X
AU-2	**Auditable Events**			X	X	X
AU-2 (1)	*AUDITABLE EVENTS | COMPILATION OF AUDIT RECORDS FROM MULTIPLE SOURCES*	**W**	Incorporated into AU-12.			
AU-2 (2)	*AUDITABLE EVENTS | SELECTION OF AUDIT EVENTS BY COMPONENT*	**W**	Incorporated into AU-12.			
AU-2 (3)	*AUDITABLE EVENTS | REVIEWS AND UPDATES*				X	X
AU-2 (4)	*AUDITABLE EVENTS | PRIVILEGED FUNCTIONS*				X	X
AU-3	**Content of Audit Records**			X	X	X
AU-3 (1)	*CONTENT OF AUDIT RECORDS | ADDITIONAL AUDIT INFORMATION*				X	X
AU-3 (2)	*CONTENT OF AUDIT RECORDS | CENTRALIZED MANAGEMENT OF PLANNED AUDIT RECORD CONTENT*					X
AU-4	**Audit Storage Capacity**			X	X	X
AU-4 (1)	*AUDIT STORAGE CAPACITY | TRANSFER TO ALTERNATE STORAGE*					
AU-5	**Response to Audit Processing Failures**			X	X	X
AU-5 (1)	*RESPONSE TO AUDIT PROCESSING FAILURES | AUDIT STORAGE CAPACITY*					X
AU-5 (2)	*RESPONSE TO AUDIT PROCESSING FAILURES | REAL-TIME ALERTS*					X
AU-5 (3)	*RESPONSE TO AUDIT PROCESSING FAILURES | CONFIGURABLE TRAFFIC VOLUME THRESHOLDS*					
AU-5 (4)	*RESPONSE TO AUDIT PROCESSING FAILURES | SHUTDOWN ON FAILURE*					
AU-6	**Audit Review, Analysis, and Reporting**		**A**	X	X	X
AU-6 (1)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | PROCESS INTEGRATION*		**A**		X	X
AU-6 (2)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | AUTOMATED SECURITY ALERTS*	**W**	Incorporated into SI-4.			
AU-6 (3)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | CORRELATE AUDIT REPOSITORIES*		**A**		X	X
AU-6 (4)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | CENTRAL REVIEW AND ANALYSIS*					
AU-6 (5)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | INTEGRATION / SCANNING AND MONITORING CAPABILITIES*		**A**			X
AU-6 (6)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | CORRELATION WITH PHYSICAL MONITORING*		**A**			X
AU-6 (7)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | PERMITTED ACTIONS*	**W**	Incorporated into AU-6.			
AU-6 (8)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | FULL TEXT ANALYSIS OF PRIVILEGED COMMANDS*		**A**			
AU-6 (9)	*AUDIT REVIEW, ANALYSIS, AND REPORTING | CORRELATION WITH INPUT FROM NON-TECHNICAL SOURCES*		**A**		X	X
AU-7	**Audit Reduction and Report Generation**		**A**		X	X
AU-7 (1)	*AUDIT REDUCTION AND REPORT GENERATION | AUTOMATIC PROCESSING*		**A**		X	X
AU-7 (2)	*AUDIT REDUCTION AND REPORT GENERATION | AUTOMATIC SORTING*					
AU-8	**Time Stamps**			X	X	X
AU-8 (1)	*TIME STAMPS | SYNCHRONIZATION WITH AUTHORITATIVE TIME SOURCE*				X	X
AU-8 (2)	*TIME STAMPS | SECONDARY AUTHORITATIVE TIME SOURCE*					
AU-9	**Protection of Audit Information**			X	X	X
AU-9 (1)	*PROTECTION OF AUDIT INFORMATION | HARDWARE WRITE-ONCE* MEDIA					

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
AU-9 (2)	*PROTECTION OF AUDIT INFORMATION | AUDIT BACKUP ON SEPARATE PHYSICAL SYSTEMS / COMPONENTS*					x
AU-9 (3)	*PROTECTION OF AUDIT INFORMATION | CRYPTOGRAPHIC PROTECTION*					x
AU-9 (4)	*PROTECTION OF AUDIT INFORMATION | ACCESS BY SUBSET OF PRIVILEGED USERS*				x	x
AU-9 (5)	*PROTECTION OF AUDIT INFORMATION | DUAL AUTHORIZATION*					
AU-9 (6)	*PROTECTION OF AUDIT INFORMATION | READ ONLY ACCESS*					
AU-10	**Non-repudiation**		**A**			x
AU-10 (1)	*NON-REPUDIATION | ASSOCIATION OF IDENTITIES*		**A**			
AU-10 (2)	*NON-REPUDIATION | VALIDATE BINDING OF INFORMATION PRODUCER IDENTITY*		**A**			
AU-10 (3)	*NON-REPUDIATION | CHAIN OF CUSTODY*		**A**			
AU-10 (4)	*NON-REPUDIATION | VALIDATE BINDING OF INFORMATION REVIEWER IDENTITY*		**A**			
AU-10 (5)	*NON-REPUDIATION | DIGITAL SIGNATURES*	**W**	Incorporated into SI-7.			
AU-11	**Audit Record Retention**			x	x	x
AU-12	**Audit Generation**			x	x	x
AU-12 (1)	*AUDIT GENERATION | SYSTEM-WIDE / TIME-CORRELATED AUDIT TRAIL*					x
AU-12 (2)	*AUDIT GENERATION | STANDARDIZED FORMATS*					
AU-12 (3)	*AUDIT GENERATION | CHANGES BY AUTHORIZED INDIVIDUALS*					x
AU-13	**Monitoring for Information Disclosure**		**A**			
AU-14	**Session Audit**		**A**			
AU-14 (1)	*SESSION AUDIT | SYSTEM START-UP*		**A**			
AU-15	**Alternate Audit Capability**					
AU-16	**Cross-Organizational Auditing**					
AU-16 (1)	*CROSS-ORGANIZATIONAL AUDITING | IDENTITY PRESERVATION*					
AU-16 (2)	*CROSS-ORGANIZATIONAL AUDITING | SHARING OF AUDIT INFORMATION*					

TABLE D-6: SUMMARY — SECURITY ASSESSMENT AND AUTHORIZATION CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
CA-1	**Security Assessment and Authorization Policies and Procedures**		**A**	x	x	x
CA-2	**Security Assessments**		**A**	x	x	x
CA-2 (1)	*SECURITY ASSESSMENTS | INDEPENDENT ASSESSORS*		**A**		x	x
CA-2 (2)	*SECURITY ASSESSMENTS | TYPES OF ASSESSMENTS*		**A**			x
CA-2 (3)	*SECURITY ASSESSMENTS | EXTERNAL ORGANIZATIONS*		**A**			
CA-3	**Information System Connections**		**A**	x	x	x
CA-3 (1)	*INFORMATION SYSTEM CONNECTIONS | UNCLASSIFIED NATIONAL SECURITY SYSTEM CONNECTIONS*					
CA-3 (2)	*INFORMATION SYSTEM CONNECTIONS | CLASSIFIED NATIONAL SECURITY SYSTEM CONNECTION*					
CA-3 (3)	*INFORMATION SYSTEM CONNECTIONS | PROHIBIT CONNECTIONS TO PUBLIC NETWORKS*					
CA-4	**Security Certification**	**W**	Incorporated into CA-2.			
CA-5	**Plan of Action and Milestones**		**A**	x	x	x
CA-5 (1)	*PLAN OF ACTION AND MILESTONES | AUTOMATION SUPPORT FOR ACCURACY / CURRENCY*		**A**			
CA-6	**Security Authorization**		**A**	x	x	x
CA-7	**Continuous Monitoring**		**A**	x	x	x
CA-7 (1)	*CONTINUOUS MONITORING | INDEPENDENT ASSESSMENT*		**A**		x	x
CA-7 (2)	*CONTINUOUS MONITORING | TYPES OF ASSESSMENTS*	**W**	Incorporated into CA-2.			

TABLE D-7: SUMMARY — CONFIGURATION MANAGEMENT CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
CM-1	**Configuration Management Policy and Procedures**		**A**	X	X	X
CM-2	**Baseline Configuration**		**A**	X	X	X
CM-2 (1)	*BASELINE CONFIGURATION | REVIEWS AND UPDATES*		**A**		X	X
CM-2 (2)	*BASELINE CONFIGURATION | AUTOMATION SUPPORT FOR ACCURACY / CURRENCY*		**A**			X
CM-2 (3)	*BASELINE CONFIGURATION | RETENTION OF PREVIOUS CONFIGURATIONS*		**A**		X	X
CM-2 (4)	*BASELINE CONFIGURATION | UNAUTHORIZED SOFTWARE*	**W**	Incorporated into CM-7.			
CM-2 (5)	*BASELINE CONFIGURATION | AUTHORIZED SOFTWARE*	**W**	Incorporated into CM-7.			
CM-2 (6)	*BASELINE CONFIGURATION | DEVELOPMENT AND TEST ENVIRONMENTS*		**A**			X
CM-3	**Configuration Change Control**		**A**		X	X
CM-3 (1)	*CONFIGURATION CHANGE CONTROL | AUTOMATED DOCUMENT / NOTIFICATION / PROHIBITION OF CHANGES*		**A**			X
CM-3 (2)	*CONFIGURATION CHANGE CONTROL | TEST / VALIDATE / DOCUMENT CHANGES*		**A**		X	X
CM-3 (3)	*CONFIGURATION CHANGE CONTROL | AUTOMATED CHANGE IMPLEMENTATION*					
CM-3 (4)	*CONFIGURATION CHANGE CONTROL | SECURITY REPRESENTATIVE*					
CM-4	**Security Impact Analysis**		**A**		X	X
CM-4 (1)	*SECURITY IMPACT ANALYSIS | SEPARATE TEST ENVIRONMENTS*		**A**			X
CM-4 (2)	*SECURITY IMPACT ANALYSIS | VERIFICATION OF SECURITY FUNCTIONS*		**A**			
CM-5	**Access Restrictions for Change**				X	X
CM-5 (1)	*ACCESS RESTRICTIONS FOR CHANGE | AUTOMATED ACCESS ENFORCEMENT / AUDITING*					X
CM-5 (2)	*ACCESS RESTRICTIONS FOR CHANGE | AUDIT SYSTEM CHANGES*					X
CM-5 (3)	*ACCESS RESTRICTIONS FOR CHANGE | SIGNED COMPONENTS*					X
CM-5 (4)	*ACCESS RESTRICTIONS FOR CHANGE | TWO-PERSON RULE*					
CM-5 (5)	*ACCESS RESTRICTIONS FOR CHANGE | LIMIT PRODUCTION / OPERATIONAL PRIVILEGES*					
CM-5 (6)	*ACCESS RESTRICTIONS FOR CHANGE | LIMIT LIBRARY PRIVILEGES*					
CM-5 (7)	*ACCESS RESTRICTIONS FOR CHANGE | AUTOMATIC IMPLEMENTATION OF SECURITY SAFEGUARDS*	**W**	Incorporated into SI-7.			
CM-6	**Configuration Settings**			X	X	X
CM-6 (1)	*CONFIGURATION SETTINGS | AUTOMATED CENTRAL MANAGEMENT / APPLICATION / VERIFICATION*					X
CM-6 (2)	*CONFIGURATION SETTINGS | RESPOND TO UNAUTHORIZED CHANGES*					X
CM-6 (3)	*CONFIGURATION SETTINGS | UNAUTHORIZED CHANGE DETECTION*	**W**	Incorporated into SI-7.			
CM-6 (4)	*CONFIGURATION SETTINGS | CONFORMANCE DEMONSTRATION*	**W**	Incorporated into CA-2 and CA-7.			
CM-7	**Least Functionality**			X	X	X
CM-7 (1)	*LEAST FUNCTIONALITY | PERIODIC REVIEW*				X	X
CM-7 (2)	*LEAST FUNCTIONALITY | PREVENT PROGRAM EXECUTION*					X
CM-7 (3)	*LEAST FUNCTIONALITY | REGISTRATION COMPLIANCE*					
CM-7 (4)	*LEAST FUNCTIONALITY | UNAUTHORIZED SOFTWARE*				X	
CM-7 (5)	*LEAST FUNCTIONALITY | AUTHORIZED SOFTWARE*					X
CM-8	**Information System Component Inventory**		**A**	X	X	X

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
CM-8 (1)	*INFORMATION SYSTEM COMPONENT INVENTORY | UPDATES DURING INSTALLATIONS / REMOVALS*		**A**		X	X
CM-8 (2)	*INFORMATION SYSTEM COMPONENT INVENTORY | AUTOMATED MAINTENANCE*		**A**			X
CM-8 (3)	*INFORMATION SYSTEM COMPONENT INVENTORY | AUTOMATED UNAUTHORIZED COMPONENT DETECTION*		**A**			X
CM-8 (4)	*INFORMATION SYSTEM COMPONENT INVENTORY | PROPERTY ACCOUNTABILITY INFORMATION*		**A**			X
CM-8 (5)	*INFORMATION SYSTEM COMPONENT INVENTORY | ALL COMPONENTS WITHIN AUTHORIZATION BOUNDARY*		**A**		X	X
CM-8 (6)	*INFORMATION SYSTEM COMPONENT INVENTORY | ASSESSED CONFIGURATIONS / APPROVED DEVIATIONS*					
CM-9	**Configuration Management Plan**				X	X
CM-9 (1)	*CONFIGURATION MANAGEMENT PLAN | ASSIGNMENT OF RESPONSIBILITY*					
CM-10	**Software Usage Restrictions**			X	X	X
CM-11	**User-Installed Software**			X	X	X
CM-11 (1)	*USER-INSTALLED SOFTWARE | AUTOMATED ALERTS FOR UNAUTHORIZED INSTALLATIONS*					

TABLE D-8: SUMMARY — CONTINGENCY PLANNING CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
CP-1	**Contingency Planning Policy and Procedures**		**A**	X	X	X
CP-2	**Contingency Plan**			X	X	X
CP-2 (1)	*CONTINGENCY PLAN | COORDINATE WITH RELATED PLANS*				X	X
CP-2 (2)	*CONTINGENCY PLAN | CAPACITY PLANNING*					X
CP-2 (3)	*CONTINGENCY PLAN | RESUME ESSENTIAL MISSIONS / BUSINESS FUNCTIONS*				X	X
CP-2 (4)	*CONTINGENCY PLAN | RESUME ALL MISSIONS / BUSINESS FUNCTIONS*					X
CP-2 (5)	*CONTINGENCY PLAN | CONTINUE ESSENTIAL MISSIONS / BUSINESS FUNCTIONS*					X
CP-2 (6)	*CONTINGENCY PLAN | ALTERNATE PROCESSING / STORAGE SITE*					
CP-2 (7)	*CONTINGENCY PLAN | COORDINATE WITH EXTERNAL SERVICE PROVIDERS*					
CP-2 (8)	*CONTINGENCY PLAN | IDENTIFY CRITICAL ASSETS*				X	X
CP-3	**Contingency Training**		**A**	X	X	X
CP-3 (1)	*CONTINGENCY TRAINING | SIMULATED EVENTS*		**A**			X
CP-3 (2)	*CONTINGENCY TRAINING | AUTOMATED TRAINING ENVIRONMENTS*		**A**			
CP-4	**Contingency Plan Testing**		**A**	X	X	X
CP-4 (1)	*CONTINGENCY PLAN TESTING | COORDINATE WITH RELATED PLANS*		**A**		X	X
CP-4 (2)	*CONTINGENCY PLAN TESTING | ALTERNATE PROCESSING SITE*		**A**			X
CP-4 (3)	*CONTINGENCY PLAN TESTING | AUTOMATED TESTING*		**A**			
CP-4 (4)	*CONTINGENCY PLAN TESTING | FULL RECOVERY / RECONSTITUTION*		**A**			X
CP-5	**Contingency Plan Update**	**W**	Incorporated into CP-2.			
CP-6	**Alternate Storage Site**				X	X
CP-6 (1)	*ALTERNATE STORAGE SITE | SEPARATION FROM PRIMARY SITE*				X	X
CP-6 (2)	*ALTERNATE STORAGE SITE | RECOVERY TIME / POINT OBJECTIVES*					X
CP-6 (3)	*ALTERNATE STORAGE SITE | ACCESSIBILITY*				X	X
CP-7	**Alternate Processing Site**				X	X
CP-7 (1)	*ALTERNATE PROCESSING SITE | SEPARATION FROM PRIMARY SITE*				X	X
CP-7 (2)	*ALTERNATE PROCESSING SITE | ACCESSIBILITY*				X	X
CP-7 (3)	*ALTERNATE PROCESSING SITE | PRIORITY OF SERVICE*				X	X
CP-7 (4)	*ALTERNATE PROCESSING SITE | CONFIGURATION FOR USE*					X
CP-7 (5)	*ALTERNATE PROCESSING SITE | EQUIVALENT INFORMATION SECURITY SAFEGUARDS*	**W**	Incorporated into CP-7.			
CP-7 (6)	*ALTERNATE PROCESSING SITE | INABILITY TO RETURN TO PRIMARY SITE*					
CP-8	**Telecommunications Services**				X	X
CP-8 (1)	*TELECOMMUNICATIONS SERVICES | PRIORITY OF SERVICE PROVISIONS*				X	X
CP-8 (2)	*TELECOMMUNICATIONS SERVICES | SINGLE POINTS OF FAILURE*				X	X
CP-8 (3)	*TELECOMMUNICATIONS SERVICES | SEPARATION OF PRIMARY / ALTERNATE PROVIDERS*					X
CP-8 (4)	*TELECOMMUNICATIONS SERVICES | PROVIDER CONTINGENCY PLAN*					X
CP-8 (5)	*TELECOMMUNICATIONS SERVICES | ALTERNATE TELECOMMUNICATION SERVICE TESTING*					
CP-9	**Information System Backup**			X	X	X
CP-9 (1)	*INFORMATION SYSTEM BACKUP | TESTING FOR RELIABILITY / INTEGRITY*				X	X

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
CP-9 (2)	*INFORMATION SYSTEM BACKUP | TEST RESTORATION USING SAMPLING*					X
CP-9 (3)	*INFORMATION SYSTEM BACKUP | SEPARATE STORAGE FOR CRITICAL INFORMATION*					X
CP-9 (4)	*INFORMATION SYSTEM BACKUP | PROTECTION FROM UNAUTHORIZED MODIFICATION*	**W**	Incorporated into CP-9.			
CP-9 (5)	*INFORMATION SYSTEM BACKUP | TRANSFER TO ALTERNATE SITE*					X
CP-9 (6)	*INFORMATION SYSTEM BACKUP | REDUNDANT SECONDARY SYSTEM*					
CP-9 (7)	*INFORMATION SYSTEM BACKUP | TWO-PERSON RULE*					
CP-10	**Information System Recovery and Reconstitution**			X	X	X
CP-10 (1)	*INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | CONTINGENCY PLAN TESTING*	**W**	Incorporated into CP-4.			
CP-10 (2)	*INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | TRANSACTION RECOVERY*				X	X
CP-10 (3)	*INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | COMPENSATING SECURITY CONTROLS*				X	X
CP-10 (4)	*INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | RESTORE WITHIN TIME PERIOD*					X
CP-10 (5)	*INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | FAILOVER CAPABILITY*					X
CP-10 (6)	*INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | COMPONENT PROTECTION*					
CP-11	**Predictable Failure Prevention**		**A**			X
CP-11 (1)	*PREDICTABLE FAILURE PREVENTION | TRANSFERRING COMPONENT RESPONSIBILITIES*		**A**			
CP-11 (2)	*PREDICTABLE FAILURE PREVENTION | TIME LIMIT ON PROCESS EXECUTION WITHOUT SUPERVISION*		**A**			
CP-11 (3)	*PREDICTABLE FAILURE PREVENTION | MANUAL TRANSFER BETWEEN COMPONENTS*		**A**			
CP-11 (4)	*PREDICTABLE FAILURE PREVENTION | STANDBY COMPONENT INSTALLATION / NOTIFICATION*		**A**			
CP-12	**Alternate Communications Protocols**					
CP-13	**Safe Mode**		**A**			

TABLE D-9: SUMMARY — IDENTIFICATION AND AUTHENTICATION CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
IA-1	**Identification and Authentication Policy and Procedures**		**A**	X	X	X
IA-2	**Identification and Authentication (Organizational Users)**			X	X	X
IA-2 (1)	*IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO PRIVILEGED ACCOUNTS*			X	X	X
IA-2 (2)	*IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO NON-PRIVILEGED ACCOUNTS*				X	X
IA-2 (3)	*IDENTIFICATION AND AUTHENTICATION | LOCAL ACCESS TO PRIVILEGED ACCOUNTS*				X	X
IA-2 (4)	*IDENTIFICATION AND AUTHENTICATION | LOCAL ACCESS TO NON-PRIVILEGED ACCOUNTS*					X
IA-2 (5)	*IDENTIFICATION AND AUTHENTICATION | INDIVIDUAL AND GROUP AUTHENTICATORS*					
IA-2 (6)	*IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO PRIVILEGED ACCOUNTS - SEPARATE DEVICE*					
IA-2 (7)	*IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO NON-PRIVILEGED ACCOUNTS - SEPARATE DEVICE*					
IA-2 (8)	*IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO PRIVILEGED ACCOUNTS - REPLAY RESISTANT*				X	X
IA-2 (9)	*IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO NON-PRIVILEGED ACCOUNTS - REPLAY RESISTANT*					X
IA-2 (10)	*IDENTIFICATION AND AUTHENTICATION | SINGLE SIGN-ON*					
IA-3	**Device-to-Device Identification and Authentication**				X	X
IA-3 (1)	*DEVICE-TO-DEVICE IDENTIFICATION AND AUTHENTICATION | CRYPTOGRAPHIC BIDIRECTIONAL AUTHENTICATION*					
IA-3 (2)	*DEVICE-TO-DEVICE IDENTIFICATION AND AUTHENTICATION | CRYPTOGRAPHIC BIDIRECTIONAL AUTHENTICATION*	**W**	Incorporated into IA-3.			
IA-3 (3)	*DEVICE-TO-DEVICE IDENTIFICATION AND AUTHENTICATION | DYNAMIC ADDRESS ALLOCATION*					
IA-4	**Identifier Management**			X	X	X
IA-4 (1)	*IDENTIFIER MANAGEMENT | PROHIBIT ACCOUNT IDENTIFIERS AS PUBLIC IDENTIFIERS*					
IA-4 (2)	*IDENTIFIER MANAGEMENT | SUPERVISOR AUTHORIZATION*					
IA-4 (3)	*IDENTIFIER MANAGEMENT | MULTIPLE FORMS OF CERTIFICATION*					
IA-4 (4)	*IDENTIFIER MANAGEMENT | IDENTIFY USER STATUS*					
IA-4 (5)	*IDENTIFIER MANAGEMENT | DYNAMIC MANAGEMENT*					
IA-4 (6)	*IDENTIFIER MANAGEMENT | CROSS-ORGANIZATION MANAGEMENT*					
IA-5	**Authenticator Management**			X	X	X
IA-5 (1)	*AUTHENTICATOR MANAGEMENT | PASSWORD-BASED AUTHENTICATION*			X	X	X
IA-5 (2)	*AUTHENTICATOR MANAGEMENT | PKI-BASED AUTHENTICATION*				X	X
IA-5 (3)	*AUTHENTICATOR MANAGEMENT | IN PERSON REGISTRATION*				X	X
IA-5 (4)	*AUTHENTICATOR MANAGEMENT | AUTOMATED TOOLS FOR STRENGTH DETERMINATION*					
IA-5 (5)	*AUTHENTICATOR MANAGEMENT | CHANGE AUTHENTICATORS PRIOR TO DELIVERY*					
IA-5 (6)	*AUTHENTICATOR MANAGEMENT | PROTECTION OF AUTHENTICATORS*					
IA-5 (7)	*AUTHENTICATOR MANAGEMENT | NO EMBEDDED UNENCRYPTED STATIC AUTHENTICATORS*					
IA-5 (8)	*AUTHENTICATOR MANAGEMENT | MULTIPLE INFORMATION SYSTEM ACCOUNTS*					

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
IA-5 (9)	*AUTHENTICATOR MANAGEMENT | CROSS-ORGANIZATION MANAGEMENT*					
IA-5 (10)	*AUTHENTICATOR MANAGEMENT | DYNAMIC AUTHENTICATOR ASSOCIATION*					
IA-5 (11)	*AUTHENTICATOR MANAGEMENT | HARDWARE TOKEN-BASED AUTHENTICATION*					
IA-5 (12)	*AUTHENTICATOR MANAGEMENT | BIOMETRIC AUTHENTICATION*					
IA-6	**Authenticator Feedback**			x	x	x
IA-7	**Cryptographic Module Authentication**			x	x	x
IA-8	**Identification and Authentication (Non-Organizational Users)**			x	x	x
IA-9	**Service Identification and Authentication**					
IA-9 (1)	*SERVICE IDENTIFICATION AND AUTHENTICATION | INFORMATION EXCHANGE*					
IA-9 (2)	*SERVICE IDENTIFICATION AND AUTHENTICATION | TRANSMISSION OF DECISIONS*					
IA-10	**Alternative Authentication**					
IA-11	**Adaptive Identification and Authentication**					
IA-12	**Reauthentication**					

TABLE D-10: SUMMARY — INCIDENT RESPONSE CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
IR-1	**Incident Response Policy and Procedures**		**A**	X	X	X
IR-2	**Incident Response Training**		**A**	X	X	X
IR-2 (1)	*INCIDENT RESPONSE TRAINING | SIMULATED EVENTS*		**A**			X
IR-2 (2)	*INCIDENT RESPONSE TRAINING | AUTOMATED TRAINING ENVIRONMENTS*		**A**			X
IR-3	**Incident Response Testing**		**A**		X	X
IR-3 (1)	*INCIDENT RESPONSE TESTING | AUTOMATED TESTING*		**A**			X
IR-3 (2)	*INCIDENT RESPONSE TESTING | COORDINATION WITH RELATED PLANS*		**A**		X	X
IR-4	**Incident Handling**			X	X	X
IR-4 (1)	*INCIDENT HANDLING | AUTOMATED INCIDENT HANDLING PROCESSES*				X	X
IR-4 (2)	*INCIDENT HANDLING | DYNAMIC RECONFIGURATION*					
IR-4 (3)	*INCIDENT HANDLING | CONTINUITY OF OPERATIONS*					
IR-4 (4)	*INCIDENT HANDLING | INFORMATION CORRELATION*					X
IR-4 (5)	*INCIDENT HANDLING | AUTOMATIC DISABLING OF INFORMATION SYSTEM*					
IR-4 (6)	*INCIDENT HANDLING | INSIDER THREATS - SPECIFIC CAPABILITIES*					
IR-4 (7)	*INCIDENT HANDLING | INSIDER THREATS - INTRA-ORGANIZATION COORDINATION*					
IR-4 (8)	*INCIDENT HANDLING | CORRELATION WITH EXTERNAL ORGANIZATIONS*					
IR-4 (9)	*INCIDENT HANDLING | DYNAMIC RESPONSE CAPABILITY*					
IR-4 (10)	*INCIDENT HANDLING | SUPPLY CHAIN COORDINATION*					
IR-5	**Incident Monitoring**		**A**	X	X	X
IR-5 (1)	*INCIDENT MONITORING | AUTOMATED TRACKING / DATA COLLECTION / ANALYSIS*		**A**			X
IR-6	**Incident Reporting**			X	X	X
IR-6 (1)	*INCIDENT REPORTING | AUTOMATED REPORTING*				X	X
IR-6 (2)	*INCIDENT REPORTING | VULNERABILITIES RELATED TO INCIDENTS*					
IR-6 (3)	*INCIDENT REPORTING | COORDINATION WITH SUPPLY CHAIN*					
IR-7	**Incident Response Assistance**			X	X	X
IR-7 (1)	*INCIDENT RESPONSE ASSISTANCE | AUTOMATION SUPPORT FOR AVAILABILITY OF INFORMATION / SUPPORT*				X	X
IR-7 (2)	*INCIDENT RESPONSE ASSISTANCE | COORDINATION WITH EXTERNAL PROVIDERS*					
IR-8	**Incident Response Plan**			X	X	X
IR-9	**Information Spillage Response**					
IR-9 (1)	*INFORMATION SPILLAGE RESPONSE | RESPONSIBLE PERSONNEL*					
IR-9 (2)	*INFORMATION SPILLAGE RESPONSE | TRAINING*					
IR-9 (3)	*INFORMATION SPILLAGE RESPONSE | POST-SPILL OPERATIONS*					
IR-9 (4)	*INFORMATION SPILLAGE RESPONSE | EXPOSURE TO UNAUTHORIZED PERSONNEL*					

TABLE D-11: SUMMARY — MAINTENANCE CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
MA-1	**System Maintenance Policy and Procedures**		**A**	X	X	X
MA-2	**Controlled Maintenance**			X	X	X
MA-2 (1)	*CONTROLLED MAINTENANCE | RECORD CONTENT*	**W**	Incorporated into MA-2.			
MA-2 (2)	*CONTROLLED MAINTENANCE | AUTOMATED MAINTENANCE ACTIVITIES*					X
MA-3	**Maintenance Tools**				X	X
MA-3 (1)	*MAINTENANCE TOOLS | INSPECT TOOLS*				X	X
MA-3 (2)	*MAINTENANCE TOOLS | INSPECT MEDIA*				X	X
MA-3 (3)	*MAINTENANCE TOOLS | PREVENT UNAUTHORIZED REMOVAL*					X
MA-3 (4)	*MAINTENANCE TOOLS | AUTOMATED RESTRICTED TOOL USE*					
MA-4	**Non-Local Maintenance**			X	X	X
MA-4 (1)	*NON-LOCAL MAINTENANCE | AUDITING AND REVIEW*				X	X
MA-4 (2)	*NON-LOCAL MAINTENANCE | DOCUMENT NON-LOCAL MAINTENANCE*				X	X
MA-4 (3)	*NON-LOCAL MAINTENANCE | COMPARABLE SECURITY / SANITIZATION*					X
MA-4 (4)	*NON-LOCAL MAINTENANCE | AUTHENTICATION / SEPARATION OF MAINTENANCE SESSIONS*					
MA-4 (5)	*NON-LOCAL MAINTENANCE | APPROVALS AND NOTIFICATIONS*					
MA-4 (6)	*NON-LOCAL MAINTENANCE | CRYPTOGRAPHIC PROTECTION*					
MA-4 (7)	*NON-LOCAL MAINTENANCE | REMOTE DISCONNECT VERIFICATION*					
MA-5	**Maintenance Personnel**			X	X	X
MA-5 (1)	*MAINTENANCE PERSONNEL | INDIVIDUALS WITHOUT APPROPRIATE ACCESS*					X
MA-5 (2)	*MAINTENANCE PERSONNEL | SECURITY CLEARANCES FOR CLASSIFIED SYSTEMS*					
MA-5 (3)	*MAINTENANCE PERSONNEL | CITIZENSHIP REQUIREMENTS FOR CLASSIFIED SYSTEMS*					
MA-5 (4)	*MAINTENANCE PERSONNEL | FOREIGN NATIONALS*					
MA-6	**Timely Maintenance**				X	X

TABLE D-12: SUMMARY — MEDIA PROTECTION CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
MP-1	**Media Protection Policy and Procedures**		**A**	X	X	X
MP-2	**Media Access**			X	X	X
MP-2 (1)	*MEDIA ACCESS | AUTOMATED RESTRICTED ACCESS*				X	X
MP-2 (2)	*MEDIA ACCESS | CRYPTOGRAPHIC PROTECTION*					
MP-3	**Media Marking**				X	X
MP-4	**Media Storage**				X	X
MP-4 (1)	*MEDIA STORAGE | CRYPTOGRAPHIC PROTECTION*					
MP-4 (2)	*MEDIA STORAGE | OFF-LINE STORAGE*					
MP-5	**Media Transport**				X	X
MP-5 (1)	*MEDIA TRANSPORT | PROTECTION OUTSIDE OF CONTROLLED AREAS*	**W**	Incorporated into MP-5.			
MP-5 (2)	*MEDIA TRANSPORT | DOCUMENTATION OF ACTIVITIES*	**W**	Incorporated into MP-5.			
MP-5 (3)	*MEDIA TRANSPORT | CUSTODIANS*					X
MP-5 (4)	*MEDIA TRANSPORT | CRYPTOGRAPHIC PROTECTION*				X	X
MP-6	**Media Sanitization**			X	X	X
MP-6 (1)	*MEDIA SANITIZATION | TRACKING / DOCUMENTING / VERIFYING*					X
MP-6 (2)	*MEDIA SANITIZATION | EQUIPMENT TESTING*					X
MP-6 (3)	*MEDIA SANITIZATION | NON-DESTRUCTIVE TECHNIQUES*					X
MP-6 (4)	*MEDIA SANITIZATION | CONTROLLED UNCLASSIFIED INFORMATION*	**W**	Incorporated into MP-6.			
MP-6 (5)	*MEDIA SANITIZATION | CLASSIFIED INFORMATION*	**W**	Incorporated into MP-6.			
MP-6 (6)	*MEDIA SANITIZATION | MEDIA DESTRUCTION*	**W**	Incorporated into MP-6.			
MP-6 (7)	*MEDIA SANITIZATION | TWO-PERSON RULE*					
MP-7	**Media Use**			X	X	X
MP-7 (1)	*MEDIA USE | ORGANIZATIONAL RESTRICTIONS*				X	X
MP-7 (2)	*MEDIA USE | PROHIBITION OF USE WITHOUT OWNER*				X	X
MP-8	**Media Downgrading**					
MP-8 (1)	*MEDIA DOWNGRADING | TRACKING / DOCUMENTING*					
MP-8 (2)	*MEDIA DOWNGRADING | EQUIPMENT TESTING*					
MP-8 (3)	*MEDIA DOWNGRADING | CONTROLLED UNCLASSIFIED INFORMATION*					
MP-8 (4)	*MEDIA DOWNGRADING | CLASSIFIED INFORMATION*					

TABLE D-13: SUMMARY — PHYSICAL AND ENVIRONMENTAL PROTECTION CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
PE-1	**Physical and Environmental Protection Policy and Procedures**		**A**	X	X	X
PE-2	**Physical Access Authorizations**			X	X	X
PE-2 (1)	*PHYSICAL ACCESS AUTHORIZATIONS | ACCESS BY POSITION / ROLE*					
PE-2 (2)	*PHYSICAL ACCESS AUTHORIZATIONS | TWO FORMS OF IDENTIFICATION*					
PE-2 (3)	*PHYSICAL ACCESS AUTHORIZATIONS | RESTRICT UNESCORTED ACCESS*					
PE-3	**Physical Access Control**			X	X	X
PE-3 (1)	*PHYSICAL ACCESS CONTROL | INFORMATION SYSTEM ACCESS*					X
PE-3 (2)	*PHYSICAL ACCESS CONTROL | FACILITY / INFORMATION SYSTEM BOUNDARIES*					
PE-3 (3)	*PHYSICAL ACCESS CONTROL | CONTINUOUS GUARDS / ALARMS / MONITORING*					
PE-3 (4)	*PHYSICAL ACCESS CONTROL | LOCKABLE CASINGS*					
PE-3 (5)	*PHYSICAL ACCESS CONTROL | TAMPER PROTECTION*					
PE-3 (6)	*PHYSICAL ACCESS CONTROL | PENETRATION TESTING*					
PE-4	**Access Control for Transmission Medium**				X	X
PE-5	**Access Control for Output Devices**				X	X
PE-5 (1)	*ACCESS CONTROL FOR OUTPUT DEVICES | AUTOMATED ACCESS CONTROL / IDENTITY LINKAGE*					
PE-6	**Monitoring Physical Access**		**A**	X	X	X
PE-6 (1)	*MONITORING PHYSICAL ACCESS | INTRUSION ALARMS / SURVEILLANCE EQUIPMENT*		**A**		X	X
PE-6 (2)	*MONITORING PHYSICAL ACCESS | AUTOMATED INTRUSION RECOGNITION / RESPONSES*		**A**			X
PE-6 (3)	*MONITORING PHYSICAL ACCESS | VIDEO SURVEILLANCE*		**A**			
PE-7	**Visitor Control**	**W**	Incorporated into PE-2 and PE-3.			
PE-8	**Visitor Access Records**		**A**	X	X	X
PE-8 (1)	*VISITOR ACCESS RECORDS | AUTOMATED RECORDS MAINTENANCE / REVIEW*					X
PE-8 (2)	*VISITOR ACCESS RECORDS | PHYSICAL ACCESS RECORDS*	**W**	Incorporated into PE-2.			
PE-9	**Power Equipment and Cabling**				X	X
PE-9 (1)	*POWER EQUIPMENT AND CABLING | REDUNDANT CABLING*					
PE-9 (2)	*POWER EQUIPMENT AND CABLING | AUTOMATIC VOLTAGE CONTROLS*					
PE-10	**Emergency Shutoff**				X	X
PE-10 (1)	*EMERGENCY SHUTOFF | ACCIDENTAL / UNAUTHORIZED ACTIVATION*	**W**	Incorporated into PE-10.			
PE-11	**Emergency Power**				X	X
PE-11 (1)	*EMERGENCY POWER | LONG-TERM ALTERNATE POWER SUPPLY - MINIMAL OPERATIONAL CAPABILITY*					X
PE-11 (2)	*EMERGENCY POWER | LONG-TERM ALTERNATE POWER SUPPLY - SELF-CONTAINED*					
PE-12	**Emergency Lighting**			X	X	X
PE-12 (1)	*EMERGENCY LIGHTING | ESSENTIAL MISSIONS / BUSINESS FUNCTIONS*					
PE-13	**Fire Protection**			X	X	X
PE-13 (1)	*FIRE PROTECTION | DETECTION DEVICES / SYSTEMS*				X	X
PE-13 (2)	*FIRE PROTECTION | SUPPRESSION DEVICES / SYSTEMS*				X	X

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
PE-13 (3)	*FIRE PROTECTION | AUTOMATIC FIRE SUPPRESSION*				X	X
PE-13 (4)	*FIRE PROTECTION | INSPECTIONS*					
PE-14	**Temperature and Humidity Controls**			X	X	X
PE-14 (1)	*TEMPERATURE AND HUMIDITY CONTROLS | AUTOMATIC CONTROLS*					
PE-14 (2)	*TEMPERATURE AND HUMIDITY CONTROLS | MONITORING WITH ALARMS / NOTIFICATIONS*					
PE-15	**Water Damage Protection**			X	X	X
PE-15 (1)	*WATER DAMAGE PROTECTION | AUTOMATION SUPPORT*					X
PE-16	**Delivery and Removal**			X	X	X
PE-17	**Alternate Work Site**				X	X
PE-18	**Location of Information System Components**				X	X
PE-18 (1)	*LOCATION OF INFORMATION SYSTEM COMPONENTS | FACILITY SITE*				X	X
PE-19	**Information Leakage**					
PE-19 (1)	*INFORMATION LEAKAGE | NATIONAL EMISSIONS / TEMPEST POLICIES AND PROCEDURES*					
PE-20	**Port and I/O Device Access**					

TABLE D-14: SUMMARY — PLANNING CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
PL-1	**Security Planning Policy and Procedures**		**A**	X	X	X
PL-2	**System Security Plan**		**A**	X	X	X
PL-2 (1)	*SYSTEM SECURITY PLAN | CONCEPT OF OPERATIONS*	**W**	Incorporated into PL-7.			
PL-2 (2)	*SYSTEM SECURITY PLAN | FUNCTIONAL ARCHITECTURE*	**W**	Incorporated into PL-8.			
PL-2 (3)	*SYSTEM SECURITY PLAN | PLAN / COORDINATE WITH OTHER ORGANIZATIONAL ENTITIES*		**A**		X	X
PL-3	**System Security Plan Update**	**W**	Incorporated into PL-2.			
PL-4	**Rules of Behavior**		**A**	X	X	X
PL-4 (1)	*RULES OF BEHAVIOR | SOCIAL MEDIA AND NETWORKING RESTRICTIONS*		**A**		X	X
PL-5	**Privacy Impact Assessment**	**W**	Incorporated into Appendix J, AR-2.			
PL-6	**Security-Related Activity Planning**	**W**	Incorporated into PL-2.			
PL-7	**Security Concept of Operations**					
PL-8	**Security Architecture**					

TABLE D-15: SUMMARY — PERSONNEL SECURITY CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
PS-1	**Personnel Security Policy and Procedures**		**A**	X	X	X
PS-2	**Position Categorization**			X	X	X
PS-3	**Personnel Screening**			X	X	X
PS-3 (1)	*PERSONNEL SCREENING | CLASSIFIED INFORMATION*					
PS-3 (2)	*PERSONNEL SCREENING | FORMAL INDOCTRINATION*					
PS-3 (3)	*PERSONNEL SCREENING | ADDITIONAL SCREENING CRITERIA*					
PS-3 (4)	*PERSONNEL SCREENING | INFORMATION WITH SPECIAL PROTECTION MEASURES*					
PS-4	**Personnel Termination**			X	X	X
PS-4 (1)	*PERSONNEL TERMINATION | POST-EMPLOYMENT REQUIREMENTS*					X
PS-4 (2)	*PERSONNEL TERMINATION | AUTOMATED NOTIFICATION*					X
PS-5	**Personnel Transfer**			X	X	X
PS-6	**Access Agreements**		**A**	X	X	X
PS-6 (1)	*ACCESS AGREEMENTS | INFORMATION REQUIRING SPECIAL PROTECTION*	**W**	Incorporated into PS-3.			
PS-6 (2)	*ACCESS AGREEMENTS | CLASSIFIED INFORMATION REQUIRING SPECIAL PROTECTION*		**A**			
PS-7	**Third-Party Personnel Security**		**A**	X	X	X
PS-7 (1)	*THIRD-PARTY PERSONNEL SECURITY | NOTIFICATIONS*		**A**		X	X
PS-8	**Personnel Sanctions**			X	X	X
PS-8 (1)	*PERSONNEL SANCTIONS | NOTIFICATIONS*				X	X

TABLE D-16: SUMMARY — RISK ASSESSMENT CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
RA-1	**Risk Assessment Policy and Procedures**		**A**	x	x	x
RA-2	**Security Categorization**			x	x	x
RA-3	**Risk Assessment**		**A**	x	x	x
RA-4	**Risk Assessment Update**	**W**	Incorporated into RA-3.			
RA-5	**Vulnerability Scanning**		**A**	x	x	x
RA-5 (1)	*VULNERABILITY SCANNING | UPDATE TOOL CAPABILITY*		**A**		x	x
RA-5 (2)	*VULNERABILITY SCANNING | UPDATE BY FREQUENCY / WHEN IDENTIFIED*		**A**			x
RA-5 (3)	*VULNERABILITY SCANNING | BREADTH /DEPTH OF COVERAGE*		**A**			x
RA-5 (4)	*VULNERABILITY SCANNING | DISCOVERABLE INFORMATION*		**A**			x
RA-5 (5)	*VULNERABILITY SCANNING | PRIVILEGED ACCESS*		**A**			x
RA-5 (6)	*VULNERABILITY SCANNING | AUTOMATED TREND ANALYSES*		**A**			
RA-5 (7)	*VULNERABILITY SCANNING | AUTOMATED DETECTION AND NOTIFICATION OF UNAUTHORIZED COMPONENTS*		**A**			x
RA-5 (8)	*VULNERABILITY SCANNING | REVIEW HISTORIC AUDIT LOGS*		**A**			
RA-5 (9)	*VULNERABILITY SCANNING | PENETRATION TESTING AND ANALYSES*		**A**			
RA-5 (10)	*VULNERABILITY SCANNING | CORRELATE SCANNING INFORMATION*		**A**			

TABLE D-17: SUMMARY — SYSTEM AND SERVICES ACQUISITION CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SA-1	**System and Services Acquisition Policy and Procedures**		**A**	x	x	x
SA-2	**Allocation of Resources**		**A**	x	x	x
SA-3	**System Development Life Cycle**		**A**	x	x	x
SA-4	**Acquisition Process**		**A**	x	x	x
SA-4 (1)	*ACQUISITION PROCESS | FUNCTIONAL PROPERTIES OF SECURITY CONTROLS*		**A**		x	x
SA-4 (2)	*ACQUISITION PROCESS | DESIGN / IMPLEMENTATION INFORMATION FOR SECURITY CONTROLS*		**A**			x
SA-4 (3)	*ACQUISITION PROCESS | DEVELOPMENT METHODS / TECHNIQUES / PRACTICES*		**A**			
SA-4 (4)	*ACQUISITION PROCESS | ASSIGNMENT OF COMPONENTS TO SYSTEMS*		**A**		x	x
SA-4 (5)	*ACQUISITION PROCESS | COMPONENT CONFIGURATIONS*		**A**			
SA-4 (6)	*ACQUISITION PROCESS | USE OF INFORMATION ASSURANCE PRODUCTS*		**A**			
SA-4 (7)	*ACQUISITION PROCESS | U.S. GOVERNMENT PROTECTION PROFILES*		**A**			
SA-4 (8)	*ACQUISITION PROCESS | CONTINUOUS MONITORING PLAN*		**A**			
SA-5	**Information System Documentation**		**A**	x	x	x
SA-5 (1)	*INFORMATION SYSTEM DOCUMENTATION | FUNCTIONAL PROPERTIES OF SECURITY CONTROLS*		**A**		x	x
SA-5 (2)	*INFORMATION SYSTEM DOCUMENTATION | SECURITY-RELEVANT EXTERNAL SYSTEM INTERFACES*		**A**			x
SA-5 (3)	*INFORMATION SYSTEM DOCUMENTATION | HIGH-LEVEL DESIGN*		**A**		x	x
SA-5 (4)	*INFORMATION SYSTEM DOCUMENTATION | LOW-LEVEL DESIGN*		**A**			
SA-5 (5)	*INFORMATION SYSTEM DOCUMENTATION | SOURCE CODE*		**A**			
SA-5 (6)	*INFORMATION SYSTEM DOCUMENTATION | FUNCTIONS / PORTS / PROTOCOLS / SERVICES IN USE*		**A**		x	x
SA-6	**Software Usage Restrictions**	**W**	Incorporated into CM-10 and SI-7.			
SA-7	**User-Installed Software**	**W**	Incorporated into CM-11 and SI-7.			
SA-8	**Security Engineering Principles**		**A**		x	x
SA-9	**External Information System Services**		**A**	x	x	x
SA-9 (1)	*EXTERNAL INFORMATION SYSTEMS | RISK ASSESSMENTS / ORGANIZATIONAL APPROVALS*		**A**			
SA-9 (2)	*EXTERNAL INFORMATION SYSTEMS | IDENTIFICATION OF FUNCTIONS / PORTS / PROTOCOLS / SERVICES*		**A**		x	x
SA-9 (3)	*EXTERNAL INFORMATION SYSTEMS | ESTABLISH / MAINTAIN CHAIN OF TRUST WITH PROVIDERS*		**A**			x
SA-9 (4)	*EXTERNAL INFORMATION SYSTEMS | CONSISTENT INTERESTS OF CONSUMERS AND PROVIDERS*		**A**			
SA-9 (5)	*EXTERNAL INFORMATION SYSTEMS | PROCESSING, STORAGE, AND SERVICE LOCATION*		**A**			
SA-10	**Developer Configuration Management**		**A**		x	x
SA-10 (1)	*DEVELOPER CONFIGURATION MANAGEMENT | SOFTWARE / FIRMWARE INTEGRITY VERIFICATION*		**A**			
SA-10 (2)	*DEVELOPER CONFIGURATION MANAGEMENT | ALTERNATIVE CONFIGURATION MANAGEMENT PROCESSES*		**A**			
SA-10 (3)	*DEVELOPER CONFIGURATION MANAGEMENT | HARDWARE INTEGRITY VERIFICATION*		**A**			
SA-11	**Developer Security Testing**		**A**		x	x

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SA-11 (1)	*DEVELOPER SECURITY TESTING | CODE ANALYSIS TOOLS*		**A**			
SA-11 (2)	*DEVELOPER SECURITY TESTING | THREAT AND VULNERABILITY ANALYSES / FLAW REMEDIATION*		**A**			
SA-11 (3)	*DEVELOPER SECURITY TESTING | INDEPENDENT VERIFICATION OF TESTING / RESULTS*		**A**			
SA-11 (4)	*DEVELOPER SECURITY TESTING | MANUAL CODE REVIEWS*		**A**			
SA-11 (5)	*DEVELOPER SECURITY TESTING | PENETRATION TESTING*		**A**			
SA-11 (6)	*DEVELOPER SECURITY TESTING | UNIT / INTEGRATION / REGRESSION TESTING*		**A**			
SA-11 (7)	*DEVELOPER SECURITY TESTING | ATTACK SURFACE REVIEWS*		**A**			
SA-11 (8)	*DEVELOPER SECURITY TESTING | VERIFY SCOPE OF TESTING*		**A**			
SA-12	**Supply Chain Protection**		**A**			X
SA-12 (1)	*SUPPLY CHAIN PROTECTION | ACQUISITION STRATEGIES / TOOLS / METHODS*		**A**			
SA-12 (2)	*SUPPLY CHAIN PROTECTION | SUPPLIER REVIEWS*		**A**			
SA-12 (3)	*SUPPLY CHAIN PROTECTION | TRUSTED SHIPPING AND WAREHOUSING*	**W**	Incorporated into SA-12.			
SA-12 (4)	*SUPPLY CHAIN PROTECTION | DIVERSITY OF SUPPLIERS*	**W**	Incorporated into SA-12.			
SA-12 (5)	*SUPPLY CHAIN PROTECTION | LIMITATION OF HARM*		**A**			
SA-12 (6)	*SUPPLY CHAIN PROTECTION | MINIMIZING PROCUREMENT TIME*	**W**	Incorporated into SA-12.			
SA-12 (7)	*SUPPLY CHAIN PROTECTION | ASSESSMENTS PRIOR TO SELECTION / ACCEPTANCE / UPDATE*		**A**			
SA-12 (8)	*SUPPLY CHAIN PROTECTION | USE OF ALL-SOURCE INTELLIGENCE*		**A**			
SA-12 (9)	*SUPPLY CHAIN PROTECTION | OPERATIONS SECURITY*		**A**			
SA-12 (10)	*SUPPLY CHAIN PROTECTION | UNAUTHORIZED MODIFICATIONS*		**A**			
SA-12 (11)	*SUPPLY CHAIN PROTECTION | VALIDATE AS GENUINE AND NOT ALTERED*		**A**			
SA-12 (12)	*SUPPLY CHAIN PROTECTION | PENETRATION TESTING / ANALYSIS OF SUPPLY CHAIN ELEMENTS*		**A**			
SA-12 (13)	*SUPPLY CHAIN PROTECTION | INTER-ORGANIZATIONAL AGREEMENTS*		**A**			
SA-12 (14)	*SUPPLY CHAIN PROTECTION | CRITICAL INFORMATION SYSTEM COMPONENTS*		**A**			
SA-12 (15)	*SUPPLY CHAIN PROTECTION | PROCESSES TO ADDRESS WEAKNESSES OR DEFICIENCIES*		**A**			
SA-13	**Trustworthiness**	**W**	Incorporated into Appendix E.			
SA-14	**Critical Information System Components**		**A**			
SA-14 (1)	*SUPPLY CHAIN PROTECTION | NO ALTERNATIVE SOURCING*	**W**	Incorporated into SA-12.			
SA-15	**Development Process, Standards, and Tools**		**A**			X
SA-15 (1)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | QUALITY METRICS*		**A**			
SA-15 (2)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | SECURITY TRACKING TOOLS*		**A**			
SA-15 (3)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | CRITICALITY ANALYSIS*		**A**			
SA-15 (4)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | THREAT MODELING / VULNERABILITY ANALYSIS*		**A**			
SA-15 (5)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | ATTACK SURFACE REDUCTION*		**A**			
SA-15 (6)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | CONTINUOUS IMPROVEMENT*		**A**			

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SA-15 (7)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | AUTOMATED VULNERABILITY ANALYSIS*		A			
SA-15 (8)	*DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | REUSE OF THREAT / VULNERABILITY INFORMATION*		A			
SA-16	**Developer-Provided Training**		A			X
SA-17	**Developer Security Architecture and Design**		A			X
SA-17 (1)	*DEVELOPER SECURITY ARCHITECTURE AND DESIGN | FORMAL POLICY MODEL*		A			
SA-17 (2)	*DEVELOPER SECURITY ARCHITECTURE AND DESIGN | SECURITY-RELEVANT COMPONENTS*		A			
SA-17 (3)	*DEVELOPER SECURITY ARCHITECTURE AND DESIGN | FORMAL CORRESPONDENCE*		A			
SA-18	**Tamper Resistance and Detection**		A			
SA-18 (1)	*TAMPER RESISTANCE AND DETECTION | MULTIPLE PHASES OF SDLC*		A			
SA-19	**Anti-Counterfeit**		A			

TABLE D-18: SUMMARY — SYSTEM AND COMMUNICATIONS PROTECTION CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SC-1	**System and Communications Protection Policy and Procedures**		**A**	x	x	x
SC-2	**Application Partitioning**		**A**		x	x
SC-2 (1)	*APPLICATION PARTITIONING | INTERFACES FOR NON-PRIVILEGED USERS*		**A**			
SC-3	**Security Function Isolation**		**A**			x
SC-3 (1)	*SECURITY FUNCTION ISOLATION | HARDWARE SEPARATION*		**A**			
SC-3 (2)	*SECURITY FUNCTION ISOLATION | ACCESS / FLOW CONTROL FUNCTIONS*		**A**			
SC-3 (3)	*SECURITY FUNCTION ISOLATION | MINIMIZE NONSECURITY FUNCTIONALITY*		**A**			
SC-3 (4)	*SECURITY FUNCTION ISOLATION | MODULE COUPLING*		**A**			
SC-3 (5)	*SECURITY FUNCTION ISOLATION | LAYERED STRUCTURES*		**A**			
SC-3 (6)	*SECURITY FUNCTION ISOLATION | BOUNDARY PROTECTION MECHANISMS*		**A**			x
SC-3 (7)	*SECURITY FUNCTION ISOLATION | MODULE COHESION*		**A**			
SC-4	**Information in Shared Resources**				x	x
SC-4 (1)	*INFORMATION IN SHARED RESOURCES | SECURITY LEVELS*	**W**	Incorporated into SC-4.			
SC-4 (2)	*INFORMATION IN SHARED RESOURCES | CLASSIFICATION LEVELS / SECURITY CATEGORIES*					
SC-5	**Denial of Service Protection**			x	x	x
SC-5 (1)	*DENIAL OF SERVICE PROTECTION | RESTRICT INTERNAL USERS*					
SC-5 (2)	*DENIAL OF SERVICE PROTECTION | EXCESS CAPACITY / BANDWIDTH / REDUNDANCY*					
SC-5 (3)	*DENIAL OF SERVICE PROTECTION | DETECTION / MONITORING*					
SC-6	**Resource Availability**		**A**			
SC-7	**Boundary Protection**			x	x	x
SC-7 (1)	*BOUNDARY PROTECTION | PHYSICALLY SEPARATED SUBNETWORKS*				x	x
SC-7 (2)	*BOUNDARY PROTECTION | PUBLIC ACCESS*	**W**	Incorporated into SC-7.			
SC-7 (3)	*BOUNDARY PROTECTION | ACCESS POINTS*				x	x
SC-7 (4)	*BOUNDARY PROTECTION | EXTERNAL TELECOMMUNICATIONS SERVICES*				x	x
SC-7 (5)	*BOUNDARY PROTECTION | DENY BY DEFAULT / ALLOW BY EXCEPTION*				x	x
SC-7 (6)	*BOUNDARY PROTECTION | RESPONSE TO RECOGNIZED FAILURES*					x
SC-7 (7)	*BOUNDARY PROTECTION | REMOTE DEVICES*				x	x
SC-7 (8)	*BOUNDARY PROTECTION | ROUTE TRAFFIC TO AUTHENTICATED PROXY SERVERS*					x
SC-7 (9)	*BOUNDARY PROTECTION | RESTRICT OUTGOING COMMUNICATIONS TRAFFIC*					
SC-7 (10)	*BOUNDARY PROTECTION | UNAUTHORIZED EXFILTRATION*					
SC-7 (11)	*BOUNDARY PROTECTION | RESTRICT INCOMING COMMUNICATIONS TRAFFIC*					
SC-7 (12)	*BOUNDARY PROTECTION | HOST-BASED PROTECTION*					
SC-7 (13)	*BOUNDARY PROTECTION | ISOLATION OF SECURITY TOOLS / MECHANISMS / SUPPORT COMPONENTS*					
SC-7 (14)	*BOUNDARY PROTECTION | UNAUTHORIZED PHYSICAL CONNECTIONS*					
SC-7 (15)	*BOUNDARY PROTECTION | ROUTE PRIVILEGED NETWORK ACCESSES*					

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SC-7 (16)	*BOUNDARY PROTECTION | PREVENT DISCOVERY OF COMPONENTS / DEVICES*					
SC-7 (17)	*BOUNDARY PROTECTION | AUTOMATED ENFORCEMENT OF PROTOCOL FORMATS*					
SC-7 (18)	*BOUNDARY PROTECTION | FAIL SECURE*					
SC-7 (19)	*BOUNDARY PROTECTION | BLOCKING INBOUND / OUTBOUND COMMUNICATIONS TRAFFIC*					
SC-7 (20)	*BOUNDARY PROTECTION | DYNAMIC ISOLATION / SEGREGATION*					
SC-8	**Transmission Integrity**				X	X
SC-8 (1)	*TRANSMISSION INTEGRITY | CRYPTOGRAPHIC OR ALTERNATE PHYSICAL PROTECTION*				X	X
SC-8 (2)	*TRANSMISSION INTEGRITY | INTEGRITY PRIOR TO TRANSMISSION*					
SC-9	**Transmission Confidentiality**				X	X
SC-9 (1)	*TRANSMISSION CONFIDENTIALITY | CRYPTOGRAPHIC OR ALTERNATE PHYSICAL PROTECTION*				X	X
SC-9 (2)	*TRANSMISSION CONFIDENTIALITY | PRIOR TO TRANSMISSION*					
SC-9 (3)	*TRANSMISSION CONFIDENTIALITY | CRYPTOGRAPHIC OR ALTERNATIVE PROTECTION FOR MESSAGE EXTERNALS*					
SC-9 (4)	*TRANSMISSION CONFIDENTIALITY | CONCEAL / RANDOMIZE COMMUNICATIONS*					
SC-10	**Network Disconnect**				X	X
SC-11	**Trusted Path**		**A**			
SC-12	**Cryptographic Key Establishment and Management**			X	X	X
SC-12 (1)	*CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | AVAILABILITY*					X
SC-12 (2)	*CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | SYMMETRIC KEYS*					
SC-12 (3)	*CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | ASYMMETRIC KEYS*					
SC-12 (4)	*CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | PKI CERTIFICATES*	**W**	Incorporated into SC-12.			
SC-12 (5)	*CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | PKI CERTIFICATES / HARDWARE TOKENS*	**W**	Incorporated into SC-12.			
SC-13	**Cryptographic Protection**			X	X	X
SC-13 (1)	*CRYPTOGRAPHIC PROTECTION | FIPS-VALIDATED CRYPTOGRAPHY*					
SC-13 (2)	*CRYPTOGRAPHIC PROTECTION | NSA-APPROVED CRYPTOGRAPHY*					
SC-13 (3)	*CRYPTOGRAPHIC PROTECTION | INDIVIDUALS WITHOUT FORMAL ACCESS APPROVALS*					
SC-13 (4)	*CRYPTOGRAPHIC PROTECTION | DIGITAL SIGNATURES*					
SC-14	**Public Access Protections**			X	X	X
SC-15	**Collaborative Computing Devices**			X	X	X
SC-15 (1)	*COLLABORATIVE COMPUTING DEVICES | PHYSICAL DISCONNECT*					
SC-15 (2)	*COLLABORATIVE COMPUTING DEVICES | BLOCKING INBOUND / OUTBOUND COMMUNICATIONS TRAFFIC*	**W**	Incorporated into SC-7.			
SC-15 (3)	*COLLABORATIVE COMPUTING DEVICES | DISABLING / REMOVAL IN SECURE WORK AREAS*					
SC-15 (4)	*COLLABORATIVE COMPUTING DEVICES | EXPLICITLY INDICATE CURRENT PARTICIPANTS*					
SC-16	**Transmission of Security Attributes**					
SC-16 (1)	*TRANSMISSION OF SECURITY ATTRIBUTES | INTEGRITY VALIDATION*					

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SC-17	**Public Key Infrastructure Certificates**				X	X
SC-18	**Mobile Code**				X	X
SC-18 (1)	*MOBILE CODE | IDENTIFY UNACCEPTABLE CODE / TAKE CORRECTIVE ACTIONS*					
SC-18 (2)	*MOBILE CODE | ACQUISITION / DEVELOPMENT / USE*					
SC-18 (3)	*MOBILE CODE | PREVENT DOWNLOADING / EXECUTION*					
SC-18 (4)	*MOBILE CODE | PREVENT AUTOMATIC EXECUTION*					
SC-18 (5)	*MOBILE CODE | ALLOW EXECUTION IN ONLY IN CONFINED ENVIRONMENTS*					
SC-19	**Voice Over Internet Protocol**				X	X
SC-20	**Secure Name /Address Resolution Service (Authoritative Source)**			X	X	X
SC-20 (1)	*SECURE NAME / ADDRESS RESOLUTION SERVICE (AUTHORITATIVE SOURCE) | CHILD SUBSPACES*	**W**	Incorporated into SC-20.			
SC-20 (2)	*SECURE NAME / ADDRESS RESOLUTION SERVICE (AUTHORITATIVE SOURCE) | DATA ORIGIN / INTEGRITY*					
SC-21	**Secure Name /Address Resolution Service (Recursive or Caching Resolver)**			X	X	X
SC-21 (1)	*SECURE NAME / ADDRESS RESOLUTION SERVICE (RECURSIVE OR CACHING RESOLVER) | DATA ORIGIN / INTEGRITY*	**W**	Incorporated into SC-21.			
SC-22	**Architecture and Provisioning for Name/Address Resolution Service**			X	X	X
SC-23	**Session Authenticity**				X	X
SC-23 (1)	*SESSION AUTHENTICITY | INVALIDATE SESSION IDENTIFIERS AT LOGOUT*					
SC-23 (2)	*SESSION AUTHENTICITY | USER-INITIATED LOGOUTS / MESSAGE DISPLAYS*					
SC-23 (3)	*SESSION AUTHENTICITY | UNIQUE SESSION IDENTIFIERS*					
SC-23 (4)	*SESSION AUTHENTICITY | UNIQUE SESSION IDENTIFIERS WITH RANDOMIZATION*					
SC-23 (5)	*SESSION AUTHENTICITY | ALLOWED CERTIFICATE AUTHORITIES*					
SC-24	**Fail in Known State**		**A**			X
SC-25	**Thin Nodes**					
SC-26	**Honeypots**					
SC-26 (1)	*HONEYPOTS | DETECTION OF MALICIOUS CODE*	**W**	Incorporated into SC-36.			
SC-27	**Operating System-Independent Applications**					
SC-28	**Protection of Information at Rest**				X	X
SC-28 (1)	*PROTECTION OF INFORMATION AT REST | CRYPTOGRAPHIC PROTECTION*					
SC-29	**Heterogeneity**		**A**			
SC-29 (1)	*HETEROGENEITY | VIRTUALIZATION TECHNIQUES*		**A**			
SC-30	**Concealment and Misdirection**		**A**			
SC-30 (1)	*CONCEALMENT AND MISDIRECTION | VIRTUALIZATION TECHNIQUES*	**W**	Incorporated into SC-29.			
SC-30 (2)	*CONCEALMENT AND MISDIRECTION | RANDOMNESS*		**A**			
SC-30 (3)	*CONCEALMENT AND MISDIRECTION | CHANGE PROCESSING / STORAGE LOCATIONS*		**A**			
SC-30 (4)	*CONCEALMENT AND MISDIRECTION | MISLEADING INFORMATION*		**A**			
SC-30 (5)	*CONCEALMENT AND MISDIRECTION | CONCEALMENT OF SYSTEM COMPONENTS*		**A**			

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SC-31	**Covert Channel Analysis**		**A**			
SC-31 (1)	*COVERT CHANNEL ANALYSIS | TESTING OF DEVELOPER-IDENTIFIED COVERT CHANNELS*	**W**	Incorporated into SC-31.			
SC-31 (2)	*COVERT CHANNEL ANALYSIS | MAXIMUM BANDWIDTH*		**A**			
SC-31 (3)	*COVERT CHANNEL ANALYSIS | MEASURE BANDWIDTH IN OPERATIONAL ENVIRONMENTS*		**A**			
SC-32	**Information System Partitioning**		**A**		X	X
SC-33	**Transmission Preparation Integrity**	**W**	Incorporated into SC-8.			
SC-34	**Non-Modifiable Executable Programs**		**A**			
SC-34 (1)	*NON-MODIFIABLE EXECUTABLE PROGRAMS | NO WRITABLE STORAGE*		**A**			
SC-34 (2)	*NON-MODIFIABLE EXECUTABLE PROGRAMS | INTEGRITY PROTECTION / READ-ONLY MEDIA*		**A**			
SC-35	**Technical Surveillance Countermeasures Survey**					
SC-36	**Honeyclients**					
SC-37	**Distributed Processing and Storage**		**A**			
SC-37 (1)	*DISTRIBUTED PROCESSING AND STORAGE | DIVERSITY OF IMPLEMENTATION*		**A**			
SC-37 (2)	*DISTRIBUTED PROCESSING AND STORAGE | POLLING TECHNIQUES*		**A**			
SC-38	**Malware Analysis**		**A**			
SC-39	**Out-of-Band Channels**		**A**			
SC-39 (1)	*OUT-OF-BAND CHANNELS | ENSURE DELIVERY / TRANSMISSION*		**A**			
SC-40	**Operations Security**		**A**			
SC-41	**Process Isolation**		**A**	X	X	X
SC-41 (1)	*PROCESS ISOLATION | HARDWARE SEPARATION*		**A**			
SC-41 (2)	*PROCESS ISOLATION | THREAD ISOLATION*		**A**			
SC-42	**Wireless Link Protection**					
SC-42 (1)	*WIRELESS LINK PROTECTION | ELECTROMAGNETIC INTERFERENCE*					
SC-42 (2)	*WIRELESS LINK PROTECTION | REDUCE DETECTION POTENTIAL*					
SC-42 (3)	*WIRELESS LINK PROTECTION | IMITATIVE OR MANIPULATIVE COMMUNICATIONS DECEPTION*					
SC-42 (4)	*WIRELESS LINK PROTECTION | SIGNAL PARAMETER IDENTIFICATION*					

TABLE D-19: SUMMARY — SYSTEM AND INFORMATION INTEGRITY CONTROLS

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SI-1	**System and Information Integrity Policy and Procedures**		**A**	X	X	X
SI-2	**Flaw Remediation**			X	X	X
SI-2 (1)	*FLAW REMEDIATION | CENTRAL MANAGEMENT AND AUTOMATIC SOFTWARE / FIRMWARE UPDATES*					X
SI-2 (2)	*FLAW REMEDIATION | AUTOMATED FLAW REMEDIATION STATUS*				X	X
SI-2 (3)	*FLAW REMEDIATION | TIME TO REMEDIATE FLAWS / CORRECTIVE ACTIONS*					
SI-2 (4)	*FLAW REMEDIATION | AUTOMATED PATCH MANAGEMENT TOOLS*	**W**	Incorporated into SI-2.			
SI-3	**Malicious Code Protection**			X	X	X
SI-3 (1)	*MALICIOUS CODE PROTECTION | CENTRAL MANAGEMENT*				X	X
SI-3 (2)	*MALICIOUS CODE PROTECTION | AUTOMATIC UPDATES*				X	X
SI-3 (3)	*MALICIOUS CODE PROTECTION | NON-PRIVILEGED USERS*				X	X
SI-3 (4)	*MALICIOUS CODE PROTECTION | UPDATES ONLY BY PRIVILEGED USERS*					
SI-3 (5)	*MALICIOUS CODE PROTECTION | REMOVABLE MEDIA*	**W**	Incorporated into MP-7.			
SI-3 (6)	*MALICIOUS CODE PROTECTION | TESTING / VERIFICATION*					
SI-3 (7)	*MALICIOUS CODE PROTECTION | NON SIGNATURE-BASED DETECTION*					
SI-3 (8)	*MALICIOUS CODE PROTECTION | DETECT UNAUTHORIZED COMMANDS*					
SI-4	**Information System Monitoring**		**A**	X	X	X
SI-4 (1)	*INFORMATION SYSTEM MONITORING | SYSTEM-WIDE INTRUSION DETECTION SYSTEM*		**A**			
SI-4 (2)	*INFORMATION SYSTEM MONITORING | AUTOMATED TOOLS FOR REAL-TIME ANALYSIS*		**A**		X	X
SI-4 (3)	*INFORMATION SYSTEM MONITORING | AUTOMATED TOOL INTEGRATION*		**A**			
SI-4 (4)	*INFORMATION SYSTEM MONITORING | INBOUND AND OUTBOUND COMMUNICATIONS TRAFFIC*		**A**		X	X
SI-4 (5)	*INFORMATION SYSTEM MONITORING | NEAR REAL-TIME ALERTS*		**A**		X	X
SI-4 (6)	*INFORMATION SYSTEM MONITORING | RESTRICT NON-PRIVILEGED USERS*		**A**		X	X
SI-4 (7)	*INFORMATION SYSTEM MONITORING | AUTOMATED RESPONSE TO SUSPICIOUS EVENTS*		**A**			
SI-4 (8)	*INFORMATION SYSTEM MONITORING | PROTECTION OF MONITORING INFORMATION*		**A**			
SI-4 (9)	*INFORMATION SYSTEM MONITORING | TESTING OF MONITORING TOOLS*		**A**			
SI-4 (10)	*INFORMATION SYSTEM MONITORING | VISIBILITY OF ENCRYPTED COMMUNICATIONS*		**A**			
SI-4 (11)	*INFORMATION SYSTEM MONITORING | ANALYZE COMMUNICATIONS TRAFFIC ANOMALIES*		**A**			
SI-4 (12)	*INFORMATION SYSTEM MONITORING | AUTOMATED ALERTS*		**A**			
SI-4 (13)	*INFORMATION SYSTEM MONITORING | ANALYZE TRAFFIC / EVENT PATTERNS*		**A**			
SI-4 (14)	*INFORMATION SYSTEM MONITORING | WIRELESS INTRUSION DETECTION*		**A**			
SI-4 (15)	*INFORMATION SYSTEM MONITORING | WIRELESS TO WIRELINE COMMUNICATIONS*		**A**			
SI-4 (16)	*INFORMATION SYSTEM MONITORING | CORRELATE MONITORING INFORMATION*		**A**			

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SI-4 (17)	*INFORMATION SYSTEM MONITORING | INTEGRATED SITUATIONAL AWARENESS*		**A**			
SI-4 (18)	*INFORMATION SYSTEM MONITORING | ANALYZE TRAFFIC / COVERT EXFILTRATION*		**A**			
SI-4 (19)	*INFORMATION SYSTEM MONITORING | INDIVIDUALS POSING GREATER RISK*		**A**			
SI-4 (20)	*INFORMATION SYSTEM MONITORING | PRIVILEGED USER*		**A**			
SI-4 (21)	*INFORMATION SYSTEM MONITORING | PROBATIONARY PERIODS*		**A**			
SI-4 (22)	*INFORMATION SYSTEM MONITORING | UNAUTHORIZED NETWORK SERVICES*		**A**			
SI-4 (23)	*INFORMATION SYSTEM MONITORING | HOST-BASED DEVICES*		**A**			
SI-5	**Security Alerts, Advisories, and Directives**		**A**	X	X	X
SI-5 (1)	*SECURITY ALERTS, ADVISORIES, AND DIRECTIVES | AUTOMATED ALERTS AND ADVISORIES*		**A**			X
SI-6	**Security Function Verification**		**A**			X
SI-6 (1)	*SECURITY FUNCTION VERIFICATION | NOTIFICATION OF FAILED SECURITY TESTS*	**W**	Incorporated into SI-6.			
SI-6 (2)	*SECURITY FUNCTION VERIFICATION | AUTOMATION SUPPORT FOR DISTRIBUTED TESTING*					
SI-6 (3)	*SECURITY FUNCTION VERIFICATION | REPORT VERIFICATION RESULTS*					
SI-7	**Software, Firmware, and Information Integrity**		**A**		X	X
SI-7 (1)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | INTEGRITY SCANS*		**A**		X	X
SI-7 (2)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | AUTOMATED NOTIFICATIONS*		**A**			X
SI-7 (3)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CENTRALLY-MANAGED INTEGRITY TOOLS*		**A**			
SI-7 (4)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | TAMPER-EVIDENT PACKAGING*	**W**	Incorporated into SA-12.			
SI-7 (5)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | AUTOMATED RESPONSE TO INTEGRITY VIOLATIONS*		**A**			X
SI-7 (6)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CRYPTOGRAPHIC PROTECTION*		**A**			
SI-7 (7)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | HARDWARE-BASED PROTECTION*		**A**			
SI-7 (8)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | INTEGRATION OF DETECTION AND RESPONSE*		**A**		X	X
SI-7 (9)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | AUDITING CAPABILITY FOR SIGNIFICANT EVENTS*		**A**			
SI-7 (10)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | VERIFY BOOT PROCESS*		**A**			
SI-7 (11)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | PROTECTION OF BOOT FIRMWARE*		**A**			
SI-7 (12)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CONFINED ENVIRONMENTS WITH LIMITED PRIVILEGES*		**A**			
SI-7 (13)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | INTEGRITY VERIFICATION*		**A**			
SI-7 (14)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CODE EXECUTION IN PROTECTED ENVIRONMENTS*		**A**			
SI-7 (15)	*SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | BINARY OR MACHINE EXECUTABLE CODE*		**A**			X

CNTL NO.	CONTROL NAME *Control Enhancement Name*	WITHDRAWN	ASSURANCE	CONTROL BASELINES		
				LOW	MOD	HIGH
SI-8	**Spam Protection**				X	X
SI-8 (1)	*SPAM PROTECTION | CENTRAL MANAGEMENT OF PROTECTION MECHANISMS*				X	X
SI-8 (2)	*SPAM PROTECTION | AUTOMATIC UPDATES*				X	X
SI-8 (3)	*SPAM PROTECTION | CONTINUOUS LEARNING CAPABILITY*					
SI-9	**Information Input Restrictions**				X	X
SI-9 (1)	*INFORMATION INPUT RESTRICTIONS | PROTECT REMOTE COMMANDS*					
SI-9 (2)	*INFORMATION INPUT RESTRICTIONS | DETECT UNAUTHORIZED COMMANDS*					
SI-10	**Information Input Validation**		**A**		X	X
SI-10 (1)	*INFORMATION INPUT VALIDATION | MANUAL OVERRIDE CAPABILITY*					
SI-10 (2)	*INFORMATION INPUT VALIDATION | REVIEW / RESOLUTION OF ERRORS*					
SI-10 (3)	*INFORMATION INPUT VALIDATION | PREDICTABLE BEHAVIOR*					
SI-10 (4)	*INFORMATION INPUT VALIDATION | REVIEW / TIMING INTERACTIONS*					
SI-11	**Error Handling**				X	X
SI-12	**Information Output Handling and Retention**			X	X	X
SI-13	**Predictable Failure Prevention**	**W**	Incorporated into CP-11.			
SI-14	**Non-Persistence**		**A**			

APPENDIX E

ASSURANCE AND TRUSTWORTHINESS

MEASURES OF CONFIDENCE FOR LOW, MODERATE, AND HIGH-IMPACT SYSTEMS

Security assurance is a critical aspect in determining the trustworthiness of information systems. Assurance is the measure of confidence that the security functions, features, practices, procedures, mechanisms, and architecture of organizational information systems accurately mediate/enforce established security policies.[83] The objective of this appendix is:

- To encourage acquisition organizations to include assurance requirements in procurements of information systems, system components, and services;
- To encourage hardware, software, and firmware developers to employ development practices that result in more trustworthy information technology products and systems;
- To encourage information systems integrators to select information technology products that have been built with higher assurance and to employ sound systems and security engineering techniques and methods during the systems integration process; and
- To increase security capability by facilitating the deployment of more trustworthy information technology products within critical information systems or system components.

Minimum security requirements for federal information and information systems are required by FIPS Publication 200. These requirements, including the minimum assurance requirements, can be satisfied by selecting and implementing the security controls in the low, moderate, or high baselines in Appendix D.[84] The assurance-related controls in the baselines reflect the minimum assurance requirements that are generally applicable to federal information and information systems.[85] However, considering the current threat space (i.e., capabilities, intentions, targeting activities of adversaries) and the risk to organizational operations and assets, individuals, other organizations, and the Nation, posed by the advanced persistent threat (APT), organizations may choose to implement additional assurance-related controls from Appendix F. These additional controls can be selected based on the tailoring guidance provided in Section 3.2. Organizations can also consider creating specific high-assurance overlays for critical missions and business functions, specialized environments of operation, or information technologies (see Section 3.2 and Appendix I). When assurance-related controls cannot be satisfied, organizations can propose compensating controls (e.g., procedural or operational solutions to compensate for insufficient technology-based solutions) or assume a greater degree of risk with regard to the actual security capability achieved.

[83] Assurance can also be viewed as the extent to which the security functionality is implemented correctly, operating as intended, and producing the desired outcome with respect to meeting stated security requirements.

[84] CNSS Instruction 1253 provides security control baselines for national security systems. Therefore, the assurance-related controls in the baselines established for the national security community, if so designated, may differ from those controls designated in Tables E-1 through E-3.

[85] It is difficult to determine if a given security control baseline from Appendix D provides the assurance needed across all applicable information technologies, users, platforms, and organizations. For example, while the use of formal methods might be appropriate in a cross-domain product, different assurance techniques might be appropriate for a complex air traffic control system or for a web server providing emergency preparedness information from the Department of Homeland Security. Still, the existing baselines do have assurance aspects that reflect the minimum assurance that is anticipated to be common across all technologies, users, platforms, and organizations.

As illustrated in Figure 3 (Section 2.6), the actions taken by developers, implementers, operators, and assessors produce many different types of *security evidence* that is used to provide assurance in the security functionality employed in the information systems and environment in which those systems operate—ultimately contributing to the security capability achieved and trustworthiness of the systems. With regard to the security evidence produced, the *depth* and *coverage* of such evidence can affect the level of assurance in the functionality implemented. Depth and coverage are attributes associated with assessment methods and the generation of security evidence. The assessment methods can be applied to developmental and operational assurance. With regard to developmental assurance, depth is associated with the rigor, level of detail, and formality of the artifacts produced during the design and development of the hardware, software, and firmware components of information systems (e.g., functional specifications, high-level design, low-level design, and implementation representation). The level of detail available in development artifacts can affect the type of testing, evaluation, and analysis conducted during the system development life cycle (e.g., black-box testing, gray-box testing, white-box testing, static/dynamic analysis). For operational assurance, the depth attribute addresses the number and types of assurance-related security controls selected and implemented. In contrast, the coverage attribute is associated with the assessment methods employed during development and operations, addressing the scope and breadth of assessment objects included in the assessments (e.g., number/types of tests conducted on source code, number of software modules reviewed, number of network nodes/mobile devices scanned for vulnerabilities, number of individuals interviewed to check basic understanding of contingency responsibilities).[86]

The following sections provide a description of the minimum assurance requirements for federal information systems and the assurance-related controls that are included in each of the security control baselines in Appendix D to ensure the requirements are satisfied. The criteria for whether a particular security control is assurance-related or functionality-related is based on the overall characteristics or properties of the control. In general, assurance-related controls are controls that address: (i) processes, procedures, techniques, or methodologies for designing and developing information systems, system components (i.e., hardware, software, or firmware), or supporting operational processes including improving the quality of those systems/components/processes; or (ii) developmental/operational activities that produce security evidence, help determine security control effectiveness or risk (e.g., audit, testing, evaluation, analysis, assessment, verification, validation, monitoring, authorization), or improve personnel skills, expertise, and understanding (e.g., security awareness/training, incident response training, contingency training).

Security controls may be designated as assurance-related controls even when the controls exhibit some functional characteristics or properties as well (e.g., SI-4, Information System Monitoring). The distinction between functionality and assurance is less important when describing the assurance-related controls in the baselines—primarily because the security controls in the three baselines after the tailoring process is applied, become part of the security plans for information systems or organizations. However, the distinction becomes more important in Table E-4 when organizations can exercise the option of selecting additional security controls on an optional basis to increase the assurance in security functionality. The controls in Table E-4 were identified using the same criteria as described above for the designation of assurance-related controls in the initial baselines. Whether security controls are designated as functionality-related or assurance-related, the controls contribute to the security capability achieved by organizations.

[86] NIST Special Publication 800-53A provides guidance on the generation of security evidence related to security assessments conducted during the system development life cycle.

Minimum Assurance for Low-Impact Systems

Assurance Requirement: The organization, based on its security requirements, security policies, and needed security capabilities, has an expectation of: (i) a **limited** strength of security functionality; and (ii) a **limited** degree of confidence supported by the depth and coverage of associated security evidence, that the security functionality is complete, consistent, and correct.

Supplemental Guidance: Security functionality and assurance are implemented in the form of security controls selected from Appendix F. Minimum assurance for low-impact systems and the information technology components that compose those systems, aligns with that which is readily achievable with unmodified, commercial off-the-shelf (COTS) products and services. Due to the limited strength of functionality expected for low-impact systems, the depth and coverage of security evidence produced is minimal and is not expected to be more than what is routinely provided by COTS manufacturers, vendors, and resellers, supplemented by the results of security control assessments and monitoring of organizational information systems and environments of operation. For other than technology-based functionality, the emphasis is on a limited degree of confidence in the completeness, correctness, and consistency of procedural/operational security functionality (e.g., policies, procedures, physical security, and personnel security). Minimum assurance requirements in the form of developmental and operational assurance controls for low-impact information systems are listed in Table E-1. Organizations, through the tailoring process (including an organizational assessment of risk), may choose to designate other security controls as assurance-related and add to the minimum set in Table E-1.

TABLE E-1: MINIMUM ASSURANCE CONTROLS FOR LOW-IMPACT SYSTEMS[87]

ID	CONTROLS	ID	CONTROLS
AC	AC-1	MP	MP-1
AT	AT-1, AT-2, AT-3, AT-4	PE	PE-1, PE-6, PE-8
AU	AU-1, AU-6	PL	PL-1, PL-2, PL-4
CA	CA-1, CA-2, CA-3, CA-5, CA-6, CA-7	PS	PS-1, PS-6, PS-7
CM	CM-1, CM-2, CM-8	RA	RA-1, RA-3, RA-5
CP	CP-1, CP-3, CP-4	SA	SA-1, SA-2, SA-3, SA-4, SA-5, SA-9
IA	IA-1	SC	SC-1, SC-41
IR	IR-1, IR-2, IR-5	SI	SI-1, SI-4, SI-5
MA	MA-1		

[87] Implementing the assurance-related controls from Appendix D represented in Table E.1 will satisfy the minimum assurance requirements for low-impact systems mandated by FIPS 200.

Minimum Assurance for Moderate-Impact Systems

Assurance Requirement: The organization, based on its security requirements, security policies, and needed security capabilities, has an expectation of: (i) a **moderate** strength of security functionality; and (ii) a **moderate** degree of confidence supported by the depth and coverage of associated security evidence, that the security functionality is complete, consistent, and correct.

Supplemental Guidance: Security functionality and assurance are implemented in the form of security controls selected from Appendix F. Minimum assurance for moderate-impact systems and the information technology components that compose those systems, adds to the expectations at the low assurance level by incorporating higher-end COTS security capabilities, perhaps some special development, establishing more secure configuration settings, and likely some additional assessment of implemented capability. Due to the moderate strength of functionality expected for moderate-impact systems, the security evidence produced is more substantial than the minimal evidence produced for low-impact systems but still in the range of what can be provided by COTS manufacturers, vendors, and resellers, supplemented by the results of additional security control assessments and ongoing monitoring of organizational information systems/environments of operation. For non-technology-based functionality, the emphasis is on a moderate degree of confidence in the completeness, correctness, and consistency of procedural/operational security functionality (e.g., policies, procedures, physical security, and personnel security). Minimum-assurance requirements in the form of developmental and operational assurance controls for moderate-impact information systems are listed in Table E-2. Organizations, through the tailoring process (including an organizational assessment of risk), may choose to designate other security controls as assurance-related and add to the minimum set in Table E-2.

TABLE E-2: MINIMUM ASSURANCE CONTROLS FOR MODERATE-IMPACT SYSTEMS[88]

ID	CONTROLS	ID	CONTROLS
AC	AC-1	MP	MP-1
AT	AT-1, AT-2, **AT-2 (2)**, AT-3, AT-4, **AT-5**	PE	PE-1, PE-6, **PE-6 (1)**, PE-8
AU	AU-1, AU-6, **AU-6 (1)**, **AU-6 (3)**, **AU-6 (9)**, AU-7, **AU-7 (1)**	PL	PL-1, PL-2, **PL-2 (3)**, PL-4, **PL-4 (1)**
CA	CA-1, CA-2, CA-3, **CA-2 (1)**, CA-5, CA-6, CA-7, **CA-7 (1)**	PS	PS-1, PS-6, PS-7, **PS-7 (1)**
CM	CM-1, CM-2, **CM-2 (1)**, **CM-2 (3)**, CM-3, **CM-3 (2)**, CM-4, **CM-8**, **CM-8 (1)**, **CM-8 (5)**	RA	RA-1, RA-3, RA-5, **RA-5 (1)**
CP	CP-1, CP-3, CP-4, **CP-4 (1)**	SA	SA-1, SA-2, SA-3, SA-4, **SA-4 (1)**, SA-5, **SA-5 (1)**, **SA-5 (3)**, **SA-8**, **SA-9**, **SA-9 (2)**, **SA-10**, **SA-11**
IA	IA-1	SC	SC-1, SC-2, **SC-32**, SC-41
IR	IR-1, IR-2, **IR-3**, **IR-3 (2)**, IR-5	SI	SI-1, SI-4, **SI-4 (2)**, **SI-4 (4)**, **SI-4 (5)**, **SI-4 (6)**, SI-5, SI-7, **SI-7 (1)**, **SI-7 (8)**, **SI-10**
MA	MA-1		

[88] Implementing the assurance-related controls from Appendix D represented in Table E.2 will satisfy the minimum assurance requirements for moderate-impact systems mandated by FIPS 200. The **bold** text indicates the *delta* from the low baseline (i.e., the assurance-related controls added to the low baseline to produce the increased level of assurance in the moderate baseline).

Minimum Assurance for High-Impact Systems

Assurance Requirement: The organization, based on its security requirements, security policies, and needed security capabilities, has an expectation of: (i) a **high** strength of security functionality; and (ii) a **high** degree of confidence supported by the depth and coverage of associated security evidence, that the security functionality is complete, consistent, and correct.

Supplemental Guidance: Security functionality and assurance are implemented in the form of security controls selected from Appendix F. Minimum assurance for high-impact systems and the information technology components that compose those systems, adds to the expectations at the moderate assurance level by incorporating higher-end COTS security capabilities that result from the application of commonly accepted good commercial development practices for reducing latent flaw rates, some special development, and additional assessment of implemented capability. Due to the high strength of functionality expected for high-impact systems, the security evidence produced is more comprehensive than the evidence produced for moderate-impact systems. The security evidence is supplemented by the results of additional security control assessments and the ongoing monitoring of organizational information systems/environments of operation. For non-technology-based functionality, the emphasis is on the high degree of confidence in the completeness, correctness, and consistency of procedural/operational security functionality (e.g., policies, procedures, physical security, and personnel security). Minimum assurance requirements in the form of developmental and operational assurance controls for high-impact information systems are listed in Table E-3. Organizations, through the tailoring process (including an organizational assessment of risk), may choose to designate other security controls as assurance-related and add to the minimum set in Table E-3.

TABLE E-3: MINIMUM ASSURANCE CONTROLS FOR HIGH-IMPACT SYSTEMS[89]

ID	CONTROLS	ID	CONTROLS
AC	AC-1	MP	MP-1
AT	AT-1, AT-2, AT-2 (2), AT-3, AT-4, AT-5	PE	PE-1, PE-6, PE-6 (1), **PE-6 (2)**, PE-8
AU	AU-1, AU-6, AU-6 (1), AU-6 (3), **AU-6 (5)**, **AU-6 (6)**, AU-6 (9), AU-7, AU-7 (1), **AU-10**	PL	PL-1, PL-2, PL-2 (3), PL-4, PL-4 (1)
CA	CA-1, CA-2, CA-3, CA-2 (1), **CA-2 (2)**, CA-5, CA-6, CA-7, CA-7 (1)	PS	PS-1, PS-6, PS-7, PS-7 (1)
CM	CM-1, CM-2, CM-2 (1), **CM-2 (2)**, CM-2 (3), **CM-2 (6)**, CM-3, **CM-3 (1)**, CM-3 (2), CM-4, **CM-4 (1)**, CM-8, CM-8 (1), **CM-8 (2)**, **CM-8 (3)**, **CM-8 (4)**, CM-8 (5)	RA	RA-1, RA-3, RA-5, RA-5 (1), RA-5 (1), **RA-5 (2)**, **RA-5 (3)**, **RA-5 (4)**, **RA-5 (5)**, **RA-5 (7)**
CP	CP-1, CP-3, **CP-3 (1)**, CP-4, CP-4 (1), **CP-4 (2)**, **CP-4 (4)**, **CP-11**	SA	SA-1, SA-2, SA-3, SA-4, SA-4 (1), **SA-4 (2)**, SA-5, SA-5 (1), **SA-5 (2)**, SA-5 (3), SA-8, SA-9, SA-9 (2), **SA-9 (3)**, SA-10, SA-11, **SA-12**, **SA-15**, **SA-16**, **SA-17**
IA	IA-1	SC	SC-1, SC-2, SC-3, **SC-3 (6)**, SC-24, SC-32, SC-41
IR	IR-1, IR-2, IR-2 (1), IR-2 (2), IR-3, IR-3 (1), IR-3 (2), IR-5, IR-5 (1)	SI	SI-1, SI-4, SI-4 (2), SI-4 (4), SI-4 (5), SI-4 (6), SI-5, **SI-5 (1)**, SI-6, SI-7, SI-7 (1), **SI-7 (2)**, **SI-7 (5)**, SI-7 (8), **SI-7 (15)**, SI-10
MA	MA-1		

[89] Implementing the assurance-related controls from Appendix D represented in Table E.3 will satisfy the minimum assurance requirements for high-impact systems mandated by FIPS 200. The **bold** text indicates the *delta* from the moderate baseline (i.e., the assurance-related controls added to the moderate baseline to produce the increased level of assurance in the high baseline).

Developmental and Operational Activities to Achieve High Assurance

Raising the bar on assurance can be difficult and costly for organizations—but sometimes essential for critical applications, missions, or business functions. Determining what parts of the organization's information technology infrastructure demand higher assurance of implemented security functionality is a Tier 1/Tier 2 risk management activity (see Figure 1 in Chapter Two). This type of activity occurs when organizations determine the *security capability* necessary to protect organizational operations (i.e., mission, functions, image, and reputation), organizational assets, individuals, other organizations, and the Nation. Determining required security capability is an integral part of the organizational risk management process described in NIST Special Publication 800-39—specifically in the development of the *risk response strategy* following the risk framing and risk assessment steps (where organizations establish priorities, assumptions, constraints, risk tolerance and assess threats, vulnerabilities, mission/business impacts, and likelihood of threat occurrence).[90] After the security capability is determined at Tiers 1 and 2 and reflected in the design of the enterprise architecture and associated mission/business processes, the focus subsequently turns to the organizational information systems that are needed to support those processes. Organizations can use the Risk Management Framework (RMF), described in NIST Special Publication 800-37, to ensure that the appropriate assurance levels are achieved for the information systems and system components deployed to carry out core missions and business functions. This is primarily a Tier 3 activity but can have some overlap with Tiers 1 and 2, for example, in the area of common control selection.

Trustworthy information systems are difficult to build from a software and systems development perspective. However, there are a number of design, architectural, and implementation principles that, if used, can result in more trustworthy systems. These core *security principles* include, for example, simplicity, modularity, layering, domain isolation, least privilege, least functionality, and resource isolation/encapsulation. Information technology products and systems exhibiting a higher degree of trustworthiness (i.e., products/systems having the requisite security functionality and security assurance) are expected to exhibit a lower rate of latent design/implementation flaws and a higher degree of penetration resistance against a range of threats including, for example, sophisticated cyber attacks, natural disasters, accidents, and intentional/unintentional errors.[91] The vulnerability and susceptibility of organizational missions/business functions and supporting information systems to known threats, the environments of operation where those systems are deployed, and the maximum acceptable level of information security risk, guide the degree of trustworthiness needed.

Ensuring Better Outcomes

Having security functionality in critical organizational information systems and environments of operation without appropriate assurance is like skydiving without a backup parachute—you don't need it until you need it. And without it, the outcome is *very* predictable.

[90] As illustrated in Figure 3 in Chapter Two, the ability to achieve the appropriate security capability is linked to the concept of trustworthy information systems.

[91] Organizations also rely to a great extent on security assurance from an operational perspective as illustrated by the assurance-related controls in Tables E-1 through E-3. Operational assurance is obtained by other than developmental actions, including for example, defining and applying security configuration settings on information technology products, establishing policies and procedures, assessing security controls, and conducting a rigorous continuous monitoring program. In some situations, to achieve the necessary security capability with weak or deficient information technology, organizations compensate by increasing their operational assurance.

While the assurance-related controls[92] allocated to the low, moderate, and high baselines in the previous sections, represent minimum assurance requirements, organizations can, over time, choose to raise the level of assurance in their information systems—increasing the level of trustworthiness accordingly. This is accomplished by adding assurance-related controls to the controls in the baselines to increase both the strength of security functionality and degree of confidence that the functionality is correct, complete, and consistent—making the functionality highly resistant to penetration, tamper, or bypass. Security functionality that is highly resistant to penetration, tamper, and bypass requires a significant work factor on the part of adversaries to compromise the confidentiality, integrity, or availability of the information system or system components where that functionality is employed.

Since high-assurance information technology products may be more costly and difficult to obtain, organizations may choose to partition their information systems into distinct subsystems to isolate the critical components and focus the high-assurance efforts on a more narrowly defined subset of information resources. Organizations that find it difficult to achieve high-assurance information technology solutions may have to rely to a greater extent on procedural or operational protections to ensure mission and business success. This includes, for example, reengineering critical mission and business processes to be less susceptible to high-end threats. Table E-4 provides additional developmental and operational activities that organizations can initiate or require to achieve an enhanced level of assurance (up to and including high assurance) as part of their overall security capability. The list of assurance-related controls is not exhaustive. Organizations, through the tailoring process (including an organizational assessment of risk), may choose to designate other security controls as assurance-related and add to the exemplar set in Table E-4.

TABLE E-4: ASSURANCE CONTROLS FOR ENHANCED ASSURANCE[93]

ID	CONTROLS	ID	CONTROLS
AC	AC-25	MP	No additional controls.
AT	AT-2 (1), AT-3 (remaining enhancements)	PE	PE-6 (3)
AU	AU-6 (8), AU-10 (remaining enhancements), AU-13, AU-14, AU-14 (1)	PL	No additional controls.
CA	CA-2 (3), CA-5 (1)	PS	PS-6 (2)
CM	CM-4 (2)	RA	RA-5 (6), RA-5 (8), RA-5 (9), RA-5 (10)
CP	CP-3 (2), CP-4 (3), CP-11 (remaining enhancements), CP-13	SA	SA-4 (remaining enhancements), SA-5 (remaining enhancements), SA-9 (remaining enhancements), SA-10 (remaining enhancements), SA-11 (remaining enhancements), SA-12 (remaining enhancements), SA-14, SA-15 (remaining enhancements), SA-17 (remaining enhancements), SA-18, SA-18 (1), SA-19
IA	No additional controls.	SC	SC-2 (1), SC-3 (remaining enhancements), SC-6, SC-11, SC-29, SC-29 (1), SC-30 (plus enhancements), SC-31 (plus enhancements), SC-34 (plus enhancements), SC-37 (plus enhancements), SC-38, SC-39, SC-39 (1), SC-40, SC-41 (remaining enhancements)
IR	No additional controls.	SI	SI-4 (remaining enhancements),SI-7 (remaining enhancements), SI-14
MA	No additional controls.		

[92] *Assurance-related controls* are those security controls in Appendix F that contribute to achieving measures of confidence in the security functionality deployed in organizational information systems and environments of operation. The assurance-related controls can provide both developmental assurance (e.g., providing greater strength of function, more reliable, trustworthy information system components, and more disciplined system/security engineering practices during system integration) and operational assurance (e.g., verifying secure configuration settings, providing security training, and conducting penetration testing).

[93] The assurance-related controls in Table E.4 represent the additional security controls needed to achieve enhanced levels of assurance—that is, the controls needed to go beyond the minimum assurance and assurance-related controls in Tables E-1, E-2, and E-3.

Assurance and Continuous Monitoring

As the federal government transitions to a strategy of near real-time risk management and continuous monitoring of information systems and organizations, the role of security assurance takes on greater importance. Ongoing monitoring to understand the security state of organizational information systems and current information security risks is much more effective if the underlying information technology infrastructure is strong—that is, more resistant to cyber attacks and capable of absorbing such attacks and continuing to operate even in a debilitated or degraded state. Implementing continuous monitoring programs on weak or deficient information technology infrastructures is not as effective and may give a false sense of security with regard to the protection of critical missions/business functions. Security assurance works in a complementary manner with security functionality to strengthen the underlying IT infrastructure and organizational information systems (including the hardware, software, and firmware components that compose those systems). A simple example illustrates the relationship of assurance to continuous monitoring. Checking broken, weak, or deficient locks on the external doors of a house once a day or ten times a day makes little difference. Installing strong locks with the right protective capability first, and then checking the locks more frequently can make a significant difference in protecting the house and its contents.

APPENDIX F

SECURITY CONTROL CATALOG

SECURITY CONTROLS, ENHANCEMENTS, AND SUPPLEMENTAL GUIDANCE

The catalog of security controls in this appendix provides a range of safeguards and countermeasures for organizations and information systems. The organization of the security control catalog, the structure of the controls, and the concept of allocating security controls and control enhancements to the initial baselines in Appendix D are described in Chapter Two. The security controls in the catalog are expected to change over time, as controls are withdrawn, revised, and added. In order to maintain stability in security plans and automated tools supporting the implementation of NIST Special Publication 800-53, security controls and control enhancements will not be renumbered each time a control or enhancement is withdrawn. Rather, notations of security controls and controls enhancements that have been withdrawn over time will be maintained in the catalog for historical purposes.

There may, on occasion, be redundancy in requirements that appear in the security controls and control enhancements that are part of the security control catalog. This overlap in requirements is intended to reinforce the security requirements from the perspective of multiple controls and/or enhancements. For example, the requirement for strong identification and authentication when conducting remote maintenance activities appears in the MA family in the specific context of systems maintenance activities conducted by organizations. The identification and authentication requirement also appears in a more general context in the IA family. While these requirements appear to be redundant (i.e., overlapping), they are, in fact, mutually reinforcing and not intended to require additional effort on the part of organizations in the development and implementation of security programs.

Fundamentals of the Catalog

Security controls and control enhancements in Appendices F and G are generally designed to be policy-neutral and technology/implementation-independent. Organizations provide information about security controls and control enhancements in two ways:

- By specifying security control implementation details (e.g., platform dependencies) in the associated security plan for the information system or security program plan for the organization; and
- By establishing specific values in the variable sections of selected security controls through the use of *assignment* and *selection* statements.

Assignment and selection statements provide organizations with the capability to specialize security controls and control enhancements based on organizational security requirements or requirements originating in federal laws, Executive Orders, directives, policies, regulations, standards, or guidelines. Organization-defined parameters used in assignment and selection statements in the basic security controls apply also to all control enhancements associated with those controls. Control enhancements strengthen the fundamental security capability in the base control but are not a substitute for using assignment or selection statements to provide greater specificity to the control. Assignment statements for security controls and control enhancements do not contain minimum or maximum values (e.g., testing contingency plans *at least annually*). Organizations should consult specific federal laws, Executive Orders, directives, regulations, policies, standards, or guidelines as the definitive sources for such information. The absence of minimum and maximum values from the security controls and control enhancements does not obviate the need for organizations to comply with requirements in the controlling source publications.

The first security control in each family (i.e., the dash-1 control) generates requirements for specific policies and procedures that are needed for the effective implementation of the other security controls in the family. Therefore, individual controls and control enhancements in a particular family do not call for the development of such policies and procedures. Supplemental guidance sections of security controls and control enhancements do not contain any requirements or references to FIPS or NIST Special Publications. NIST publications are, however, included in a *references* section for each security control.

In support of the Joint Task Force initiative to develop a unified information security framework for the federal government, security controls and control enhancements for national security systems are included in this Appendix. The inclusion of such controls and enhancements is not intended to impose security requirements on organizations that operate national security systems. Rather, organizations can use the security controls and control enhancements on a voluntary basis with the approval of federal officials exercising policy authority over national security systems. In addition, the security control priorities and security control baselines listed in Appendix D and in the priority and baseline allocation summary boxes below each security control in Appendix F, apply to non-national security systems *only* unless otherwise directed by the federal officials with national security policy authority.

Using the Catalog

Organizations employ security controls in federal information systems and the environments in which those systems operate in accordance with FIPS Publication 199, FIPS Publication 200, and NIST Special Publications 800-39 and 800-37. Security categorization of federal information and information systems, as required by FIPS 199, is the first step in the risk management process.[94] Next, organizations select an appropriate set of security controls for their information systems by satisfying the minimum security requirements set forth in FIPS 200. Appendix D includes three security control baselines that are associated with the designated impact levels of organizational information systems as determined during the security categorization process.[95] After baseline selection, organizations tailor the baselines by: (i) identifying/designating common controls; (ii) applying scoping considerations; (iii) selecting compensating controls, if needed; (iv) assigning control parameter values in selection and assignment statements; (v) supplementing the baseline controls with additional controls and control enhancements from the security control catalog; and (vi) providing additional information for control implementation. Organizations can also use the baseline tailoring process with the overlay concept described in Section 3.2 and Appendix I. Risk assessments, as described in NIST Special Publication 800-30, guide/inform the security control selection process.[96]

[94] CNSS Instruction 1253 provides guidance for security categorization of national security systems.

[95] CNSS Instruction 1253 provides guidance on security control baselines for national security systems and specific tailoring requirements associated with such systems.

[96] There are additional security controls and control enhancements that appear in the catalog that are not used in any of the initial baselines. These additional controls and control enhancements are available to organizations and can be used in the tailoring process to achieve the needed level of protection in accordance with organizational risk assessments.

FAMILY: ACCESS CONTROL

AC-1 ACCESS CONTROL POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented access control policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the access control policy and associated access controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the AC family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** AC-1	**MOD** AC-1	**HIGH** AC-1

AC-2 ACCOUNT MANAGEMENT

Control: The organization manages information system accounts, including:

a. Identifying account types (e.g., individual, shared/group, system, application, guest/anonymous, emergency, and temporary);

b. Establishing conditions for group and role membership;

c. Specifying authorized users of the information system, group and role membership, and account access authorizations (i.e., privileges) for each account;

d. Requiring approvals by [*Assignment: organization-defined personnel*] for requests to create accounts;

e. Creating, enabling, modifying, disabling, and removing accounts (including adding and deleting members from groups or roles);

f. Authorizing and monitoring the use of shared/group, guest/anonymous, emergency, and temporary accounts;

g. Notifying account managers:

- When accounts (including shared/group, emergency, and temporary accounts) are no longer required;
- When users are terminated or transferred; or
- When individual information system usage or need-to-know changes;

h. Associating access authorizations and other attributes as required by the organization with each information system account;

i. Granting access to the system based on:

- A valid access authorization;
- Intended system usage; and
- Other attributes as required by the organization or associated missions/business functions;

j. Reviewing accounts for compliance with account management requirements [*Assignment: organization-defined frequency*]; and

k. Establishing a process for modifying shared/group account credentials when individuals are removed from the group.

Supplemental Guidance: The identification of authorized users of the information system and the specification of access privileges reflects the requirements in other security controls in the security plan. Users requiring administrative privileges on information system accounts receive additional scrutiny by appropriate organizational personnel (e.g., system owner, mission/business owner, or chief information security officer) responsible for approving such accounts and privileged access. Organizations may choose to define access privileges or other attributes by account, by type of account, or a combination of both. Other attributes required for authorizing access include, for example, restrictions on time-of-day, day-of-week, and point-of-origin. Temporary and emergency accounts are accounts intended for short-term use. Organizations establish temporary accounts as a part of normal account activation procedures when there is a need for short-term accounts without the demand for immediacy in account activation. Organizations establish emergency accounts in response to crisis situations and with the need for rapid account activation. Therefore, emergency account activation may bypass normal account authorization processes. Emergency and temporary accounts are not to be confused with infrequently used accounts (e.g., local login accounts used for special tasks defined by organizations or when network resources are unavailable). Such accounts remain available and are not subject to automatic termination dates. Conditions for disabling or deactivating accounts include, for example: (i) when shared/group, emergency, or temporary accounts are no longer required; or (ii) when individuals are transferred or terminated. Related controls: AC-3, AC-4, AC-5, AC-6, AC-10, AC-17, AC-19, AC-20, AU-9, IA-2, IA-4, IA-5, IA-8, CM-5, CM-6, CM-11, MA-3, MA-4, MA-5, PL-4, SC-13, SI-9.

Control Enhancements:

(1) *ACCOUNT MANAGEMENT | AUTOMATED SYSTEM ACCOUNT MANAGEMENT*

The organization employs automated mechanisms to support the management of information system accounts.

(2) *ACCOUNT MANAGEMENT | REMOVAL OF TEMPORARY / EMERGENCY ACCOUNTS*

The information system automatically removes temporary and emergency accounts after [*Assignment: organization-defined time period for each type of account*].

(3) *ACCOUNT MANAGEMENT | DISABLE INACTIVE ACCOUNTS*

The information system automatically disables inactive accounts after [*Assignment: organization-defined time period*].

(4) *ACCOUNT MANAGEMENT | AUTOMATED AUDIT ACTIONS*

The information system automatically audits account creation, modification, enabling, disabling, and removal actions and notifies, as required, [*Assignment: organization-defined personnel*].

Supplemental Guidance: Related controls: AU-2, AU-12.

(5) *ACCOUNT MANAGEMENT | INACTIVITY LOGOUT / TYPICAL USAGE MONITORING*

The organization requires that users log out when [*Assignment: organization defined time-period of expected inactivity and/or description of when to log out*].

Supplemental Guidance: Related control: SI-4.

(6) *ACCOUNT MANAGEMENT | DYNAMIC PRIVILEGE MANAGEMENT*

The information system performs [*Assignment: organization-defined* dynamic management of *user privileges and associated access authorizations*] within [*Assignment: organization-defined time period*].

Supplemental Guidance: In contrast to conventional access control approaches which employ static information system accounts and predefined sets of user privileges, dynamic access control approaches (e.g., service-oriented architectures) rely on run time access control decisions facilitated by dynamic privilege management. While user identities may remain relatively constant over time, user privileges may change more frequently based on ongoing mission/business requirements and operational needs of organizations. Dynamic privilege management can include, for example, the immediate revocation of privileges from users, as opposed to requiring that users terminate and restart their sessions to reflect any changes in privileges. Dynamic privilege management can also refer to mechanisms that change the privileges of users based on dynamic rules as opposed to editing specific user profiles. This type of privilege management includes, for example, automatic adjustments of privileges if users are operating out of their normal work times, or if information systems are under duress or in emergency maintenance situations. This control enhancement also includes the ancillary effects of privilege changes, for example, the potential changes to encryption keys used for communications. Related control: AC-16.

(7) *ACCOUNT MANAGEMENT | ROLE-BASED SCHEMES*

The organization:

(a) Establishes and administers privileged user accounts in accordance with a role-based access scheme that organizes allowed information system access and privileges into roles;

(b) Monitors privileged role assignments; and

(c) Takes [*Assignment: organization-defined actions*] when privileged role assignments are no longer appropriate.

Supplemental Guidance: Privileged roles are organization-defined roles assigned to individuals that allow those individuals to perform certain security-relevant functions that ordinary users are not authorized to perform. These privileged roles include, for example, key management, account management, network and system administration, database administration, and web administration.

(8) *ACCOUNT MANAGEMENT | DYNAMIC ACCOUNT CREATION*

The information system creates accounts dynamically.

Supplemental Guidance: Dynamic approaches for creating information system accounts (e.g., as implemented within service-oriented architectures) rely on establishing accounts (identities) at run time for entities that were previously unknown. Organizations plan for the dynamic creation of information system accounts by establishing trust relationships and mechanisms with appropriate authorities to validate related authorizations and privileges.

Supplemental Guidance: Related control: AC-16.

(9) *ACCOUNT MANAGEMENT | RESTRICTIONS ON USE OF SHARED GROUPS / ACCOUNTS*

The organization prohibits the use of shared/group accounts that do not meet [*Assignment: organization-defined conditions for establishing shared/group accounts*].

(10) *ACCOUNT MANAGEMENT | SHARED / GROUP ACCOUNT REQUESTS / APPROVALS*

The organization employs automated mechanisms to request and approve membership and use of shared/group accounts.

(11) *ACCOUNT MANAGEMENT | SHARED / GROUP ACCOUNT CREDENTIAL RENEWALS*

The information system enforces the renewal of shared/group account credentials if members leave the group.

(12) *ACCOUNT MANAGEMENT | USAGE CONDITIONS*

The organization determines [*Assignment: organization-defined circumstances and/or usage conditions*] for [*Assignment: organization-defined information system accounts*].

Supplemental Guidance: Organizations can describe the specific conditions or circumstances under which information system accounts can be used, for example, by restricting usage to certain days of the week, time of day, or specific durations of time.

(13) *ACCOUNT MANAGEMENT | ACCOUNT REVIEWS*

The organization conducts [*Assignment: organization-defined frequency*] reviews of information system accounts (including access authorizations and shared/group account memberships).

(14) *ACCOUNT MANAGEMENT | ACCOUNT MONITORING / ATYPICAL USAGE*

The organization:

(a) Monitors information system accounts for [*Assignment: organization-defined atypical use*]; and

(b) Reports atypical usage of information system accounts to [*Assignment: organization-defined personnel*].

(15) *ACCOUNT MANAGEMENT | DISABLE ACCOUNTS FOR HIGH-RISK INDIVIDUALS*

The organization applies account management capabilities to expeditiously disable accounts of users posing a significant risk.

Supplemental Guidance: Users posing a significant risk to organizations include individuals for whom reliable evidence or intelligence indicates either the intention to use authorized access to information systems to cause harm or through whom adversaries will cause harm. Harm includes potential adverse impacts to organizational operations and assets, individuals, other organizations, or the Nation. Close coordination between authorizing officials, information system administrators, and human resource managers is essential in order for timely execution of this control enhancement.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AC-2	**MOD** AC-2 (1) (2) (3) (4)	**HIGH** AC-2 (1) (2) (3) (4) (5) (12) (13)

AC-3 ACCESS ENFORCEMENT

Control: The information system enforces approved authorizations for logical access to information and system resources in accordance with applicable access control policies.

Supplemental Guidance: Access enforcement includes controlling access to information system accounts during login (e.g., restricting login access by time of day, day of week, or location). Subsequent to account access, access control policies (e.g., identity-based policies, role-based policies, attribute-based policies) and access enforcement mechanisms (e.g., access control lists, access control matrices, cryptography) control access between active entities or subjects (i.e., users or processes acting on behalf of users) and passive entities or objects (e.g., devices, files, records, domains) in information systems. In addition to enforcing authorized access at the information system level and recognizing that information systems can host many applications and services in support of organizational missions and business operations, access enforcement mechanisms can also be employed at the application and service level to provide increased information security. Organizations also consider implementing an audited, explicit override of automated mechanisms in the event of emergencies or other serious events. If organizations employ encryption of stored information (i.e., information at rest) as an access enforcement mechanism, the cryptography is FIPS 140 (as amended)-compliant. For classified information, the cryptography used depends on the classification level of the information and the clearances of the individuals having access to the information. Related controls: AC-2, AC-4, AC-5, AC-6, AC-16, AC-17, AC-18, AC-19, AC-20, AC-21, AC-22, AU-9, CM-5, CM-6, CM-11, MA-3, MA-4, MA-5, PE-3, SC-13, SI-9.

Control Enhancements:

(1) *ACCESS ENFORCEMENT | RESTRICTED ACCESS TO PRIVILEGED FUNCTIONS*

[Withdrawn: Incorporated into AC-6].

(2) *ACCESS ENFORCEMENT | DUAL AUTHORIZATION*

The information system enforces dual authorization for [*Assignment: organization-defined privileged commands and/or other organization-defined actions*].

Supplemental Guidance: This control enhancement addresses dual authorization. Dual authorization mechanisms require the approval of two authorized individuals in order to execute. Organizations do not require dual authorization mechanisms when immediate responses are necessary to ensure public and environmental safety. Related controls: CP-9, MP-6.

(3) *ACCESS ENFORCEMENT | NONDISCRETIONARY ACCESS CONTROL*

The information system enforces [*Assignment: organization-defined nondiscretionary access control policies*] over [*Assignment: organization-defined users and information resources*] where the policy rule set for each policy specifies:

(a) Access control information (i.e., attributes) employed by the policy rule set; and

(b) Required relationships among the access control information to permit access.

Supplemental Guidance: Nondiscretionary access control is a type of access control that restricts access to objects based on the identity of subjects or groups to which the subjects belong. The access controls are nondiscretionary because subjects are restricted from passing privileges (i.e., access permissions) or information on to any other subjects or objects—that is, information systems strictly and uniformly enforce access control policies based on the rule sets established by the policies. Nondiscretionary policies include, for example, mandatory access control, type enforcement, and originator-controlled access control.

(4) *ACCESS ENFORCEMENT | DISCRETIONARY ACCESS CONTROL*

The information system enforces a discretionary access control policy.

Supplemental Guidance: Discretionary access control is a type of access control that restricts access to objects based on the identity of subjects or groups to which subjects belong. The access controls are discretionary because subjects are not restricted from passing privileges (i.e., access permissions) or information to any other subjects or objects. Nondiscretionary access controls, in contrast, restrict this capability.

(5) *ACCESS ENFORCEMENT | SECURITY-RELEVANT INFORMATION*

The information system prevents access to [*Assignment: organization-defined security-relevant information*] except during secure, non-operable system states.

Supplemental Guidance: Security-relevant information is any information within information systems that can potentially impact the operation of security functions or the provision of security services in a manner that could result in failure to enforce system security policies or maintain the isolation of code and data. Security-relevant information includes, for example, filtering rules for routers/firewalls, cryptographic key management information, configuration parameters for security services, and access control lists. Secure, non-operable system states include the times in which information systems are not performing mission/business-related processing (e.g., the system is off-line for maintenance, troubleshooting, boot-up, shut down). Related controls: CM-3, CM-6.

(6) *ACCESS ENFORCEMENT | PROTECTION OF USER AND SYSTEM INFORMATION*

[Withdrawn: Incorporated into MP-4 and SC-28].

(7) *ACCESS ENFORCEMENT | MANDATORY ACCESS CONTROL*

The information system enforces a mandatory access control policy over [*Assignment: organization-defined users and information resources*] and controls access based on [*Assignment: organization-defined hierarchical security levels and formal access compartments*].

Supplemental Guidance: Organizations implement mandatory access control policies using the Bell-LaPadula security model, or some variation of the security model, which defines allowed accesses to information resources based on hierarchical security levels and user privileges. Hierarchical security levels include, for example: (i) unclassified, confidential, secret, top-

secret; and (ii) public, sensitive, and senior-executive-only. Organizations also employ formal access compartments defining explicit information categories when applying mandatory access control policies with regard to hierarchical security levels. Organizations require formal access authorizations to specific compartments in order for access to be granted.

(8) *ACCESS ENFORCEMENT | ROLE-BASED ACCESS CONTROL*

The information system enforces a role-based access control policy over [*Assignment: organization-defined users and information resources*] and controls access based upon [*Assignment: organization-defined roles and users authorized to assume such roles*].

Supplemental Guidance: Role-based access control is a type of nondiscretionary access control.

(9) *ACCESS ENFORCEMENT | REVOCATION OF ACCESS AUTHORIZATIONS*

The information system revokes access authorizations resulting from changes to the security attributes of subjects and objects based on [*Assignment: organization-defined rules governing revocation of access authorizations*].

Supplemental Guidance: Revocation of access rules may differ based on the types of access revoked. For example, if a subject (i.e., user or process) is removed from a group, access may not be revoked until the next time the object (e.g., file) is opened or until the next time the subject attempts a new access to the object. Revocation based on changes to security labels may take effect immediately. Organizations can provide alternative approaches on how to make revocations immediate if information systems cannot provide such capability and immediate revocation is necessary. Related control: AC-16.

(10) *ACCESS ENFORCEMENT | NETWORK ACCESS SECURITY-RELATED FUNCTIONS*

The organization ensures that network sessions for accessing [*Assignment: organization-defined security functions and security-relevant information*] employ [*Assignment: organization-defined additional security safeguards*] and are audited.

Supplemental Guidance: Additional security safeguards typically include more than standard bulk or session layer encryption (e.g., Secure Shell [SSH], Virtual Private Networking [VPN] with blocking mode enabled) deployed by organizations. Related controls: AU-2, AU-12, SC-7, SC-8, SC-9.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AC-3	**MOD** AC-3	**HIGH** AC-3

AC-4 INFORMATION FLOW ENFORCEMENT

Control: The information system enforces approved authorizations for controlling the flow of information within the system and between interconnected systems in accordance with applicable flow control policies.

Supplemental Guidance: Information flow control regulates where information is allowed to travel within an information system and between information systems (as opposed to who is allowed to access the information) and without explicit regard to subsequent accesses to that information. Flow control restrictions include, for example, keeping export-controlled information from being transmitted in the clear to the Internet, blocking outside traffic that claims to be from within the organization, restricting web requests to the Internet that are not from the internal web proxy server, and limiting information transfers between organizations based on data structures and content. Organizations commonly employ information flow control policies and enforcement mechanisms to control the flow of information between designated sources and destinations (e.g., networks, individuals, devices) within information systems and between interconnected systems. Flow control is based on the characteristics of the information and/or the information path. Flow enforcement occurs, for example, in boundary protection devices (e.g., gateways, routers, guards, encrypted tunnels, firewalls) that employ rule sets or establish configuration settings that restrict information system services, provide a packet-filtering capability based on header information, or

message-filtering capability based on message content (e.g., implementing key word searches or document characteristics). Organizations also consider the trustworthiness of filtering and inspection mechanisms (including hardware, firmware, and software components) that are critical to information flow enforcement. Control enhancements 3 through 21 are primarily intended to address cross-domain solution needs. Related controls: AC-17, AC-19, AC-21, CM-6, CM-7, SA-8, SC-2, SC-5, SC-7, SC-18.

Control Enhancements:

(1) *INFORMATION FLOW ENFORCEMENT | OBJECT SECURITY ATTRIBUTES*

The information system enforces information flow control using explicit security attributes on information, source, and destination objects as a basis for flow control decisions.

Supplemental Guidance: Information flow enforcement mechanisms compare security attributes on information (data content and data structure), source and destination objects, and respond appropriately (e.g., block, quarantine, alert administrator) when the mechanisms encounter information flows not explicitly allowed by information flow policies. Flow enforcement using explicit security attributes can be used, for example, to control the release of certain types of information. Related control: AC-16.

(2) *INFORMATION FLOW ENFORCEMENT | PROCESSING DOMAINS*

The information system enforces information flow control using protected processing domains as a basis for flow control decisions.

Supplemental Guidance: Protected processing domains are processing spaces with controlled interactions with other processing spaces, thus enabling control of information flows between these spaces and to/from data/information objects. A protected processing domain includes, for example, domain type enforcement where information system processes are assigned to domains, information is identified by types, and information flows are controlled based on allowed information accesses (determined by domain and type), allowed signaling among domains, and allowed process transitions to other domains.

(3) *INFORMATION FLOW ENFORCEMENT | CONDITION / OPERATIONAL CHANGES*

The information system enforces dynamic information flow control based on policy that allows or disallows information flows based on changing conditions or operational considerations.

Supplemental Guidance: Changing conditions include, for example, changes in organizational risk tolerance due to changes in the immediacy of mission/business needs, changes in threat environments, and detection of potentially harmful events. Related control: SI-4.

(4) *INFORMATION FLOW ENFORCEMENT | CONTENT CHECK ENCRYPTED DATA*

The information system prevents encrypted data from bypassing content-checking mechanisms.

Supplemental Guidance: Related control: SI-4.

(5) *INFORMATION FLOW ENFORCEMENT | EMBEDDED DATA TYPES*

The information system enforces [*Assignment: organization-defined limitations*] on embedding data types within other data types.

Supplemental Guidance: Embedding data types within other data types may result in reduced flow control effectiveness. Data type embedding includes, for example, inserting executable files as objects within word processing files or inserting references or descriptive information into a media file.

(6) *INFORMATION FLOW ENFORCEMENT | METADATA*

The information system enforces information flow control based on [*Assignment: organization-defined metadata*].

Supplemental Guidance: Metadata is information used to describe the characteristics of data. Metadata can include structural metadata describing data structures (e.g., data format, syntax, and semantics) or descriptive metadata describing data contents (e.g., age, location, telephone number). Enforcing allowed information flows based on metadata enables simpler and more effective flow control. Organizations consider the trustworthiness of metadata with regard to data integrity (i.e., protecting against unauthorized changes to metadata tags) and the binding of metadata to the data payload (i.e., ensuring sufficiently strong binding techniques with appropriate levels of assurance). Related controls: AC-16, SI-7.

(7) *INFORMATION FLOW ENFORCEMENT | ONE-WAY FLOW MECHANISMS*

The information system enforces [*Assignment: organization-defined one-way flows*] using hardware mechanisms.

(8) *INFORMATION FLOW ENFORCEMENT | SECURITY POLICY FILTERS*

The information system enforces information flow control using [*Assignment: organization-defined security policy filters*] as a basis for flow control decisions for [*Assignment: organization-defined information flows*].

Supplemental Guidance: Organization-defined security policy filters can address data structures and content. For example, security policy filters for data structures can check for maximum file lengths, maximum field sizes, and data/file types (for structured and unstructured data). Security policy filters for data content can check for specific words (e.g., dirty/clean word filters), metadata content, and hidden content. Structured data permits the interpretation of data content by applications. Unstructured data typically refers to digital information without a particular data structure or with a data structure that does not facilitate the development of rule sets to address the particular sensitivity of the information conveyed by the data or the associated flow enforcement decisions. Unstructured data consists of: (i) bitmap objects that are inherently non-language-based (i.e., image, video, or audio files); and (ii) textual objects that are based on written or printed languages (e.g., commercial off-the-shelf word processing documents, spreadsheets, or emails). Organizations can implement more than one security policy filter to meet information flow control objectives (e.g., employing clean word lists in conjunction with dirty word lists may help to reduce false positives).

(9) *INFORMATION FLOW ENFORCEMENT | HUMAN REVIEWS*

The information system enforces the use of human reviews for [*Assignment: organization-defined security policy filters*] and [*Assignment: organization-defined information flows*].

Supplemental Guidance: Human reviews regarding information flow enforcement decisions are necessary when information systems are not capable of making such flow control decisions or when organizations deem human reviews necessary. Organizations define policy filters for all cases where automated flow control decisions are not possible or deemed to be not sufficient.

(10) *INFORMATION FLOW ENFORCEMENT | ENABLE / DISABLE SECURITY POLICY FILTERS*

The information system provides the capability for privileged administrators to enable/disable [*Assignment: organization-defined security policy filters*].

(11) *INFORMATION FLOW ENFORCEMENT | CONFIGURATION OF SECURITY POLICY FILTERS*

The information system provides the capability for privileged administrators to configure [*Assignment: organization-defined security policy filters*] to support different security policies.

Supplemental Guidance: For example, to reflect changes in security policies, administrators can change the list of "dirty words" that security policy mechanisms check in accordance with the definitions provided by organizations.

(12) *INFORMATION FLOW ENFORCEMENT | DATA TYPES IDENTIFIERS*

The information system, when transferring information between different security domains, identifies information flows by [*Assignment: organization-defined data type identifiers*].

Supplemental Guidance: Data type identifiers include, for example, filenames, file types, file signatures/tokens, and multiple internal file signatures/tokens.

(13) *INFORMATION FLOW ENFORCEMENT | DECOMPOSITION INTO POLICY-RELEVANT SUBCOMPONENTS*

The information system, when transferring information between different security domains, decomposes information into policy-relevant subcomponents for submission to policy enforcement mechanisms.

Supplemental Guidance: Policy enforcement mechanisms apply filtering, inspection, and/or sanitization rules to the policy-relevant subcomponents of information to facilitate flow enforcement prior to transferring such information to different security domains. Parsing transfer files facilitates policy decisions on source, destination, certificates, classification, attachments, and other security-related component differentiators. Policy rules for cross-domain transfers include, for example, limitations on embedding components or information types within other components/information types, prohibiting multiple levels of component or

information type embedding beyond the capability of inspection tools, and prohibiting the transfer of archived data types.

(14) *INFORMATION FLOW ENFORCEMENT | POLICY FILTER CONSTRAINTS ON DATA STRUCTURES AND CONTENT*

The information system, when transferring information between different security domains, implements [*Assignment: organization-defined security policy filters*] requiring fully enumerated and rigid formats that restrict data structure and content.

Supplemental Guidance: Data structure and content restrictions reduce the range of potential malicious and/or unsanctioned content in cross-domain transactions. Security policy filters that restrict data structures include, for example, restricting file sizes and field lengths. Data content policy filters include, for example: (i) encoding formats for character sets (e.g., Universal Character Set Transformation Formats, American Standard Code for Information Interchange); (ii) restricting character data fields to only contain alpha-numeric characters; (iii) prohibiting special characters; and (iv) restricting the use of archived data types.

(15) *INFORMATION FLOW ENFORCEMENT | DETECTION OF UNSANCTIONED INFORMATION*

The information system, when transferring information between different security domains, detects [*Assignment: organized-defined unsanctioned information*] and prohibits the transfer of such information in accordance with the [*Assignment: organization-defined security policy*].

Supplemental Guidance: Detection of unsanctioned information includes, for example, checking all information to be transferred for malicious code and dirty words. Related control: SI-3.

(16) *INFORMATION FLOW ENFORCEMENT | INFORMATION TRANSFERS ON INTERCONNECTED SYSTEMS*

The information system enforces [*Assignment: organization-defined security policies*] regarding information transferred to and from interconnected systems.

Supplemental Guidance: Transferring information between information systems representing different security domains with different security policies introduces risk that such transfers violate one or more domain security policies. In such situations, information owners/stewards provide guidance at designated policy enforcement points between interconnected systems. Organizations consider mandating specific architectural solutions when required to enforce specific security policies. Solutions include, for example: (i) prohibiting information transfers between interconnected systems; (ii) employing hardware mechanisms to enforce one-way information flows; and (iii) implementing trustworthy regrading mechanisms to reassign security attributes/security labels.

(17) *INFORMATION FLOW ENFORCEMENT | DOMAIN AUTHENTICATION*

The information system uniquely identifies and authenticates source and destination domains for information transfer.

Supplemental Guidance: Attribution is a critical component of a security concept of operations. The ability to identify source and destination points for information flowing in information systems, allows the forensic reconstruction of events when required, and encourages policy compliance by attributing policy violations to specific organizations/individuals. Successful domain authentication requires that information system labels distinguish among systems, organizations, and individuals involved in preparing, sending, receiving, or disseminating information. Related controls: IA-2, IA-3, IA-4, IA-5.

(18) *INFORMATION FLOW ENFORCEMENT | SECURITY ATTRIBUTE BINDING*

The information system binds security attributes to information using [*Assignment: organization-defined binding techniques*] to achieve [*Assignment: organization-defined strength of binding*] and to facilitate information flow policy enforcement.

Supplemental Guidance: Binding strength and the assurance associated with binding techniques play an important part in the trust organizations have in the information flow enforcement process. The binding techniques affect the number and degree of additional reviews required by organizations. Related controls: AC-16, SC-16.

(19) *INFORMATION FLOW ENFORCEMENT | PROTECTION OF METADATA*

The information system, when transferring information between different security domains, applies the same security safeguards to metadata as it applies to data payloads.

Supplemental Guidance: This control enhancement requires the protection of metadata and the data to which the metadata applies. Some organizations distinguish between metadata and

data payloads (i.e., only the data to which the metadata is bound). Other organizations do not make such distinctions, considering metadata and the data to which the metadata applies as part of the payload. All information (including metadata and the data to which the metadata applies) is subject to filtering and inspection.

(20) *INFORMATION FLOW ENFORCEMENT | CLASSIFIED INFORMATION*

The organization employs [*Assignment: organization-defined devices in approved configurations*] to control the flow of classified information across security domains.

Supplemental Guidance: Organizations define approved devices and configurations in cross-domain policies, guidance, and solutions in accordance with the types of information flows across classification boundaries.

(21) *INFORMATION FLOW ENFORCEMENT | PHYSICAL / LOGICAL SEPARATION OF INFORMATION FLOWS*

The information system separates information flows logically or physically using [*Assignment: organization-defined mechanisms and/or techniques*] to accomplish [*Assignment: organization-defined required separations by types of information*].

Supplemental Guidance: Enforcing the separation of information flows by type can enhance protection by ensuring that information is not commingled while in transit and by enabling flow control by transmission paths perhaps not otherwise achievable. Types of separable information include, for example, inbound and outbound communications traffic, service requests and responses, and information of differing security categories.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** AC-4	**HIGH** AC-4

AC-5 SEPARATION OF DUTIES

Control: The organization:

a. Separates [*Assignment: organization-defined duties of individuals*];

b. Documents separation of duties of individuals; and

c. Defines information system access authorizations to support separation of duties.

Supplemental Guidance: Separation of duties addresses the potential for abuse of authorized privileges and helps to reduce the risk of malevolent activity without collusion. Separation of duties includes, for example: (i) dividing mission functions and information system support functions among different individuals and/or roles; (ii) conducting information system support functions with different individuals (e.g., system management, programming, configuration management, quality assurance and testing, and network security); and (iii) ensuring security personnel administering access control functions do not also administer audit functions. Related controls: AC-3, AC-6, PE-3, PE-4.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** AC-5	**HIGH** AC-5

AC-6 LEAST PRIVILEGE

Control: The organization employs the concept of least privilege, allowing only authorized accesses for users (and processes acting on behalf of users) which are necessary to accomplish assigned tasks in accordance with organizational missions and business functions.

Supplemental Guidance: Organizations employ the concept of least privilege for specific duties and information systems (including specific functions, ports, protocols, and services). The concept of least privilege is also applied to information system processes, ensuring that the processes operate at privilege levels no higher than necessary to accomplish required organizational missions and/or functions. Organizations consider the creation of additional processes, roles, and information system accounts as necessary to achieve least privilege. Organizations also apply least privilege concepts to the design, development, implementation, and operations of information systems. Related controls: AC-2, AC-3, AC-5, CM-6, CM-7, PL-2.

Control Enhancements:

(1) *LEAST PRIVILEGE | AUTHORIZE ACCESS TO SECURITY FUNCTIONS*

The organization explicitly authorizes access to [*Assignment: organization-defined security functions (deployed in hardware, software, and firmware) and security-relevant information*].

Supplemental Guidance: Security functions include, for example, establishing system accounts, configuring access authorizations (i.e., permissions, privileges), setting events to be audited, and setting intrusion detection parameters. Security-relevant information includes, for example, filtering rules for routers/firewalls, cryptographic key management information, configuration parameters for security services, and access control lists. Explicitly authorized personnel include, for example, security administrators, system and network administrators, system security officers, system maintenance personnel, system programmers, and other privileged users. Related controls: AC-17, AC-18, AC-19.

(2) *LEAST PRIVILEGE | NON-PRIVILEGED ACCESS FOR NONSECURITY FUNCTIONS*

The organization requires that users of information system accounts, or roles, with access to [*Assignment: organization-defined security functions or security-relevant information*], use non-privileged accounts or roles, when accessing nonsecurity functions.

Supplemental Guidance: This control enhancement limits exposure when operating from within privileged accounts or roles. The inclusion of roles addresses situations where organizations implement access control policies such as role-based access control and where a change of role provides the same degree of assurance in the change of access authorizations for both the user and all processes acting on behalf of the user as would be provided by a change between a privileged and non-privileged account. Related control: PL-4.

(3) *LEAST PRIVILEGE | NETWORK ACCESS TO PRIVILEGED COMMANDS*

The organization authorizes network access to [*Assignment: organization-defined privileged commands*] only for [*Assignment: organization-defined compelling operational needs*] and documents the rationale for such access in the security plan for the information system.

Supplemental Guidance: Network access is any access across a network connection in lieu of local access (i.e., user being physically present at the device). Related control: AC-17.

(4) *LEAST PRIVILEGE | SEPARATE PROCESSING DOMAINS*

The information system provides separate processing domains to enable finer-grained allocation of user privileges.

Supplemental Guidance: Providing separate processing domains for finer-grained allocation of user privileges includes, for example: (i) using virtualization techniques to allow additional privileges within a virtual machine while restricting privileges to other virtual machines or to the underlying actual machine; (ii) employing hardware and/or software domain separation mechanisms; and (iii) implementing separate physical domains. Related controls: AC-4, SC-30, SC-32.

(5) *LEAST PRIVILEGE | PRIVILEGED ACCOUNTS*

The organization limits authorization to privileged accounts on the information system to [*Assignment: organization-defined personnel*].

Supplemental Guidance: Privileged accounts, including super user accounts, are typically described as root or administrator for various types of commercial off-the-shelf operating systems. Limiting privileged account authorization includes, for example, configuring information systems and devices (e.g., notebook computers, servers, workstations, personal digital assistants, smart phones), such that day-to-day users do not have access to privileged information or functions. Organizations may differentiate in the application of this control enhancement between allowed privileges for local information system accounts and for domain accounts provided organizations retain the ability to control system configurations for key security parameters and as otherwise necessary to sufficiently mitigate risk. Related control: CM-6.

(6) *LEAST PRIVILEGE | PRIVILEGED ACCESS BY NON-ORGANIZATIONAL USERS*

The organization prohibits privileged access to the information system by non-organizational users.

Supplemental Guidance: Related control: IA-8.

(7) *LEAST PRIVILEGE | REVIEW OF USER PRIVILEGES*

The organization reviews [*Assignment: organization-defined frequency*] the privileges assigned to [*Assignment: organization-defined roles or classes of users*] to determine if the need for such privileges is still valid.

Supplemental Guidance: Related control: CA-7.

(8) *LEAST PRIVILEGE | PRIVILEGE LEVELS FOR CODE EXECUTION*

The information system ensures that [*Assignment: organization-defined software*] does not execute at higher privilege levels than users executing the software.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** AC-6 (1) (2) (5)	**HIGH** AC-6 (1) (2) (3) (5)

AC-7 UNSUCCESSFUL LOGIN ATTEMPTS

Control: The information system:

a. Enforces a limit of [*Assignment: organization-defined number*] consecutive invalid login attempts by a user during a [*Assignment: organization-defined time period*]; and

b. Automatically [*Selection: locks the account/node for an* [*Assignment: organization-defined time period*]; *locks the account/node until released by an administrator; delays next login prompt according to* [*Assignment: organization-defined delay algorithm*]] when the maximum number of unsuccessful attempts is exceeded.

Supplemental Guidance: This control applies regardless of whether the login occurs via a local or network connection. Due to the potential for denial of service, automatic lockouts initiated by information systems are usually temporary and automatically release after a predetermined time period established by organizations. If a delay algorithm is selected, organizations may choose to employ different algorithms for different information system components based on the capabilities of those components. Responses to unsuccessful login attempts may be implemented at both the operating system and the application levels. Related controls: AC-2, AC-9, AC-14, IA-5.

Control Enhancements:

(1) *UNSUCCESSFUL LOGIN ATTEMPTS | AUTOMATIC ACCOUNT LOCK*

[Withdrawn: Incorporated into AC-7].

(2) *UNSUCCESSFUL LOGIN ATTEMPTS | PURGE MOBILE DEVICE*

The information system purges information from [*Assignment: organization-defined mobile devices*] based on [*Assignment: organization-defined purging requirements/techniques*] after [*Assignment: organization-defined number*] consecutive, unsuccessful device login attempts.

Supplemental Guidance: This control enhancement applies only to mobile devices for which a login occurs (e.g., personal digital assistants, smart phones). In certain situations, this control enhancement may not apply to mobile devices if the information on the device is encrypted with sufficiently strong encryption mechanisms, making purging unnecessary. The login is to the mobile device, not to any one account on the device. Therefore, successful logins to any accounts on mobile devices reset the unsuccessful login count to zero. Organizations define information to be purged carefully in order to avoid over purging which may result in devices becoming unusable. Related controls: AC-19, MP-5, MP-6, SC-13.

References: None.

Priority and Baseline Allocation:

P2	**LOW** AC-7	**MOD** AC-7	**HIGH** AC-7

AC-8 SYSTEM USE NOTIFICATION

Control: The information system:

a. Displays an approved system use notification message or banner before granting access to the system that provides privacy and security notices consistent with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance and states that:
   - Users are accessing a U.S. Government information system;
   - Information system usage may be monitored, recorded, and subject to audit;
   - Unauthorized use of the information system is prohibited and subject to criminal and civil penalties; and
   - Use of the information system indicates consent to monitoring and recording;

b. Retains the notification message or banner on the screen until users take explicit actions to log on to or further access the information system; and

c. For publicly accessible systems:
   - Displays the system use information [*Assignment: organization-defined conditions*], before granting further access;
   - Displays references, if any, to monitoring, recording, or auditing that are consistent with privacy accommodations for such systems that generally prohibit those activities; and
   - Includes in the notice given to public users of the information system, a description of the authorized uses of the system.

Supplemental Guidance: System use notifications can be implemented using warning banners displayed when individuals log in to information systems. System use notifications are only used for access via interactive login interfaces with human users and are not required when interactive login interfaces do not exist.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AC-8	**MOD** AC-8	**HIGH** AC-8

AC-9 PREVIOUS LOGON (ACCESS) NOTIFICATION

Control: The information system notifies the user, upon successful interactive logon (access) to the system, of the date and time of the last logon (access).

Supplemental Guidance: This control is intended to cover both traditional logons to information systems and accesses to systems that occur in other types of architectural configurations (e.g., service oriented architectures). Related controls: AC-7, PL-4.

Control Enhancements:

(1) *PREVIOUS LOGON NOTIFICATION | UNSUCCESSFUL LOGONS*

The information system notifies the user, upon successful logon/access, of the number of unsuccessful logon/access attempts since the last successful logon/access.

(2) *PREVIOUS LOGON NOTIFICATION | SUCCESSFUL / UNSUCCESSFUL LOGONS*

The information system notifies the user of the number of [*Selection: successful logons/accesses; unsuccessful logon/access attempts; both*] during [*Assignment: organization-defined time period*].

(3) *PREVIOUS LOGON NOTIFICATION | NOTIFICATION OF ACCOUNT CHANGES*

The information system notifies the user of changes to [*Assignment: organization-defined security-related characteristics/parameters of the user's account*] during [*Assignment: organization-defined time period*].

(4) *PREVIOUS LOGON NOTIFICATION | ADDITIONAL LOGON INFORMATION*

The information system notifies the user, upon successful interactive logon (access), of the following additional information: [*Assignment: organization-defined information to be included in addition to the date and time of the last logon (access)*].

Supplemental Guidance: This control enhancement permits organizations to specify additional information to be provided to users upon login including, for example, the location of last logon. User location is defined as that information which can be determined by information systems, for example, IP addresses from which network logins occurred, device identifiers, or notifications of local logins.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

AC-10 CONCURRENT SESSION CONTROL

Control: The information system limits the number of concurrent sessions for each [*Assignment: organization-defined account*] to [*Assignment: organization-defined number*].

Supplemental Guidance: Organizations may define the maximum number of concurrent sessions for information system accounts globally, by account type (e.g., privileged user, non-privileged user, domain, specific application), by account, or a combination. For example, organizations may limit the number of concurrent sessions for system administrators or individuals working in particularly sensitive domains or mission critical applications. This control addresses concurrent sessions for information system accounts and does not address concurrent sessions by single users via multiple system accounts.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** Not Selected	**HIGH** AC-10

AC-11 SESSION LOCK

Control: The information system:

a. Prevents further access to the system by initiating a session lock after [*Assignment: organization-defined time period*] of inactivity or upon receiving a request from a user;

b. Conceals information previously visible on the display with a publicly viewable image; and

c. Retains the session lock until the user reestablishes access using established identification and authentication procedures.

Supplemental Guidance: Session locks are temporary actions taken when users stop work and move away from the immediate vicinity of information systems but do not want to log out because of the temporary nature of their absences. Session locks are implemented where session activities can be determined. This is typically at the operating system level, but can also be at the application level. Session locks are not an acceptable substitute for logging out of information systems, for example, if organizations require users to log out at the end of workdays. Publicly viewable patterns can include, for example, screen saver patterns, photographic images, solid colors, or a blank screen, so long as none of those patterns convey sensitive information. Related control: AC-7.

Control Enhancements:

(1) *SESSION LOCK | PATTERN-HIDING DISPLAYS*
[Withdrawn: Incorporated into AC-11].

References: OMB Memorandum 06-16.

Priority and Baseline Allocation:

P3	**LOW** Not Selected	**MOD** AC-11	**HIGH** AC-11

AC-12 SESSION TERMINATION

[Withdrawn: Incorporated into SC-10].

AC-13 SUPERVISION AND REVIEW — ACCESS CONTROL

[Withdrawn: Incorporated into AC-2 and AU-6].

AC-14 PERMITTED ACTIONS WITHOUT IDENTIFICATION OR AUTHENTICATION

Control: The organization:

a. Identifies [*Assignment: organization-defined user actions*] that can be performed on the information system without identification or authentication; and

b. Documents and provides supporting rationale in the security plan for the information system, user actions not requiring identification or authentication.

Supplemental Guidance: This control addresses situations in which organizations determine that no identification or authentication is required in organizational information systems. Organizations may allow a limited number of user actions without identification or authentication (e.g., when individuals access public websites or other publicly accessible federal information systems such as http://www.usa.gov) and only to the extent necessary to accomplish mission/business objectives. Organizations also identify actions that normally require identification or authentication but may under certain circumstances (e.g., emergencies), allow identification or authentication mechanisms to be bypassed. Such bypasses may occur, for example, via a software-readable physical switch that commands bypass of the login functionality and is protected from accidental or unmonitored

use. This control does not apply to situations where identification and authentication have already occurred and are not repeated, but rather to situations where identification and authentication have not yet occurred. Related controls: CP-2, IA-2.

Control Enhancements: None.

(1) *PERMITTED ACTIONS WITHOUT IDENTIFICATION OR AUTHENTICATION | NECESSARY USES*
[Withdrawn: Incorporated into AC-14].

References: None.

Priority and Baseline Allocation:

P1	**LOW** AC-14	**MOD** AC-14	**HIGH** AC-14

AC-15 AUTOMATED MARKING

[Withdrawn: Incorporated into MP-3].

AC-16 SECURITY ATTRIBUTES

Control: The organization:

a. Provides the means to associate [*Assignment: organization-defined types of security attributes*] having [*Assignment: organization-defined security attribute values*] with information in storage, in process, and/or in transmission; and

b. Ensures that the security attribute associations are made and retained with the information.

Supplemental Guidance: Information is represented internally within information systems using abstractions known as data structures. Internal data structures can represent different types of entities, both active and passive. Active entities, also known as *subjects*, are typically associated with individuals, devices, or processes acting on behalf of individuals. Passive entities, also known as *objects*, are typically associated with data structures such as records, buffers, tables, files, inter-process pipes, and communications ports. Security attributes, a form of metadata, are abstractions representing the basic properties or characteristics of active and passive entities with respect to safeguarding information. These attributes may be associated with active entities (i.e., subjects) that have the potential to send or receive information, to cause information to flow among objects, or to change the information system state. These attributes may also be associated with passive entities (i.e., objects) that contain or receive information. The association of security attributes to subjects and objects is referred to as *binding* and is typically inclusive of setting the attribute value and the attribute type. Security attributes when bound to data/information, enables the enforcement of information security policies (both for access control and information flow control), either via organizational processes or via information system functions or mechanisms. The term *security labeling* refers to the association of security attributes with subjects and objects represented by internal data structures within organizational information systems, to enable information system-based enforcement of information security policies. Security labels include, for example, access authorizations (i.e., privileges), data life cycle protection (i.e., encryption and data expiration), nationality, affiliation as contractor, and classification of information in accordance with legal and compliance requirements. The term security marking refers to the association of security attributes with objects in a human-readable form, to enable organizational process-based enforcement of information security policies. The AC-16 base control represents the requirement for user-based attribute association (marking). The enhancements to AC-16 represent additional requirements including information system-based attribute association (labeling). Types of attributes include, for example, classification level (for objects) and clearance level (for subjects). An example of a value for both of these attribute types is *Top Secret*. Related controls: AC-3, AC-4, AC-21, AU-10, SC-16, MP-3.

Control Enhancements:

(1) *SECURITY ATTRIBUTES | DYNAMIC ATTRIBUTE ASSOCIATION*

The information system dynamically associates security attributes with [*Assignment: organization-defined subjects and objects*] in accordance with [*Assignment: organization-defined security policies*] as information is created and combined.

Supplemental Guidance: Dynamic association of security attributes is appropriate whenever the security characteristics of information changes over time. Security attributes may change, for example, due to information aggregation issues (i.e., the security characteristics of individual information elements are different from the combined elements), changes in individual access authorizations (i.e., privileges), and changes in the security category of information. Related control: AC-4.

(2) *SECURITY ATTRIBUTES | ATTRIBUTE VALUE CHANGES BY AUTHORIZED INDIVIDUALS*

The information system provides authorized individuals the capability to define or change the value of associated security attributes.

Supplemental Guidance: The content or assigned values of security attributes can directly affect the ability of individuals to access organizational information. Therefore, it is important for information systems to be able to limit the ability to create or modify security attributes to authorized individuals. Related controls: AC-6, AU-2.

(3) *SECURITY ATTRIBUTES | MAINTENANCE OF ATTRIBUTE ASSOCIATIONS BY INFORMATION SYSTEM*

The information system maintains the association of [*Assignment: organization-defined security attributes*] to [*Assignment: organization-defined subjects and objects*] with sufficient assurance that the attribute associations can be used as the basis for automated policy actions.

Supplemental Guidance: Automated policy actions include, for example, access control decisions or information flow control decisions.

(4) *SECURITY ATTRIBUTES | ASSOCIATION OF ATTRIBUTES BY AUTHORIZED INDIVIDUALS*

The information system supports the association of [*Assignment: organization-defined security attributes*] with [*Assignment: organization-defined subjects and objects*] by authorized individuals.

Supplemental Guidance: The support provided by information systems can vary to include: (i) prompting users to select specific security attributes to be associated with specific information objects; (ii) employing automated mechanisms for categorizing information with appropriate attributes based on defined policies; or (iii) ensuring that the combination of selected security attributes selected is valid. Organizations consider the creation, deletion, or modification of security attributes when defining auditable events. Related control: AU-2.

(5) *SECURITY ATTRIBUTES | ATTRIBUTE DISPLAYS FOR OUTPUT DEVICES*

The information system displays security attributes in human-readable form on each object that the system transmits to output devices to identify [*Assignment: organization-identified special dissemination, handling, or distribution instructions*] using [*Assignment: organization-identified human readable, standard naming conventions*].

Supplemental Guidance: Information system outputs include, for example, pages, screens, or equivalent. Information system output devices include, for example, printers and video displays on computer workstations, notebook computers, and personal digital assistants.

(6) *SECURITY ATTRIBUTES | MAINTENANCE OF ATTRIBUTE ASSOCIATION BY ORGANIZATION*

The organization associates, and maintains the association of [*Assignment: organization-defined security attributes*] with [*Assignment: organization-defined subjects and objects*] in accordance with [*Assignment: organization-defined security policies*].

Supplemental Guidance: This control enhancement requires individual users (as opposed to the information system) to maintain associations of security attributes with subjects and objects.

(7) *SECURITY ATTRIBUTES | CONSISTENT ATTRIBUTE INTERPRETATION*

The organization provides a consistent interpretation of security attributes transmitted between distributed information system components.

Supplemental Guidance: In order to enforce security policies across multiple components in distributed information systems (e.g., distributed database management systems, cloud-based systems, and service-oriented architectures), organizations provide a consistent interpretation of security attributes that are used in access enforcement and flow enforcement decisions.

Organizations establish agreements and processes to ensure that all distributed information system components implement security attributes with consistent interpretations in automated access/flow enforcement actions.

(8) *SECURITY ATTRIBUTES | ASSOCIATION TECHNIQUES / TECHNOLOGIES*

The information system employs [*Assignment: organization-defined techniques or technologies*] with [*Assignment: organization-defined level of assurance*] in associating security attributes to information.

Supplemental Guidance: The association (i.e., binding) of security attributes to information within information systems is of significant importance with regard to conducting automated access enforcement and flow enforcement actions. The association of such security attributes can be accomplished with technologies/techniques providing different levels of assurance. For example, information systems can cryptographically bind security attributes to information using digital signatures with the supporting cryptographic keys protected by hardware devices (sometimes known as hardware roots of trust).

(9) *SECURITY ATTRIBUTES | ATTRIBUTE REASSIGNMENT*

The organization ensures that security attributes associated with information are only reassigned via re-grading mechanisms validated using [*Assignment: organization-defined techniques or procedures*].

Supplemental Guidance: Validated re-grading mechanisms are employed by organizations to provide the requisite levels of assurance for security attribute reassignment activities. The validation is facilitated by ensuring that re-grading mechanisms are single purpose and of limited function. Since security attribute reassignments can affect security policy enforcement actions (e.g., access/flow enforcement decisions), using trustworthy re-grading mechanisms is important to ensure that such mechanisms perform in a consistent/correct mode of operation.

(10) *SECURITY ATTRIBUTES | ATTRIBUTE CONFIGURATION BY AUTHORIZED INDIVIDUALS*

The information system provides authorized individuals the capability to define or change the type and value of security attributes available for association with subjects and objects.

Supplemental Guidance: The content or assigned values of security attributes can directly affect the ability of individuals to access organizational information. Therefore, it is important for information systems to be able to limit the ability to create or modify security attributes to authorized individuals only. Related controls: AC-6, AU-2.

(11) *SECURITY ATTRIBUTES | PERMITTED ATTRIBUTES FOR SPECIFIED INFORMATION SYSTEMS*

The organization establishes the permitted [*Assignment: organization-defined set security attributes*] for [*Assignment: organization-defined information systems*].

Supplemental Guidance: The content or assigned values of security attributes can directly affect the ability of individuals to access organizational information. Organizations can define the specific types of attributes needed for selected information systems to support missions and/or business functions. Related controls: AC-6, AU-2.

(12) *SECURITY ATTRIBUTES | PERMITTED VALUES AND RANGES FOR ATTRIBUTES*

The organization determines the permitted [*Assignment: organization-defined values or ranges*] for each of the established security attributes.

Supplemental Guidance: There is potentially a wide range of values that can be assigned to any given security attribute. Release markings could include, for example, US only, NATO, or NOFORN (not releasable to foreign nationals). By specifying permitted attribute ranges and values, organizations can ensure that the security attribute values are meaningful and relevant. Related controls: AC-6, AU-2.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

AC-17 REMOTE ACCESS

Control: The organization:

a. Documents allowed methods of remote access to the information system;

b. Establishes usage restrictions and implementation guidance for each allowed remote access method;

c. Monitors for unauthorized remote access to the information system [*Assignment: organization-defined frequency*] and takes [*Assignment: organization-defined actions*] if an unauthorized connection is discovered;

d. Authorizes remote access to the information system prior to allowing such connections; and

e. Enforces requirements for remote connections to the information system.

Supplemental Guidance: Remote access is access to organizational information systems by users (or processes acting on behalf of users) communicating through external networks (e.g., the Internet). Remote access methods include, for example, dial-up, broadband, and wireless. Virtual private networks (VPNs), when adequately provisioned with appropriate security controls, are considered internal networks. While access across virtual private networks is not considered remote access, organizations still rely on external networks to protect availability of connections. Organizations can establish backup virtual private networks to mitigate the risk from relying on such external networks. VPNs with encrypted tunnels can affect the capability of organizations to adequately monitor network traffic for malware. Remote access controls apply to information systems other than public web servers or systems designed for public access. This control addresses explicit authorization prior to allowing remote access without specifying formats for such authorizations. While organizations may use system interconnection agreements to authorize remote access connections, such agreements are not required by this control. Enforcing access restrictions for remote connections is addressed in AC-3. Related controls: AC-2, AC-3, AC-18, AC-19, AC-20, CA-3, CA-7, CM-8, IA-2, IA-3, IA-8, MA-4, PE-17, PL-4, SC-10, SI-4.

Control Enhancements:

(1) *REMOTE ACCESS | AUTOMATED MONITORING / CONTROL*

The organization employs automated mechanisms to facilitate the monitoring and control of remote access methods.

Supplemental Guidance: Automated monitoring and control of remote access sessions allows organizations to detect cyber attacks and also ensure ongoing compliance with remote access policies by auditing activities of remote users on a variety of information system components (e.g., servers, workstations, notebook computers, smart phones). Related controls: AU-2, AU-12.

(2) *REMOTE ACCESS | PROTECTION OF CONFIDENTIALITY / INTEGRITY USING ENCRYPTION*

The information system employs cryptography to protect the confidentiality and integrity of remote access sessions.

Supplemental Guidance: The encryption strength of mechanism is selected based on the security categorization of the information. Related controls: SC-8, SC-9, SC-13.

(3) *REMOTE ACCESS | MANAGED ACCESS CONTROL POINTS*

The information system routes all remote accesses through a limited number of managed access control points.

Supplemental Guidance: Related control: SC-7.

(4) *REMOTE ACCESS | PRIVILEGED COMMANDS / ACCESS*

The organization authorizes the execution of privileged commands and access to security-relevant information via remote access only for [*Assignment: organization-defined compelling operational needs*] and documents the rationale for such access in the security plan for the information system.

Supplemental Guidance: Related control: AC-6.

(5) *REMOTE ACCESS | MONITORING FOR UNAUTHORIZED CONNECTIONS*

[Withdrawn: Incorporated into AC-17].

(6) *REMOTE ACCESS | PROTECTION OF INFORMATION*

The organization ensures that users protect information about remote access mechanisms from unauthorized use and disclosure.

(7) *REMOTE ACCESS | ADDITIONAL PROTECTION FOR SECURITY FUNCTION ACCESS*

[Withdrawn: Incorporated into AC-3].

(8) *REMOTE ACCESS | DISABLE NONSECURE NETWORK PROTOCOLS*

[Withdrawn: Incorporated into CM-7].

(9) *REMOTE ACCESS | DISCONNECT / DISABLE ACCESS*

The organization provides the capability to expeditiously disconnect or disable remote access to the information system.

Supplemental Guidance: This control enhancement requires organizations to have the capability to rapidly disconnect current users remotely accessing the information system and/or disable further remote access. The speed of disconnect or disablement varies based on the criticality of missions/business functions and the need to eliminate immediate or future remote access to organizational information systems.

References: NIST Special Publications 800-46, 800-77, 800-113, 800-114, 800-121.

Priority and Baseline Allocation:

P1	**LOW** AC-17	**MOD** AC-17 (1) (2) (3) (4)	**HIGH** AC-17 (1) (2) (3) (4)

AC-18 WIRELESS ACCESS

Control: The organization:

a. Establishes usage restrictions and implementation guidance for wireless access;

b. Authorizes wireless access to the information system prior to connection;

c. Enforces requirements for wireless connections to the information system;

d. Monitors for unauthorized wireless connections to the information system [*Assignment: organization-defined frequency*]; and

e. Takes [*Assignment: organization-defined actions*] in response, if unauthorized connections are discovered.

Supplemental Guidance: Wireless technologies include, for example, microwave, satellite, packet radio (UHF/VHF), 802.11x, and Bluetooth. Wireless networks use authentication protocols (e.g., EAP/TLS, PEAP), which provide credential protection and mutual authentication. In certain situations, wireless signals may radiate beyond the confines of organization-controlled facilities. Organizations proactively search for unauthorized wireless connections including the conduct of thorough scans for unauthorized wireless access points. Scans are not limited to those areas within facilities containing information systems, but also include areas outside of facilities as needed, to verify that unauthorized wireless access points are not connected to the systems. Organizational response actions include, for example, disabling unauthorized wireless connections. Related controls: AC-2, AC-3, AC-17, AC-19, CA-3, CA-7, CM-8, IA-2, IA-3, IA-8, PL-4, SI-4.

Control Enhancements:

(1) *WIRELESS ACCESS | AUTHENTICATION AND ENCRYPTION*

The information system protects wireless access to the system using authentication of [*Selection (one or more): users; devices*] and encryption.

Supplemental Guidance: Related controls: SC-8, SC-9, SC-13.

(2) *WIRELESS ACCESS | MONITORING UNAUTHORIZED CONNECTIONS*

[Withdrawn: Incorporated into AC-18].

(3) *WIRELESS ACCESS | DISABLE WIRELESS NETWORKING*

The organization disables, when not intended for use, wireless networking capabilities internally embedded within information system components prior to issuance and deployment.

Supplemental Guidance: Related control: AC-19.

(4) *WIRELESS ACCESS | RESTRICT CONFIGURATIONS BY USERS*

The organization identifies and explicitly authorizes users allowed to independently configure wireless networking capabilities.

Supplemental Guidance: Organizational authorizations to allow selected users to configure wireless networking capability are enforced in part, by the access enforcement mechanisms employed within organizational information systems. Related controls: AC-3, SC-15.

(5) *WIRELESS ACCESS | CONFINE WIRELESS COMMUNICATIONS*

The organization confines [*Assignment: organization-defined wireless communications*] to organization-controlled boundaries.

Supplemental Guidance: Actions that may be taken by organizations to confine wireless communications to organization-controlled boundaries include, for example: (i) reducing the power of wireless transmissions such that the transmissions cannot transit physical perimeters of organizations; (ii) employing measures to control wireless emanations (e.g., TEMPEST); and (iii) configuring wireless accesses such that the accesses are point to point in nature. Related control: PE-19.

References: NIST Special Publications 800-48, 800-94, 800-97.

Priority and Baseline Allocation:

P1	**LOW** AC-18	**MOD** AC-18 (1)	**HIGH** AC-18 (1) (4) (5)

AC-19 ACCESS CONTROL FOR MOBILE DEVICES

Control: The organization:

a. Establishes usage restrictions and implementation guidance for organization-controlled mobile devices;

b. Authorizes connection of mobile devices meeting organizational usage restrictions and implementation guidance to organizational information systems;

c. Monitors for unauthorized connections of mobile devices to organizational information systems;

d. Enforces requirements for the connection of mobile devices to organizational information systems;

e. Disables information system functionality that provides the capability for automatic execution of code on mobile devices without user direction;

f. Issues mobile devices with [*Assignment: organization-defined configurations*] to individuals traveling to locations that the organization deems to be of significant risk; and

g. Applies [*Assignment: organization-defined security safeguards*] to mobile devices returning from locations deemed to be of significant risk in accordance with organizational policies and procedures.

Supplemental Guidance: Mobile devices include portable computing and communications devices with information storage capability (e.g., notebook computers, personal digital assistants, cellular telephones, digital cameras, and audio recording devices). Organization-controlled mobile devices include those devices for which organizations have the authority to specify and ability to enforce

specific security requirements. Usage restrictions and implementation guidance related to mobile devices include, for example, configuration management, device-to-device identification and authentication, implementation of mandatory protective software (e.g., malicious code detection, firewall), scanning devices for malicious code, updating virus protection software, scanning for critical software updates and patches, conducting primary operating system (and possibly other resident software) integrity checks, and disabling unnecessary hardware (e.g., wireless, infrared). Information system functionality that provides the capability for automatic execution of code, include, for example, AutoRun and AutoPlay.

Organizational policies and procedures for mobile devices used by individuals departing on and returning from travel include, for example, determining which locations are of concern, defining required configurations for the devices, ensuring that the devices are configured as intended before travel is initiated, and applying specific safeguards to the device after travel is completed. Specially configured mobile devices include, for example, computers with sanitized hard drives, limited applications, and additional hardening (e.g., more stringent configuration settings). Specified safeguards applied to mobile devices upon return from travel include, for example, examining the device for signs of physical tampering and purging/reimaging the hard disk drive. Protecting information residing on mobile devices is covered in the media protection family. Related controls: AC-3, AC-7, AC-18, AC-20, CM-2, IA-2, IA-3, MP-2, MP-4, MP-5, PL-4, SC-7, SI-3, SI-4.

Control Enhancements:

(1) *ACCESS CONTROL FOR MOBILE DEVICES | USE OF WRITABLE / REMOVABLE MEDIA*

[Withdrawn: Incorporated into MP-7].

(2) *ACCESS CONTROL FOR MOBILE DEVICES | USE OF PERSONALLY OWNED REMOVABLE MEDIA*

[Withdrawn: Incorporated into MP-7].

(3) *ACCESS CONTROL FOR MOBILE DEVICES | USE OF REMOVABLE MEDIA WITH NO IDENTIFIABLE OWNER*

[Withdrawn: Incorporated into MP-7].

(4) *ACCESS CONTROL FOR MOBILE DEVICES | RESTRICTIONS FOR CLASSIFIED INFORMATION*

The organization:

(a) Prohibits the use of unclassified mobile devices in facilities containing information systems processing, storing, or transmitting classified information unless specifically permitted by the authorizing official; and

(b) Enforces the following restrictions on individuals permitted by the authorizing official to use unclassified mobile devices in facilities containing information systems processing, storing, or transmitting classified information:

- **Connection of unclassified mobile devices to classified information systems is prohibited;**
- **Connection of unclassified mobile devices to unclassified information systems requires approval from the authorizing official;**
- **Use of internal or external modems or wireless interfaces within the unclassified mobile devices is prohibited; and**
- **Unclassified mobile devices and the information stored on those devices are subject to random reviews and inspections by [*Assignment: organization-defined security officials*], and if classified information is found, the incident handling policy is followed.**

Supplemental Guidance: Related controls: CA-6, IR-4.

(5) *ACCESS CONTROL FOR MOBILE DEVICES | PERSONALLY OWNED DEVICES*

The organization [*Selection: restricts; prohibits*] the connection of personally-owned, mobile devices to organizational information systems.

(6) *ACCESS CONTROL FOR MOBILE DEVICES | FULL DISK ENCRYPTION*

The organization uses full-disk encryption to protect the confidentiality of information on [*Assignment: organization-defined mobile devices*].

Supplemental Guidance: This control enhancement applies to mobile devices that are organization-controlled.

(7) *ACCESS CONTROL FOR MOBILE DEVICES | CENTRAL MANAGEMENT OF MOBILE DEVICES*

The organization centrally manages [*Assignment: organization-defined mobile devices*].

Supplemental Guidance: This control enhancement applies to mobile devices that are organization-controlled and excludes portable storage media.

(8) *ACCESS CONTROL FOR MOBILE DEVICES | REMOTE PURGING OF INFORMATION*

The organization provides the capability to remotely purge information from [*Assignment: organization-defined mobile devices*].

Supplemental Guidance: This control enhancement protects organizational information on mobile devices if the devices are obtained by unauthorized individuals.

(9) *ACCESS CONTROL FOR MOBILE DEVICES | TAMPER DETECTION*

The organization inspects [*Assignment: organization-defined mobile devices*] [*Selection (one or more): at random;* at [*Assignment: organization-defined frequency*], *upon* [*Assignment: organization-defined indications of need for inspection*]] to detect tampering.

Supplemental Guidance: This control enhancement addresses both physical and logical tampering. Related controls: SI-4, SI-7.

References: OMB Memorandum 06-16; NIST Special Publications 800-114, 800-124.

Priority and Baseline Allocation:

P1	**LOW** AC-19	**MOD** AC-19 (6)	**HIGH** AC-19 (6)

AC-20 USE OF EXTERNAL INFORMATION SYSTEMS

Control: The organization establishes terms and conditions, consistent with any trust relationships established with other organizations owning, operating, and/or maintaining external information systems, allowing authorized individuals to:

a. Access the information system from external information systems; and

b. Process, store, or transmit organization-controlled information using external information systems.

Supplemental Guidance: External information systems are information systems or components of information systems that are outside of the authorization boundary established by organizations and for which organizations typically have no direct supervision and authority over the application of required security controls or the assessment of control effectiveness. External information systems include, for example: (i) personally owned information systems/devices (e.g., notebook computers, cellular telephones, or personal digital assistants); (ii) privately owned computing and communications devices resident in commercial or public facilities (e.g., hotels, train stations, convention centers, or airports); (iii) information systems owned or controlled by nonfederal governmental organizations; and (iv) federal information systems that are not owned by, operated by, or under the direct supervision and authority of organizations. This control also addresses the use of external information systems for the processing, storage, or transmission of organizational information, including, for example, accessing cloud-based information systems and services (e.g., infrastructure as a service [IAAS], platform as a service [PAAS], software as a service [SAAS]) from organizational information systems. For some external information systems (i.e., systems operated by other federal agencies, including organizations subordinate to those agencies), the trust relationships that have been established between those organizations and the originating organization may be such, that no explicit terms and conditions are required. Information systems within these organizations would not be considered external. These situations occur when, for example, there are pre-existing sharing/trust agreements (either implicit or explicit) established between federal agencies and/or organizations subordinate to those agencies, or when such trust agreements are specified by applicable laws, Executive Orders, directives, or policies. Authorized individuals include, for example, organizational personnel, contractors, or other individuals with authorized access to organizational information systems and over which organizations have the

authority to impose rules of behavior with regard to system access. Restrictions that organizations impose on authorized individuals need not be uniform, as those restrictions may vary depending upon the trust relationships between organizations. Therefore, organizations may choose to impose different security restrictions on contractors than on state, local, or tribal governments.

This control does not apply to the use of external information systems to access public interfaces to organizational information systems (e.g., individuals accessing federal information through www.usa.gov). Organizations establish terms and conditions for the use of external information systems in accordance with organizational security policies and procedures. Terms and conditions address as a minimum: (i) types of applications that can be accessed on organizational information systems from external information systems; and (ii) the highest security category of information that can be processed, stored, or transmitted on external information systems. Related controls: AC-3, AC-17, AC-19, CA-3, PL-4, SA-9.

Control Enhancements:

(1) *USE OF EXTERNAL INFORMATION SYSTEMS | LIMITS ON AUTHORIZED USE*

The organization permits authorized individuals to use an external information system to access the information system or to process, store, or transmit organization-controlled information only when the organization:

(a) Verifies the implementation of required security controls on the external system as specified in the organization's information security policy and security plan; or

(b) Retains approved information system connection or processing agreements with the organizational entity hosting the external information system.

Supplemental Guidance: Related control: CA-2.

(2) *USE OF EXTERNAL INFORMATION SYSTEMS | PORTABLE STORAGE MEDIA*

The organization limits the use of organization-controlled portable storage media by authorized individuals on external information systems.

Supplemental Guidance: Limits on the use of organization-controlled portable storage media in external information systems include, for example, complete prohibition of the use of such devices or restrictions on how the devices may be used and under what conditions the devices may be used.

(3) *USE OF EXTERNAL INFORMATION SYSTEMS | PERSONALLY OWNED INFORMATION SYSTEMS / DEVICES*

The organization [*Selection: restricts; prohibits*] the use of personally owned information systems or devices to process, store, or transmit federal information.

(4) *USE OF EXTERNAL INFORMATION SYSTEMS | NETWORK ACCESSIBLE STORAGE DEVICES*

The organization prohibits the use of [*Assignment: organization-defined network accessible storage devices*] in external information systems.

Supplemental Guidance: Network accessible storage devices in external information systems include, for example, online storage devices in public, hybrid, or community cloud-based systems.

References: FIPS Publication 199.

Priority and Baseline Allocation:

P1	**LOW** AC-20	**MOD** AC-20 (1) (2)	**HIGH** AC-20 (1) (2)

AC-21 COLLABORATION AND INFORMATION SHARING

Control: The organization:

a. Facilitates information sharing by enabling authorized users to determine whether access authorizations assigned to the sharing partner match the access restrictions on the information for [*Assignment: organization-defined information sharing circumstances where user discretion is required*]; and

b. Employs [*Assignment: organization-defined information sharing circumstances and automated mechanisms or manual processes required*] to assist users in making information sharing/collaboration decisions.

Supplemental Guidance: This control applies to information that may be restricted in some manner (e.g., privileged medical information, contract-sensitive information, proprietary information, personally identifiable information, classified information, information related to special access programs/compartments) based on some formal or administrative determination. Depending on the particular information-sharing circumstances, sharing partners may be defined at the individual, group, or organizational level. Information may be defined by content, type, security category, or classification level. Related control: AC-3.

Control Enhancements:

(1) *COLLABORATION AND INFORMATION SHARING | AUTOMATED DECISION SUPPORT*

The organization employs automated mechanisms to enable authorized users to make information-sharing decisions based on access authorizations of sharing partners and access restrictions on information to be shared.

(2) *COLLABORATION AND INFORMATION SHARING | INFORMATION SEARCH AND RETRIEVAL*

The information system implements information search and retrieval services that enforce [*Assignment: organization-defined information sharing restrictions*].

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** AC-21	**HIGH** AC-21

AC-22 PUBLICLY ACCESSIBLE CONTENT

Control: The organization:

a. Designates individuals authorized to post information onto a publicly accessible information system;

b. Trains authorized individuals to ensure that publicly accessible information does not contain nonpublic information;

c. Reviews the proposed content of information prior to posting onto the publicly accessible information system to ensure nonpublic information is not included; and

d. Reviews the content on the publicly accessible information system for nonpublic information [*Assignment: organization-defined frequency*] and removes such information, if discovered.

Supplemental Guidance: In accordance with federal laws, Executive Orders, directives, policies, regulations, standards, and/or guidance, the general public is not authorized access to nonpublic information (e.g., information protected under the Privacy Act and proprietary information). This control addresses information systems that are accessible to the general public, typically without identification or authentication. The posting of information on non-organization information systems is covered by organizational policy. Related controls: AC-3, AC-4, AT-2, AT-3, AU-13.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P2	**LOW** AC-22	**MOD** AC-22	**HIGH** AC-22

AC-23 DATA MINING PROTECTION

Control: The organization implements [*Assignment: organization-defined data mining and data harvesting techniques*] for [*Assignment: organization-defined data storage objects*] to adequately protect against data mining and data harvesting.

Supplemental Guidance: Data storage objects include, for example, databases, database records, and database fields. Data mining and data harvesting techniques include, for example, limiting the types of responses provided to database queries or limiting the number or frequency of database queries to increase the work factor required to determine the contents of databases. This control can also be employed by organizations to reduce the effectiveness of information harvesting from social networking sites, thus, limiting the amount of information that can be obtained from those sites.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

AC-24 ACCESS CONTROL DECISIONS

Control: The organization establishes [*Assignment: organization-defined procedures*] to ensure [*Assignment: organization-defined access control decisions*] are applied to each access request prior to access control enforcement.

Supplemental Guidance: Access control decisions (also known as authorization decisions) occur when authorization information is applied to specific accesses. In contrast, access enforcement occurs when information systems enforce access control decisions. While it is common to have access control decisions and access enforcement implemented by the same entity, it is not required and it is not always an optimal implementation choice. For some architectures and distributed information systems (e.g., service-oriented architectures), different services may perform access control decisions and access control enforcement.

Control Enhancements:

(1) *ACCESS CONTROL DECISIONS | TRANSMIT ACCESS AUTHORIZATION INFORMATION*

The information system transmits [*Assignment: organization-defined access authorization information including supporting security attributes*] in a secure manner to [*Assignment: organization-defined information systems*] that make access control decisions.

Supplemental Guidance: Authorization information is provided to entities (e.g., information systems, services or components) making access control decisions. In distributed systems including for example, service-oriented architectures (SOA), authorization processes and access control decisions may occur in separate parts of the distributed systems. In such instances, it is important that authorization information is transmitted securely so timely access control decisions can be carried out at the appropriate locations. To support the access control decisions, it may be necessary to transmit as part of the authorization information, supporting security attributes. This is due to the fact that within distributed systems, there are various access control decisions that need to be made and different entities (e.g., services) make these decisions in a serial fashion, each requiring some security attributes to make the decisions.

(2) *ACCESS CONTROL DECISIONS | NO USER OR PROCESS IDENTITY*

The information system makes access control decisions based on [*Assignment: organization-defined security attributes*] that do not include the identity of the user or process acting on behalf of the user.

Supplemental Guidance: In certain situations, it is important that access control decisions can be made without information regarding the identity of the users issuing the requests. These are

generally instances where preserving individual privacy is of paramount importance. In other situations, user identification information is simply not needed for access control decisions and, especially in the case of distributed information systems, transmitting such information with the needed degree of assurance may be very expensive or difficult to accomplish.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

AC-25 REFERENCE MONITOR FUNCTION

Control: The information system implements a reference validation mechanism for [*Assignment: organization-defined access control policies*] that is tamperproof, always invoked, and small enough to be subject to analysis and testing.

Supplemental Guidance: Information is represented internally within information systems using abstractions known as data structures. Internal data structures can represent different types of entities, both active and passive. Active entities, also known as *subjects*, are typically associated with individuals, devices, or processes acting on behalf of individuals. Passive entities, also known as *objects*, are typically associated with data structures such as records, buffers, tables, files, inter-process pipes, and communications ports. Reference validation mechanisms typically enforce nondiscretionary access control policies—a type of access control that restricts access to objects based on the identity of subjects or groups to which the subjects belong. The access controls are nondiscretionary because subjects with certain privileges (i.e., access permissions) are restricted from passing those privileges on to any other subjects, either directly or indirectly—that is, the information system strictly enforces the access control policy based on the rule set established by the policy. The *tamperproof* property of the reference validation mechanism prevents adversaries from compromising the functioning of the mechanism. The *always invoked* property prevents adversaries from bypassing the mechanism and hence violating the security policy. The *smallness* property helps to ensure the completeness in the analysis and testing of the mechanism to detect weaknesses or deficiencies (i.e., latent flaws) that would prevent the enforcement of the security Related controls: AC-3, AC-16, SC-3, SC-41.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: AWARENESS AND TRAINING

AT-1 SECURITY AWARENESS AND TRAINING POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented security awareness and training policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the security awareness and training policy and associated security awareness and training controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the AT family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-16, 800-50, 800-100.

Priority and Baseline Allocation:

P1	**LOW** AT-1	**MOD** AT-1	**HIGH** AT-1

AT-2 SECURITY AWARENESS

Control: The organization provides basic security awareness training to information system users (including managers, senior executives, and contractors):

a. As part of initial training for new users;

b. When required by information system changes; and

c. [*Assignment: organization-defined frequency*] thereafter.

Supplemental Guidance: Organizations determine the appropriate content of security awareness training and security awareness techniques based on the specific organizational requirements and the information systems to which personnel have authorized access. The content includes a basic understanding of the need for information security and user actions to maintain security and to respond to suspected security incidents. The content also addresses awareness of the need for operations security. Security awareness techniques can include, for example, displaying posters, offering supplies inscribed with security reminders, generating email advisories/notices from senior organizational officials, displaying logon screen messages, and conducting information security awareness events. Related controls: AT-3, AT-4.

Control Enhancements:

(1) *SECURITY AWARENESS | PRACTICAL EXERCISES*

The organization includes practical exercises in security awareness training that simulate actual cyber attacks.

Supplemental Guidance: Practical exercises may include, for example, no-notice social engineering attempts to collect information, gain unauthorized access, or simulate the adverse

impact of opening malicious email attachments or invoking malicious web links. Related controls: CA-2, CA-7, CP-4, IR-3.

(2) *SECURITY AWARENESS | INSIDER THREAT*

The organization includes security awareness training on recognizing and reporting potential indicators of insider threat.

Supplemental Guidance: Potential indicators and possible precursors of insider threat can include concerning behaviors such as inordinate, long-term job dissatisfaction, attempts to gain access to information not required for job performance, unexplained access to financial resources, bullying or sexual harassment of fellow colleagues, workplace violence, and other serious violations of organizational policies, procedures, directives, rules, and/or practices. Security awareness training includes how to communicate employee/management concerns regarding potential indicators of insider threat through appropriate organizational channels in accordance with established organizational policies and procedures. Related control: PM-12.

References: C.F.R. Part 5 Subpart C (5 C.F.R 930.301); NIST Special Publication 800-50.

Priority and Baseline Allocation:

P1	**LOW** AT-2	**MOD** AT-2 (2)	**HIGH** AT-2 (2)

AT-3 SECURITY TRAINING

Control: The organization provides role-based security training to information system users:

a. Before authorizing access to the information system or performing assigned duties;

b. When required by information system changes; and

c. [*Assignment: organization-defined frequency*] thereafter.

Supplemental Guidance: Organizations determine the appropriate content of security training based on the assigned roles and responsibilities of individuals and the specific security requirements of organizations and the information systems to which personnel have authorized access. In addition, organizations provides enterprise architects, information system developers, software developers, acquisition/procurement officials, information system managers, system/network administrators, personnel performing independent verification and validation activities, security control assessors, and other personnel having access to system-level software, adequate security-related technical training specifically tailored for their assigned duties. Comprehensive security training addresses management, operational, and technical roles and responsibilities covering physical, personnel, and technical safeguards and countermeasures. Organizations also provide the security training necessary for individuals to carry out their responsibilities related to operations and supply chain security within the context of organizational information security programs. Role-based security training also applies to federal contractors providing services to federal agencies. Related controls: AT-2, AT-4, PS-7, SA-3.

Control Enhancements:

(1) *SECURITY TRAINING | ENVIRONMENTAL CONTROLS*

The organization provides [*Assignment: organization-defined personnel*] with initial and [*Assignment: organization-defined frequency*] training in the employment and operation of environmental controls.

Supplemental Guidance: Environmental controls include, for example, fire suppression and detection devices/systems, sprinkler systems, handheld fire extinguishers, fixed fire hoses, smoke detectors, temperature/humidity, HVAC, and power within the facility. Organizations identify personnel with specific roles and responsibilities associated with environmental controls requiring specialized training. Related controls: PE-1, PE-13, PE-14, PE-15.

(2) *SECURITY TRAINING | PHYSICAL SECURITY CONTROLS*

The organization provides [*Assignment: organization-defined employees*] with initial and [*Assignment: organization-defined frequency*] training in the employment and operation of physical security controls.

Supplemental Guidance: Physical security controls include, for example, physical access control devices, physical intrusion alarms, monitoring/surveillance equipment, and security guards (deployment and operating procedures). Organizations identify personnel with specific roles and responsibilities associated with physical security controls requiring specialized training. Related controls: AT-4, PE-2, PE-3, PE-4, PE-5.

(3) *SECURITY TRAINING | PRACTICAL EXERCISES*

The organization includes practical exercises in security training that reinforce training objectives.

Supplemental Guidance: As an example of practical exercises, organizations might provide security training for software developers that includes simulated cyber attacks exploiting common software vulnerabilities (e.g., buffer overflows). These types of practical exercises help developers better understand the effects of such vulnerabilities and appreciate the need for security coding standards and processes.

References: C.F.R. Part 5 Subpart C (5 C.F.R. 930.301); NIST Special Publications 800-16, 800-50.

Priority and Baseline Allocation:

P1	**LOW** AT-3	**MOD** AT-3	**HIGH** AT-3

AT-4 SECURITY TRAINING RECORDS

Control: The organization:

a. Documents and monitors individual information system security training activities including basic security awareness training and specific information system security training; and

b. Retains individual training records for [*Assignment: organization-defined time period*].

Supplemental Guidance: Documentation for specialized training may be maintained by individual supervisors at the option of the organization. Related controls: AT-2, AT-3, PM-15.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P3	**LOW** AT-4	**MOD** AT-4	**HIGH** AT-4

AT-5 CONTACTS WITH SECURITY GROUPS AND ASSOCIATIONS

Control: The organization establishes and institutionalizes contact with selected groups and associations within the security community:

- To facilitate ongoing security education and training for organizational personnel;
- To maintain currency with recommended security practices, techniques, and technologies; and
- To share current security-related information including threats, vulnerabilities, and incidents.

Supplemental Guidance: Ongoing contact with security groups and associations is of paramount importance in an environment of rapidly changing technologies and threats. Security groups and associations include, for example, special interest groups, forums, professional associations, news

groups, and/or peer groups of security professionals in similar organizations. Organizations select groups and associations based on organizational missions/business functions. Organizations share threat, vulnerability, and incident information consistent with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Related control: SI-5.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P3	**LOW** Not Selected	**MOD** AT-5	**HIGH** AT-5

FAMILY: AUDIT AND ACCOUNTABILITY

AU-1 AUDIT AND ACCOUNTABILITY POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented audit and accountability policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the audit and accountability policy and associated audit and accountability controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the AU family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** AU-1	**MOD** AU-1	**HIGH** AU-1

AU-2 AUDITABLE EVENTS

Control: The organization:

a. Determines that the information system must be capable of auditing the following events: [*Assignment: organization-defined auditable events*];

b. Coordinates the security audit function with other organizational entities requiring audit-related information to enhance mutual support and to help guide the selection of auditable events;

c. Provides a rationale for why the auditable events are deemed to be adequate to support after-the-fact investigations of security incidents; and

d. Determines that the following events are to be audited within the information system: [*Assignment: organization-defined subset of the auditable events defined in AU-2 a. to be audited along with the frequency of (or situation requiring) auditing for each identified event*].

Supplemental Guidance: Organizations identify events which need to be auditable as significant and relevant to the security of organizational information systems and the environments in which those systems operate in order to meet specific/ongoing audit needs. In determining auditable events, organizations consider the specific auditing appropriate for each of the security controls to be implemented. To balance auditing requirements with other information system needs, this control also requires identifying that subset of *auditable* events that are *audited* at a given point in time. For example, organizations may determine that information systems must have the capability to log every file access both successful and unsuccessful, but not activate that capability except for specific circumstances due to the extreme burden on system performance. Audit records can be

generated at various levels of abstraction, including at the packet level as information traverses the network. Selecting the right level of abstraction is a critical aspect of an audit capability and can facilitate the identification of root causes to problems. Organizations also consider in the definition of audible events, the auditing necessary to cover related events such as the various steps in distributed, transaction-based processes (e.g., processes that are distributed across multiple organizations) and actions in service-oriented architectures. Related controls: AC-6, AC-17, AU-3, AU-12, MA-4, MP-2, SI-4.

Control Enhancements:

(1) *AUDITABLE EVENTS | COMPILATION OF AUDIT RECORDS FROM MULTIPLE SOURCES*

[Withdrawn: Incorporated into AU-12].

(2) *AUDITABLE EVENTS | SELECTION OF AUDIT EVENTS BY COMPONENT*

[Withdrawn: Incorporated into AU-12].

(3) *AUDITABLE EVENTS | REVIEWS AND UPDATES*

The organization reviews and updates the auditable events [*Assignment: organization-defined frequency*].

(4) *AUDITABLE EVENTS | PRIVILEGED FUNCTIONS*

The organization includes execution of privileged functions in the events to be audited by the information system.

References: NIST Special Publication 800-92; Web: CSRC.NIST.GOV/PCIG/CIG.HTML.

Priority and Baseline Allocation:

P1	**LOW** AU-2	**MOD** AU-2 (3) (4)	**HIGH** AU-2 (3) (4)

AU-3 CONTENT OF AUDIT RECORDS

Control: The information system produces audit records containing information that, at a minimum, establishes what type of event occurred, when the event occurred, where the event occurred, the source of the event, the outcome of the event, and the identity of any user or subject associated with the event.

Supplemental Guidance: Audit record content that may be necessary to satisfy the requirement of this control, includes, for example, time stamps, source and destination addresses, user/process identifiers, event descriptions, success/fail indications, filenames involved, and access control or flow control rules invoked. Event outcomes can include indicators of event success or failure and event-specific results (e.g., the security state of the information system after the event occurred). Related controls: AU-2, AU-8, AU-12, SI-11.

Control Enhancements:

(1) *CONTENT OF AUDIT RECORDS | ADDITIONAL AUDIT INFORMATION*

The information system includes [*Assignment: organization-defined additional, more detailed information*] in the audit records for audit events identified by type, location, or subject.

Supplemental Guidance: Detailed information that organizations may consider in audit records includes, for example, full-text recording of privileged commands or the individual identities of group account users. Organizations consider limiting the additional audit information to only that information explicitly needed for specific audit requirements. This facilitates the use of the audit trails by not including information that could potentially be misleading or could make it more difficult to locate information of interest.

(2) *CONTENT OF AUDIT RECORDS | CENTRALIZED MANAGEMENT OF PLANNED AUDIT RECORD CONTENT*

The information system provides centralized management and configuration of the content to be captured in audit records generated by [*Assignment: organization-defined information system components*].

Supplemental Guidance: This control enhancement requires that the content to be captured in audit records be configured from a central location (necessitating automation). Organizations

coordinate the selection of required audit content to support the centralized management and configuration capability provided by the information system. Related controls: AU-6, AU-7.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-3	**MOD** AU-3 (1)	**HIGH** AU-3 (1) (2)

AU-4 AUDIT STORAGE CAPACITY

Control: The organization allocates audit record storage capacity in accordance with [*Assignment: organization-defined audit record storage requirements*].

Supplemental Guidance: Organizations consider the types of auditing to be performed and the audit processing requirements when allocating audit storage capacity. Allocating sufficient audit storage capacity reduces the likelihood of such capacity being exceeded and resulting in the potential loss or reduction of auditing capability. Related controls: AU-2, AU-5, AU-6, AU-7, AU-11, SI-4.

Control Enhancements:

(1) *AUDIT STORAGE CAPACITY | TRANSFER TO ALTERNATE STORAGE*

The information system off-loads audit records [*Assignment: organization-defined frequency*] onto a different system or media than the system being audited.

Supplemental Guidance: This control enhancement addresses information systems that lack the capacity to store audit records for long periods of time. Off-loading is the process of moving audit records from the primary information system to a secondary or alternate system. It is a common process in information systems with limited audit storage capacity; the audit storage is used only in a transitory fashion until the system can communicate with the secondary or alternate system designated for storing the audit records, at which point the information is transferred. The transfer process is designed to preserve the integrity and confidentiality of audit records.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-4	**MOD** AU-4	**HIGH** AU-4

AU-5 RESPONSE TO AUDIT PROCESSING FAILURES

Control: The information system:

a. Alerts [*Assignment: organization-defined personnel*] in the event of an audit processing failure; and

b. Takes the following additional actions: [*Assignment: organization-defined actions to be taken (e.g., shut down information system, overwrite oldest audit records, stop generating audit records)*].

Supplemental Guidance: Audit processing failures include, for example, software/hardware errors, failures in the audit capturing mechanisms, and audit storage capacity being reached or exceeded. Organizations may choose to define additional actions for different audit processing failures (e.g., by type, by location, by severity, or a combination of such factors). This control applies to each audit data storage repository (i.e., distinct information system component where audit records are stored), the total audit storage capacity of organizations (i.e., all audit data storage repositories combined) or both. Related controls: AU-4, SI-12.

Control Enhancements:

(1) *RESPONSE TO AUDIT PROCESSING FAILURES | AUDIT STORAGE CAPACITY*

The information system provides a warning to [*Assignment: organization-defined personnel, roles, and/or locations*] within [*Assignment: organization-defined time period*] when allocated audit record storage volume reaches [*Assignment: organization-defined percentage*] of repository maximum audit record storage capacity.

Supplemental Guidance: Organizations may have multiple audit data storage repositories distributed across multiple information system components, with each repository having different storage volume capacities.

(2) *RESPONSE TO AUDIT PROCESSING FAILURES | REAL-TIME ALERTS*

The information system provides a real-time alert to [*Assignment: organization-defined personnel, roles, and/or locations*] when the following audit failure events occur: [*Assignment: organization-defined audit failure events requiring real-time alerts*].

Supplemental Guidance: Alerts provide organizations with urgent messages. Real-time alerts provide these messages at information technology speed (i.e., the time from event detection to alert occurs in seconds or less).

(3) *RESPONSE TO AUDIT PROCESSING FAILURES | CONFIGURABLE TRAFFIC VOLUME THRESHOLDS*

The information system enforces configurable traffic volume thresholds reflecting limits on auditing capacity related to network traffic volume and [*Selection: rejects; delays*] network traffic above those thresholds.

(4) *RESPONSE TO AUDIT PROCESSING FAILURES | SHUTDOWN ON FAILURE*

The information system invokes a system shutdown in the event of [*Assignment: organization-defined audit failures*], unless an alternate audit capability exists.

Supplemental Guidance: Organizations determine the types of audit failures that trigger automatic information system shutdowns. Related control: AU-15.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-5	**MOD** AU-5	**HIGH** AU-5 (1) (2)

AU-6 AUDIT REVIEW, ANALYSIS, AND REPORTING

Control: The organization:

a. Reviews and analyzes information system audit records [*Assignment: organization-defined frequency*] for indications of inappropriate or unusual activity;

b. Reports findings to [*Assignment: organization-defined personnel*];

c. Adjusts the level of audit review, analysis, and reporting within the information system when there is a change in risk based on law enforcement information, intelligence information, or other credible sources of information; and

d. Specifies the permitted actions for each [*Selection (one or more): information system process; role; user*] associated with the review, analysis, and reporting of audit information.

Supplemental Guidance: Audit review, analysis, and reporting covers all auditing performed by organizations including, for example, auditing that results from monitoring of account usage, remote access, wireless connectivity, mobile device connection, configuration settings, system component inventory, use of maintenance tools and non-local maintenance, physical access, temperature and humidity, equipment delivery and removal, communications at the information system boundaries, use of mobile code, and use of VoIP. Permitted actions for information system processes, roles, and/or users associated with the review, analysis, and reporting of audit records include, for example, read, write, execute, append, and delete. Related controls: AC-2, AC-3, AC-6, AC-17, AC-19, AT-3, AT-5, AU-7, CA-7, CM-6, CM-8, CM-10, CM-11, IA-5, IR-5, IR-6,

MA-3, MA-4, PE-3, PE-6, PE-14, PE-16, SC-7, SC-18, SC-19, SI-4, SI-7.

Control Enhancements:

(1) *AUDIT REVIEW, ANALYSIS, AND REPORTING | PROCESS INTEGRATION*

The information system integrates audit review, analysis, and reporting processes to support organizational processes for investigation and response to suspicious activities.

Supplemental Guidance: Related controls: AU-12, PM-7.

(2) *AUDIT REVIEW, ANALYSIS, AND REPORTING | AUTOMATED SECURITY ALERTS*

[Withdrawn: Incorporated into SI-4].

(3) *AUDIT REVIEW, ANALYSIS, AND REPORTING | CORRELATE AUDIT REPOSITORIES*

The organization analyzes and correlates audit records across different repositories to gain organization-wide situational awareness.

Supplemental Guidance: Organization-wide situational awareness includes awareness across all three tiers of risk management (i.e., organizational, mission/business process, and information system) and supports cross-organization awareness. Related controls: AU-12, IR-4.

(4) *AUDIT REVIEW, ANALYSIS, AND REPORTING | CENTRAL REVIEW AND ANALYSIS*

The information system provides the capability to centrally review and analyze audit records from multiple components within the system.

Supplemental Guidance: Automated mechanisms for centralized reviews and analyses include, for example, Security Information Management products. Related controls: AU-2, AU-12.

(5) *AUDIT REVIEW, ANALYSIS, AND REPORTING | INTEGRATION / SCANNING AND MONITORING CAPABILITIES*

The organization integrates analysis of audit records with analysis of vulnerability scanning information, performance data, and information system monitoring information to further enhance the ability to identify inappropriate or unusual activity.

Supplemental Guidance: This control enhancement does not require vulnerability scanning, the generation of performance data, or information system monitoring. Rather, the enhancement requires that the analysis of information being otherwise produced in these areas is integrated with the analysis of audit information. Security Event and Information Management System tools can facilitate audit record aggregation/consolidation from multiple information system components as well as audit record correlation and analysis. The use of standardized audit record analysis scripts developed by organizations (with localized script adjustments, as necessary), provides more cost-effective approaches for analyzing audit record information collected. The correlation of audit record information with vulnerability scanning information is important in determining the veracity of vulnerability scans and correlating attack detection events with scanning results. Correlation with performance data can help uncover denial of service attacks or cyber attacks resulting in unauthorized use of resources. Correlation with system monitoring information can assist in uncovering attacks and in better relating audit information to operational situations. Related controls: AU-12, IR-4, RA-5.

(6) *AUDIT REVIEW, ANALYSIS, AND REPORTING | CORRELATION WITH PHYSICAL MONITORING*

The organization correlates information from audit records with information obtained from monitoring physical access to further enhance the ability to identify suspicious, inappropriate, unusual, or malevolent activity.

(7) *AUDIT REVIEW, ANALYSIS, AND REPORTING | PERMITTED ACTIONS*

[Withdrawn: Incorporated into AU-6].

(8) *AUDIT REVIEW, ANALYSIS, AND REPORTING | FULL TEXT ANALYSIS OF PRIVILEGED COMMANDS*

The organization performs a full-text analysis of audited privileged commands in a physically-distinct component or subsystem of the information system, or other information system that is dedicated to that analysis.

Supplemental Guidance: Full text analysis refers to analysis that considers the full text of privileged commands (i.e., commands and all parameters) as opposed to analysis that only considers the name of the command. Full text analysis includes, for example, the use of pattern matching and heuristics. Related controls: AU-3, AU-9, AU-11, AU-12.

(9) *AUDIT REVIEW, ANALYSIS, AND REPORTING | CORRELATION WITH INPUT FROM NON-TECHNICAL SOURCES*

The organization correlates input from non-technical sources with audit information to enhance organization-wide situational awareness.

Supplemental Guidance: Non-technical sources include for example, human resources records documenting organizational policy violations (e.g., sexual harassment incidents, previous arrests, and/or improper use of organizational information assets). Such information can lead organizations to a more directed analytical effort to detect potential malicious insider activity. Organizations consider limiting access to information from non-technical sources to minimize potential privacy issues.

Related control: AT-2.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-6	**MOD** AU-6 (1) (3) (9)	**HIGH** AU-6 (1) (3) (5) (6) (9)

AU-7 AUDIT REDUCTION AND REPORT GENERATION

Control: The organization employs an audit reduction and report generation capability that:

a. Supports expeditious, on-demand audit review, analysis, and reporting requirements and after-the-fact investigations of security incidents; and

b. Does not alter original audit records.

Supplemental Guidance: Audit reduction and report generation capabilities do not always emanate from the same information system or from the same organizational entities conducting auditing activities. Related control: AU-6.

Control Enhancements:

(1) *AUDIT REDUCTION AND REPORT GENERATION | AUTOMATIC PROCESSING*

The information system provides the capability to automatically process audit records for events of interest based on the content of [*Assignment: organization-defined audit fields within audit records*].

Supplemental Guidance: Events of interest can be identified by the content of specific audit record fields including for example, identities of individuals, event types, event locations, event times, event dates, system resources involved, IP addresses involved, or information objects accessed. Organizations may define audit event criteria to any degree of granularity required, for example, locations selectable by general networking location (e.g., by network or subnetwork) or selectable by specific information system component. Related controls: AU-2, AU-12.

(2) *AUDIT REDUCTION AND REPORT GENERATION | AUTOMATIC SORTING*

The information system provides the capability to automatically sort audit records for events of interest based on the content of [*Assignment: organization-defined audit fields within audit records*].

Supplemental Guidance: Sorting of audit records may be based upon the contents of audit record fields, for example: (i) date/time of events; (ii) user identifiers; (iii) Internet Protocol (IP) addresses involved in the event; (iv) type of event; or (v) event success/failure.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** AU-7 (1)	**HIGH** AU-7 (1)

AU-8 TIME STAMPS

Control: The information system:

a. Uses internal system clocks to generate time stamps for audit records; and

b. Generates time in the time stamps that can be mapped to Coordinated Universal Time (UTC) or Greenwich Mean Time (GMT) and meets [*Assignment: organization-defined granularity of time measurement*].

Supplemental Guidance: Time stamps generated by the information system include date and time. Time is commonly expressed in Coordinated Universal Time (UTC), a modern continuation of Greenwich Mean Time (GMT), or local time with an offset from UTC. Granularity of time measurements refers to the degree of synchronization between information system clocks and reference clocks, for example, clocks synchronizing within hundreds of milliseconds or within tens of milliseconds. Organizations may define different time granularities for different system components. Related controls: AU-3, AU-12.

Control Enhancements:

(1) *TIME STAMPS | SYNCHRONIZATION WITH AUTHORITATIVE TIME SOURCE*

The information system synchronizes internal information system clocks [*Assignment: organization-defined frequency*] with [*Assignment: organization-defined authoritative time source*].

Supplemental Guidance: This control enhancement provides uniformity of time stamps for information systems with multiple system clocks and systems connected over a network. Related controls: AU-12.

(2) *TIME STAMPS | SECONDARY AUTHORITATIVE TIME SOURCE*

The information system identifies a secondary authoritative time source that is located in a different geographic region than the primary authoritative time source.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-8	**MOD** AU-8 (1)	**HIGH** AU-8 (1)

AU-9 PROTECTION OF AUDIT INFORMATION

Control: The information system protects audit information and audit tools from unauthorized access, modification, and deletion.

Supplemental Guidance: Audit information includes all information (e.g., audit records, audit settings, and audit reports) needed to successfully audit information system activity. This control focuses on technical protection of audit information. Physical protection of audit information is addressed by media protection controls and physical and environmental protection controls. Related controls: AC-3, AC-6, MP-2, MP-4, PE-2, PE-3, PE-6.

Control Enhancements:

(1) *PROTECTION OF AUDIT INFORMATION | HARDWARE WRITE-ONCE* MEDIA

The information system writes audit trails to hardware-enforced, write-once media.

Supplemental Guidance: This control enhancement applies to the initial generation of audit trails (i.e., the collection of audit records that represents the audit information to be used for detection, analysis, and reporting purposes) and to the backup of those audit trails. The enhancement does not apply to the initial generation of audit records prior to being written to an audit trail. Write-once, read-many (WORM) media includes, for example, Compact Disk-Recordable (CD-R) and Digital Video Disk-Recordable (DVD-R). In contrast, the use of switchable write-protection media such as on tape cartridges or Universal Serial Bus (USB) drives results in write-protected, but not write-once, media. Related controls: AU-4, AU-5.

(2) *PROTECTION OF AUDIT INFORMATION | AUDIT BACKUP ON SEPARATE PHYSICAL SYSTEMS / COMPONENTS*

The information system backs up audit records [*Assignment: organization-defined frequency*] onto a physically different system or system component than the system or component being audited.

Supplemental Guidance: This control enhancement helps to ensure that a compromise of the information system being audited does not also result in a compromise of the audit records. Related controls: AU-4, AU-5, AU-11.

(3) *PROTECTION OF AUDIT INFORMATION | CRYPTOGRAPHIC PROTECTION*

The information system employs cryptographic mechanisms to protect the integrity of audit information and audit tools.

Supplemental Guidance: Cryptographic mechanisms used for protecting the integrity of audit information include, for example, signed hash functions using asymmetric cryptography enabling distribution of the public key to verify the hash information while maintaining the confidentiality of the secret key used to generate the hash. Related controls: AU-10, SC-12, SC-13.

(4) *PROTECTION OF AUDIT INFORMATION | ACCESS BY SUBSET OF PRIVILEGED USERS*

The organization authorizes access to management of audit functionality to only [*Assignment: organization-defined subset of privileged users*].

Supplemental Guidance: Individuals with privileged access to an information system and who are also the subject of an audit by that system, may affect the reliability of audit information by inhibiting audit activities or modifying audit records. This control enhancement requires that privileged access be further defined between audit-related privileges and other privileges, thus, limiting the users with audit-related privileges. Related controls: AC-5.

(5) *PROTECTION OF AUDIT INFORMATION | DUAL AUTHORIZATION*

The organization requires and enforces dual authorization for [*Selection (one or more): changes to; deletion of*] [*Assignment: organization-defined audit information*].

Supplemental Guidance: Organizations may choose different selection options for different types of audit information. Related controls: AC-3, MP-2.

(6) *PROTECTION OF AUDIT INFORMATION | READ ONLY ACCESS*

The organization authorizes read access to audit information to [*Assignment: organization-defined subset of privileged users*].

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-9	**MOD** AU-9 (4)	**HIGH** AU-9 (2) (3) (4)

AU-10 NON-REPUDIATION

Control: The information system protects against an individual falsely denying having performed [*Assignment: organization-defined actions to be covered by non-repudiation*].

Supplemental Guidance: Types of individual actions covered by non-repudiation include, for example, creating information, sending and receiving messages, approving information (e.g., indicating concurrence or signing a contract). Non-repudiation protects individuals against later claims by: (i) authors of not having authored particular documents; (ii) senders of not having transmitted messages; (iii) receivers of not having received messages; or (iv) signatories of not having signed documents. Non-repudiation services can be used to determine if information originated from a particular individual, or if an individual took specific actions (e.g., sending an email, signing a contract, approving a procurement request) or received specific information. Organizations obtain non-repudiation services by employing various techniques or mechanisms (e.g., digital signatures, digital message receipts). Related controls: SC-12, SC-8, SC-13, SC-16, SC-17, SC-23.

Control Enhancements:

(1) *NON-REPUDIATION | ASSOCIATION OF IDENTITIES*

The information system:

(a) Associates the identity of the information producer with the information; and

(b) Provides the means for authorized individuals to determine the identity of the producer of the information.

Supplemental Guidance: This control enhancement supports audit requirements that provide organizational personnel with the means to identify who produced specific information in the event of an information transfer. Organizations determine and approve the strength of the binding between the information producer and the information based on the security category of the information and relevant risk factors. Related controls: AC-4, AC-16.

(2) *NON-REPUDIATION | VALIDATE BINDING OF INFORMATION PRODUCER IDENTITY*

The information system:

(a) Validates the binding of the information producer identity to the information; and

(b) Performs [*Assignment: organization-defined actions*] in the event of a validation error.

Supplemental Guidance: This control enhancement prevents the modification of information between production and review. The validation of bindings can be achieved, for example, by the use of cryptographic checksums. Organizations determine if validations are in response to user requests or generated automatically. Related controls: AC-3, AC-4, AC-16.

(3) *NON-REPUDIATION | CHAIN OF CUSTODY*

The information system maintains reviewer/releaser identity and credentials within the established chain of custody for all information reviewed or released.

Supplemental Guidance: If the reviewer is a human or if the review function is automated but separate from the release/transfer function, the information system associates the identity of the reviewer of the information to be released with the information and the information label. In the case of human reviews, this control enhancement provides appropriate organizational officials the means to identify who reviewed and released the information. In the case of automated reviews, this control enhancement ensures that only approved review functions are employed. Related controls: AC-4, AC-16.

(4) *NON-REPUDIATION | VALIDATE BINDING OF INFORMATION REVIEWER IDENTITY*

The information system:

(a) Validates the binding of the information reviewer identity to the information at the transfer or release points prior to release/transfer between [*Assignment: organization-defined security domains*]; and

(b) Performs [*Assignment: organization-defined actions*] in the event of a validation error.

Supplemental Guidance: This control enhancement prevents the modification of information between review and transfer/release. The validation of bindings can be achieved, for example, by the use of cryptographic checksums. Organizations determine validations are in response to user requests or generated automatically. Related controls: AC-4, AC-16, SC-16.

(5) *NON-REPUDIATION | DIGITAL SIGNATURES*

[Withdrawn: Incorporated into SI-7].

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** Not Selected	**HIGH** AU-10

AU-11 AUDIT RECORD RETENTION

Control: The organization retains audit records for [*Assignment: organization-defined time period consistent with records retention policy*] to provide support for after-the-fact investigations of security incidents and to meet regulatory and organizational information retention requirements.

Supplemental Guidance: Organization retain audit records until it is determined that they are no longer needed for administrative, legal, audit, or other operational purposes. This includes, for example, retention and availability of audit records relative to Freedom of Information Act (FOIA) requests, subpoenas, and law enforcement actions. Organizations develop standard categories of audit records relative to such types of actions and standard response processes for each type of action. The National Archives and Records Administration (NARA) General Records Schedules provide federal policy on record retention. Related controls: AU-4, AU-5, AU-9.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P3	**LOW** AU-11	**MOD** AU-11	**HIGH** AU-11

AU-12 AUDIT GENERATION

Control: The information system:

a. Provides audit record generation capability for the auditable events defined in AU-2 at [*Assignment: organization-defined information system components*];

b. Allows [*Assignment: organization-defined personnel*] to select which auditable events are to be audited by specific components of the information system; and

c. Generates audit records for the audited events defined in AU-2 with the content defined in AU-3.

Supplemental Guidance: Audits records can be generated from many different information system components. Audited events are events for which audits are to be generated. These events are typically a subset of all events for which the information system is capable of generating audit records. Related controls: AC-3, AU-2, AU-3, AU-6, AU-7.

Control Enhancements:

(1) *AUDIT GENERATION | SYSTEM-WIDE / TIME-CORRELATED AUDIT TRAIL*

The information system compiles audit records from [*Assignment: organization-defined information system components*] into a system-wide (logical or physical) audit trail that is time-correlated to within [*Assignment: organization-defined level of tolerance for relationship between time stamps of individual records in the audit trail*].

Supplemental Guidance: Audit trails are time-correlated if the time stamps in the individual audit records can be reliably related to the time stamps in other audit records to achieve a time ordering of the records within organizational tolerances. Related controls: AU-8, AU-12.

(2) *AUDIT GENERATION | STANDARDIZED FORMATS*

The information system produces a system-wide (logical or physical) audit trail composed of audit records in a standardized format.

Supplemental Guidance: Audit information that is normalized to common standards promotes interoperability and exchange of such information between dissimilar devices and information systems. This facilitates production of event information that can be more readily analyzed and correlated. Standard formats for audit records include, for example, system log records and audit records compliant with Common Event Expressions (CEE). If logging mechanisms within information systems do not conform to standardized formats, systems may convert individual audit records into standardized formats when compiling system-wide audit trails.

(3) *AUDIT GENERATION | CHANGES BY AUTHORIZED INDIVIDUALS*

The information system provides the capability for [*Assignment: organization-defined individuals or roles*] to change within [*Assignment: organization-defined time period*], the auditing to be performed based on [*Assignment: organization-defined selectable event criteria*].

Supplemental Guidance: This control enhancement enables organizations to extend or limit auditing as necessary at specific points in time to meet organizational requirements. Auditing that is limited to conserve information system resources may be extended to address certain threat situations. In addition, auditing may be limited to a more focused set of audit events to facilitate audit reduction, analysis, and reporting. Organizations can establish time thresholds in which audit actions can be changed, for example, near real-time, within minutes, or within hours. Related control: AU-7.

References: None.

Priority and Baseline Allocation:

P1	**LOW** AU-12	**MOD** AU-12	**HIGH** AU-12 (1) (3)

AU-13 MONITORING FOR INFORMATION DISCLOSURE

Control: The organization monitors [*Assignment: organization-defined open source information*] [*Assignment: organization-defined frequency*] for evidence of unauthorized exfiltration or disclosure of organizational information.

Supplemental Guidance: Open source information includes, for example, social networking sites. Related controls: PE-3, SC-7.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

AU-14 SESSION AUDIT

Control: The information system provides the capability for authorized users to:

a. Capture/record and log all content related to a user session;

b. Remotely view/hear all content related to an established user session in real time; and

c. Select the user session to capture/record or view/hear.

Supplemental Guidance: Session auditing activities are developed, integrated, and used in consultation with legal counsel in accordance with applicable federal laws, Executive Orders, directives, policies, or regulations. Related controls: AC-3, AU-4, AU-5, AU-9, AU-11.

Control Enhancements:

(1) *SESSION AUDIT | SYSTEM START-UP*

The information system initiates session audits at system start-up.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

AU-15 ALTERNATE AUDIT CAPABILITY

Control: The organization provides an alternative audit capability in the event of a failure in primary audit capability that provides [*Assignment: organization-defined alternative audit functionality*].

Supplemental Guidance: Since alternative audit capability may be a short-term protection employed until the failure in the primary auditing capability is corrected, organizations may determine that the alternative audit capability need only provide a subset of the primary audit functionality that is impacted by the failure. Related control: AU-5.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

AU-16 CROSS-ORGANIZATIONAL AUDITING

Control: The organization employs [*Assignment: organization-defined methods*] for coordinating [*Assignment: organization-defined audit information*] among external organizations when audit information is transmitted across organizational boundaries.

Supplemental Guidance: When organizations use information systems and/or services of external organizations, the auditing capability necessitates a coordinated approach across organizations. For example, maintaining the identity of individuals that requested particular services across organizational boundaries may often be very difficult, and doing so may prove to have significant performance ramifications. Therefore, it is often the case that cross-organizational auditing (e.g., the type of auditing capability provided by service-oriented architectures) simply captures the identity of individuals issuing requests at the initial information system, and subsequent systems record that the requests emanated from authorized individuals.

Control Enhancements:

(1) *CROSS-ORGANIZATIONAL AUDITING | IDENTITY PRESERVATION*

The organization requires that the identity of individuals be preserved in cross organizational audit trails.

Supplemental Guidance: This control enhancement applies when there is a need to be able to trace actions that are performed across organizational boundaries to a specific individual.

(2) *CROSS-ORGANIZATIONAL AUDITING | SHARING OF AUDIT INFORMATION*

The organization provides cross-organizational audit information to [*Assignment: organization-defined organizations*] based on [*Assignment: organization-defined cross organizational sharing agreements*].

Supplemental Guidance: Because of the distributed nature of the audit information, cross organization sharing of audit information may be essential for effective analysis of the auditing being performed. For example, the audit records of one organization may not provide sufficient information to determine the appropriate or inappropriate use of organizational information resources by individuals in other organizations. In some instances, only the home organizations of individuals have the appropriate knowledge to make such determinations, thus requiring the sharing of audit information among organizations.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: SECURITY ASSESSMENT AND AUTHORIZATION

CA-1 SECURITY ASSESSMENT AND AUTHORIZATION POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. Formal, documented security assessment and authorization policy that address purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the security assessment and authorization policy and associated security assessment and authorization controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the CA family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-37, 800-53A, 800-100.

Priority and Baseline Allocation:

P1	**LOW** CA-1	**MOD** CA-1	**HIGH** CA-1

CA-2 SECURITY ASSESSMENTS

Control: The organization:

a. Develops a security assessment plan that describes the scope of the assessment including:
   - Security controls and control enhancements under assessment;
   - Assessment procedures to be used to determine security control effectiveness; and
   - Assessment environment, assessment team, and assessment roles and responsibilities;

b. Assesses the security controls in the information system and its environment of operation [*Assignment: organization-defined frequency*] to determine the extent to which the controls are implemented correctly, operating as intended, and producing the desired outcome with respect to meeting established security requirements;

c. Produces a security assessment report that documents the results of the assessment; and

d. Provides the results of the security control assessment to [*Assignment: organization-defined individuals or roles*].

Supplemental Guidance: Organizations assess security controls in organizational information systems and the environments in which those systems operate as part of: (i) initial and ongoing security authorizations; (ii) FISMA annual assessments; (iii) continuous monitoring; and (iv) system development life cycle activities. Security assessments: (i) ensure that information security is built into organizational information systems; (ii) identify weaknesses and deficiencies early in the development process; (iii) provide essential information needed to make risk-based decisions as part of security authorization processes; and (iv) ensure compliance to vulnerability mitigation

procedures. Organizations can use other types of assessment activities such as vulnerability scanning, penetration testing, and information system monitoring to ensure that the security posture of information systems during the entire life cycle is maintained. Security assessment reports document assessment results in sufficient detail as deemed necessary by organizations, to determine the accuracy and completeness of the reports and whether security controls are implemented correctly, operating as intended, and producing the desired outcome with respect to meeting security requirements. The FISMA requirement for assessing security controls at least annually does not require additional assessment activities to those activities already in place in organizational security authorization processes. Security assessment results are provided to the individuals or roles appropriate for the types of assessments being conducted. For example, assessments conducted in support of security authorization decisions are provided to authorizing officials or authorizing official designated representatives.

To satisfy annual assessment requirements, organizations can use assessment results from the following sources: (i) initial or ongoing information system authorizations; (ii) continuous monitoring; or (iii) system development life cycle activities. Organizations ensure that security assessment results are current, relevant to the determination of security control effectiveness, and obtained with the appropriate level of assessor independence. Existing security control assessment results can be reused to the extent that the results are still valid and can also be supplemented with additional assessments as needed. Subsequent to initial authorizations and in accordance with OMB policy, organizations assess security controls during continuous monitoring. Organizations establish the frequency for ongoing security control assessments in accordance with organizational continuous monitoring strategies. Information Assurance Vulnerability Alerts provide useful examples of vulnerability mitigation procedures. External audits (e.g., audits by external entities such as regulatory agencies) are outside the scope of this control. Related controls: CA-5, CA-6, CA-7, PM-9, RA-5, SA-11, SA-12, SI-4.

Control Enhancements:

(1) *SECURITY ASSESSMENTS | INDEPENDENT ASSESSORS*

The organization employs assessors or assessment teams with [*Assignment: organization-defined level of independence*] to conduct security control assessments.

Supplemental Guidance: Independent assessors or assessment team are individuals or groups who conduct impartial assessments of organizational information systems. Impartiality implies that assessors are free from any perceived or actual conflicts of interest with regard to the development, operation, or management of the organizational information systems under assessment or to the determination of security control effectiveness. Independent assessments can be obtained from elements within organizations or can be contracted to public or private sector entities outside of organizations. Authorizing officials determine the required level of independence based on the security categories of information systems and/or the ultimate risk to organizational operations, organizational assets, or individuals. Authorizing officials also determine if the level of assessor independence provides sufficient assurance that the results are sound and can be used to make credible, risk-based decisions. This includes determining whether contracted security assessment services have sufficient independence, for example, when information system owners are not directly involved in contracting processes or cannot unduly influence the impartiality of assessors conducting assessments. In special situations, for example, when organizations that own the information systems are small or organizational structures require that assessments are conducted by individuals that are in the developmental, operational, or management chain of system owners, independence in assessment processes can be achieved by ensuring that assessment results are carefully reviewed and analyzed by independent teams of experts to validate the completeness, accuracy, integrity, and reliability of the results. Organizations recognize that assessments performed for purposes other than direct support to authorization decisions are, when performed by assessors with sufficient independence, more likely to be useable for such decisions thereby reducing need to repeat assessments.

(2) *SECURITY ASSESSMENTS | TYPES OF ASSESSMENTS*

The organization includes as part of security control assessments, [*Assignment: organization-defined frequency*], [*Selection: announced; unannounced*], [*Selection (one or more): in-depth monitoring; vulnerability scanning; malicious user testing; insider threat assessment; penetration testing; red team exercises; performance/load testing;* [*Assignment: organization-defined other forms of security assessment*]].

Supplemental Guidance: Penetration testing can be conducted on the hardware, software, or firmware components of an information system and exercises both physical and technical security controls. A standard method for penetration testing includes, for example: (i) pretest analysis based on full knowledge of the target system; (ii) pretest identification of potential vulnerabilities based on pretest analysis; and (iii) testing designed to determine exploitability of identified vulnerabilities. All parties agree to the detailed rules of engagement before the commencement of any penetration testing scenarios. Organizations correlate the penetration testing rules of engagement with the tools, techniques, and procedures that are anticipated to be employed by threat-sources carrying out attacks. Organizational risk assessments guide decisions on the level of independence required for personnel conducting penetration testing. Red team exercises reflect simulated adversarial attempts to compromise organizational mission/business processes, thus providing a comprehensive assessment of the security state of information systems and organizations. While penetration testing may be laboratory-based testing, organizations use red team exercises to provide more comprehensive assessments that reflect real-world conditions. Organizations can also employ information system monitoring, insider threat assessments, malicious user testing, and other forms of testing (e.g., verification and validation) to improve readiness by exercising organizational capabilities and indicating current performance levels as a means of focusing actions to improve security. Organizations conduct assessment activities in accordance with applicable federal laws, Executive Orders, directives, policies, regulations, and standards. Authorizing officials approve the assessment methods in coordination with the organizational risk executive function. Organizations can incorporate vulnerabilities uncovered during assessments into vulnerability remediation processes. Related controls: PE-3, SI-2.

(3) *SECURITY ASSESSMENTS | EXTERNAL ORGANIZATIONS*

The organization accepts the results of an assessment of [*Assignment: organization-defined information system*] performed by [*Assignment: organization-defined external organization*] when the assessment meets [*Assignment: organization-defined requirements*].

Supplemental Guidance: Organizations may often rely on assessments of specific information systems by other (external) organizations. Utilizing such existing assessments (i.e., reusing existing assessment evidence) can significantly decrease the time and resources required for organizational assessments by limiting the amount of independent assessment activities that organizations need to perform. The factors that organizations may consider in determining whether to accept assessment results from external organizations can vary. Determinations for accepting assessment results can be based on, for example, past assessment experiences one organization has had with another organization, the reputation that organizations have with regard to assessments, the level of detail of supporting assessment documentation provided, or mandates imposed upon organizations by federal legislation, policies, or directives.

References: FIPS Publication 199; NIST Special Publications 800-37, 800-39, 800-53A, 800-115, 800-137.

Priority and Baseline Allocation:

P2	**LOW** CA-2	**MOD** CA-2 (1)	**HIGH** CA-2 (1) (2)

CA-3 INFORMATION SYSTEM CONNECTIONS

Control: The organization:

a. Authorizes connections from the information system as defined by its authorization boundary, to other information systems through the use of Interconnection Security Agreements;

b. Documents, for each connection, the interface characteristics, security requirements, and the nature of the information communicated; and

c. Monitors the information system connections on an ongoing basis verifying enforcement of security requirements.

Supplemental Guidance: This control applies to dedicated connections between information systems and does not apply to transitory, user-controlled connections such as email and website browsing. Organizations carefully consider the risks that may be introduced when information systems are connected to other systems with different security requirements and security controls, both within organizations and external to organizations. Authorizing officials determine the risk associated with information system connections and the appropriate controls employed. If interconnecting systems have the same authorizing official, organizations do not need to develop Interconnection Security Agreements. Instead, organizations can describe the interface characteristics between interconnecting systems in the security plans for the respective systems. If interconnecting systems have different authorizing officials within the same organization, organizations can either develop Interconnection Security Agreements or describes the interface characteristics between systems in the security plans for the respective systems. Organizations may also incorporate Interconnection Security Agreement information into formal contracts, especially for interconnections established between federal agencies and nonfederal (i.e., private sector) organizations. Risk considerations also include information systems sharing the same networks. Related controls: AC-3, AC-4, AU-2, AU-12, CA-7, IA-3, SA-9, SC-7, SI-4.

Control Enhancements:

(1) *INFORMATION SYSTEM CONNECTIONS | UNCLASSIFIED NATIONAL SECURITY SYSTEM CONNECTIONS*

The organization prohibits the direct connection of an unclassified, national security system to an external network without the use of [*Assignment: organization-defined boundary protection device*].

Supplemental Guidance: Organizations typically do not have control over external networks (e.g., the Internet). Approved boundary protection devices (e.g., routers, firewalls) mediate communications (i.e., information flows) between unclassified national security systems and external networks.

(2) *INFORMATION SYSTEM CONNECTIONS | CLASSIFIED NATIONAL SECURITY SYSTEM CONNECTION*

The organization prohibits the direct connection of a classified, national security system to an external network without the use of [*Assignment; organization-defined boundary protection device*].

Supplemental Guidance: Organizations typically do not have control over external networks (e.g., the Internet). Approved boundary protection devices (e.g., routers, firewalls) mediate communications (i.e., information flows) between classified national security systems and external networks. In addition, approved boundary protection devices (typically managed interface/cross-domain systems), provide information flow enforcement from information systems to external networks.

(3) *INFORMATION SYSTEM CONNECTIONS | PROHIBIT CONNECTIONS TO PUBLIC NETWORKS*

The organization prohibits connection to a public network from [*Assignment: organization-defined information system components*].

Supplemental Guidance: A public network is any network accessible to the general public including, for example, the Internet and organizational extranets with public access.

References: FIPS Publication 199; NIST Special Publication 800-47.

Priority and Baseline Allocation:

P1	**LOW** CA-3	**MOD** CA-3	**HIGH** CA-3

CA-4 SECURITY CERTIFICATION

[Withdrawn: Incorporated into CA-2].

CA-5 PLAN OF ACTION AND MILESTONES

Control: The organization:

a. Develops a plan of action and milestones for the information system to document the organization's planned remedial actions to correct weaknesses or deficiencies noted during the assessment of the security controls and to reduce or eliminate known vulnerabilities in the system; and

b. Updates existing plan of action and milestones [*Assignment: organization-defined frequency*] based on the findings from security controls assessments, security impact analyses, and continuous monitoring activities.

Supplemental Guidance: Plans of action and milestones are key documents in security authorization packages and are subject to federal reporting requirements established by OMB. Related controls: CA-2, CA-7, CM-4, PM-4.

Control Enhancements:

(1) *PLAN OF ACTION AND MILESTONES | AUTOMATION SUPPORT FOR ACCURACY / CURRENCY*

The organization employs automated mechanisms to help ensure that the plan of action and milestones for the information system is accurate, up to date, and readily available.

References: OMB Memorandum 02-01; NIST Special Publication 800-37.

Priority and Baseline Allocation:

P3	**LOW** CA-5	**MOD** CA-5	**HIGH** CA-5

CA-6 SECURITY AUTHORIZATION

Control: The organization:

a. Assigns a senior-level executive or manager as the authorizing official for the information system;

b. Ensures that the authorizing official authorizes the information system for processing before commencing operations; and

c. Updates the security authorization [*Assignment: organization-defined frequency*].

Supplemental Guidance: Security authorizations are official management decisions, conveyed through authorization decision documents, by senior organizational officials or executives (i.e., authorizing officials) to authorize operation of information systems and to explicitly accept the risk to organizational operations and assets, individuals, other organizations, and the Nation based on the implementation of agreed-upon security controls. Authorizing officials provide budgetary oversight for organizational information systems or assume responsibility for the mission/business operations supported by those systems. The security authorization process is an inherently federal responsibility and therefore, authorizing officials must be federal employees. Through the security authorization process, authorizing officials assume responsibility and are accountable for security

risks associated with the operation and use of organizational information systems. Accordingly, authorizing officials are in positions with levels of authority commensurate with understanding and accepting such information security-related risks. OMB policy requires that organizations conduct ongoing authorizations of information systems by implementing continuous monitoring programs. Continuous monitoring programs can satisfy three-year reauthorization requirements, so separate reauthorization processes are not necessary. Through the employment of comprehensive continuous monitoring processes, critical information contained in authorization packages (i.e., security plans, security assessment reports, and plans of action and milestones) is updated on an ongoing basis, providing authorizing officials and information system owners with an up-to-date status of the security state of organizational information systems and environments of operation. To reduce the administrative cost of security reauthorization, authorizing officials use the results of continuous monitoring processes to the maximum extent possible as the basis for rendering reauthorization decisions. Related controls: CA-2, CA-7, PM-9, PM-10.

Control Enhancements: None.

References: OMB Circular A-130; OMB Memorandum 11-33; NIST Special Publications 800-37, 800-137.

Priority and Baseline Allocation:

P3	**LOW** CA-6	**MOD** CA-6	**HIGH** CA-6

CA-7 CONTINUOUS MONITORING

Control: The organization develops a continuous monitoring strategy and implements a continuous monitoring program that includes:

a. Establishment of [*Assignment: organization-defined metrics*] to be monitored;

b. Establishment of [*Assignment: organization-defined freq*uencies] for monitoring and assessments;

c. Ongoing security control assessments in accordance with the organizational continuous monitoring strategy;

d. Ongoing security status monitoring of organization-defined metrics in accordance with the organizational continuous monitoring strategy;

e. Correlation and analysis of security-related information generated by assessments and monitoring;

f. Response actions to address results of the analysis of security-related information; and

g. Reporting the security status of organization and the information system to [*Assignment: organization-defined personnel*] [*Assignment: organization-defined frequency*].

Supplemental Guidance: Continuous monitoring programs facilitate ongoing awareness of threats, vulnerabilities, and information security to support organizational risk management decisions. The terms *continuous* and *ongoing* imply that organizations assess/analyze security controls and information security-related risks at a frequency sufficient to support organizational risk-based decisions. The results of continuous monitoring programs generate appropriate risk response actions by organizations. Continuous monitoring programs also allow organizations to maintain the security authorizations of information systems and common controls over time in highly dynamic environments of operation with changing mission/business needs, threats, vulnerabilities, and technologies. Having access to security-related information on demand gives organizational officials the capability to make more effective and timely risk management decisions, including ongoing security authorization decisions. Automation supports more frequent updates to security authorization packages, hardware/software/firmware inventories, and other system information. Effectiveness is further enhanced when continuous monitoring outputs are formatted to provide

information that is specific, measurable, actionable, relevant, and timely. Continuous monitoring activities are scaled in accordance with the security categories of information systems. Related controls: CA-2, CA-5, CA-6, CM-3, CM-4, PM-6, PM-9, RA-5, SA-11, SA-12, SI-4.

Control Enhancements:

(1) *CONTINUOUS MONITORING | INDEPENDENT ASSESSMENT*

The organization employs assessors or assessment teams with [*Assignment: organization-defined level of independence*] to monitor the security controls in the information system on an ongoing basis.

Supplemental Guidance: Organizations can maximize the value of ongoing assessments of security controls during the continuous monitoring process by requiring that such assessments be conducted by assessors or assessment teams with appropriate levels of independence based on continuous monitoring strategies.

(2) *CONTINUOUS MONITORING | TYPES OF ASSESSMENTS*

[Withdrawn: Incorporated into CA-2.]

References: OMB Memorandum 11-33; NIST Special Publications 800-37, 800-39, 800-53A, 800-115, 800-137; US-CERT Technical Cyber Security Alerts; DoD Information Assurance Vulnerability Alerts.

Priority and Baseline Allocation:

P3	**LOW** CA-7	**MOD** CA-7 (1)	**HIGH** CA-7 (1)

FAMILY: CONFIGURATION MANAGEMENT

CM-1 CONFIGURATION MANAGEMENT POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented configuration management policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the configuration management policy and associated configuration management controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the CM family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** CM-1	**MOD** CM-1	**HIGH** CM-1

CM-2 BASELINE CONFIGURATION

Control: The organization develops, documents, and maintains under configuration control, a current baseline configuration of the information system.

Supplemental Guidance: Baseline configurations are documented, formally reviewed and agreed upon sets of specifications for information systems or configuration items within those systems. Baseline configurations serve as a basis for future builds, releases, and/or changes to information systems. This control establishes baseline configurations for information systems and system components including communications and connectivity-related aspects of systems. Baseline configurations include information about information system components (e.g., standard software packages installed on workstations, notebook computers, servers, network components, or mobile devices; current version numbers and patch information on operating systems and applications; and configuration settings/parameters), network topology, and the logical placement of those components within the system architecture. Maintaining baseline configurations requires creating new baselines as organizational information systems change over time. Baseline configurations of information systems reflect the current enterprise architecture. Related controls: CM-3, CM-6, CM-8, CM-9, SA-10, PM-5, PM-7.

Control Enhancements:

(1) *BASELINE CONFIGURATION | REVIEWS AND UPDATES*

The organization reviews and updates the baseline configuration of the information system:

(a) [*Assignment: organization-defined frequency*];

(b) When required due to [*Assignment organization-defined circumstances*]; and

(c) As an integral part of information system component installations and upgrades.

Supplemental Guidance: Related control: CM-5.

(2) *BASELINE CONFIGURATION | AUTOMATION SUPPORT FOR ACCURACY / CURRENCY*

The organization employs automated mechanisms to maintain an up-to-date, complete, accurate, and readily available baseline configuration of the information system.

Supplemental Guidance: Automated mechanisms that help organizations maintain consistent baseline configurations for information systems include, for example, hardware and software inventory tools, configuration management tools, and network management tools. Such tools can be deployed and/or allocated as common controls, at the information system level, or at the operating system or component level (e.g., on workstations, servers, notebook computers, network components, or mobile devices). Tools can be used, for example, to track version numbers on operating system applications, types of software installed, and current patch levels. Related controls: CM-7, RA-5.

(3) *BASELINE CONFIGURATION | RETENTION OF PREVIOUS CONFIGURATIONS*

The organization retains [*Assignment: organization-defined previous versions of baseline configurations of the information system*] to support rollback.

Supplemental Guidance: Retaining previous versions of baseline configurations to support rollback may include, for example, hardware, software, firmware, configuration files, and configuration records.

(4) *BASELINE CONFIGURATION | UNAUTHORIZED SOFTWARE*

[Withdrawn: Incorporated into CM-7].

(5) *BASELINE CONFIGURATION | AUTHORIZED SOFTWARE*

[Withdrawn: Incorporated into CM-7].

(6) *BASELINE CONFIGURATION | DEVELOPMENT AND TEST ENVIRONMENTS*

The organization maintains a baseline configuration for information system development and test environments that is managed separately from the operational baseline configuration.

Supplemental Guidance: Establishing separate baseline configurations for development, testing, and operational environments helps protect information systems from unplanned/unexpected events related to development and testing activities). Separate baseline configurations allow organizations to apply the configuration management that is most appropriate for each type of configuration. For example, management of operational configurations typically emphasizes the need for stability, while management of development/test configurations requires greater flexibility. This control enhancement requires separate configurations but not necessarily separate physical environments. Related control: CM-4.

References: NIST Special Publication 800-128.

Priority and Baseline Allocation:

P1	**LOW** CM-2	**MOD** CM-2 (1) (3)	**HIGH** CM-2 (1) (2) (3) (6)

CM-3 CONFIGURATION CHANGE CONTROL

Control: The organization:

a. Determines the types of changes to the information system that are configuration controlled;

b. Reviews proposed configuration controlled changes to the information system and approves or disapproves such changes with explicit consideration for security impact analyses;

c. Documents approved configuration controlled changes to the information system;

d. Retains and reviews records of configuration controlled changes to the information system;

e. Audits activities associated with configuration controlled changes to the information system; and

f. Coordinates and provides oversight for configuration change control activities through [*Assignment: organization-defined configuration change control element (e.g., committee, board*] that convenes [*Selection (one or more):* [*Assignment: organization-defined frequency*]; [*Assignment: organization-defined configuration change conditions*]].

Supplemental Guidance: Configuration change controls for organizational information systems involve the systematic proposal, justification, implementation, testing, review, and disposition of changes to the systems, including system upgrades and modifications. Configuration change control includes changes to baseline configurations for components and configuration items of information systems, changes to configuration settings for information technology products (e.g., operating systems, applications, firewalls, routers, and mobile devices), unscheduled/unauthorized changes, and changes to remediate vulnerabilities. Typical processes for managing configuration changes to information systems include, for example, Configuration Control Boards that approve proposed changes to systems. Auditing of changes includes activities before and after changes are made to information systems and the auditing activities required to implement such changes. Related controls: CM-2, CM-4, CM-5, CM-6, CM-9, SA-10, SI-2.

Control Enhancements:

(1) *CONFIGURATION CHANGE CONTROL | AUTOMATED DOCUMENT / NOTIFICATION / PROHIBITION OF CHANGES*

The organization employs automated mechanisms to:

(a) Document proposed changes to the information system;

(b) Notify [*Assignment: organized-defined approval authorities*];

(c) Highlight change approvals that have not been received by [*Assignment: organization-defined time period*];

(d) Prohibit changes to the information system until designated approvals are received; and

(e) Document completed changes to the information system.

(2) *CONFIGURATION CHANGE CONTROL | TEST / VALIDATE / DOCUMENT CHANGES*

The organization tests, validates, and documents changes to the information system before implementing the changes on the operational system.

Supplemental Guidance: Organizations ensure that testing does not interfere with information system operations. Individuals/groups conducting tests understand organizational security policies and procedures, information system security policies and procedures, and the specific health, safety, and environmental risks associated with particular facilities/processes. Operational systems may need to be taken off-line, or replicated to the extent feasible, before testing can be conducted. If information systems must be taken off-line for testing, the tests are scheduled to occur during planned system outages whenever possible. If testing cannot be conducted on operational systems, organizations employ compensating controls (e.g., testing on replicated systems).

(3) *CONFIGURATION CHANGE CONTROL | AUTOMATED CHANGE IMPLEMENTATION*

The organization employs automated mechanisms to implement changes to the current information system baseline and deploys the updated baseline across the installed base.

Supplemental Guidance: Related control: CM-2.

(4) *CONFIGURATION CHANGE CONTROL | SECURITY REPRESENTATIVE*

The organization requires an information security representative to be a member of the [*Assignment: organization-defined configuration change control element (e.g., committee, board)*].

Supplemental Guidance: Information security representatives can include, for example, information system security officers or information system security managers. The configuration change control element in this control enhancement reflects the change control elements defined by organizations in CM-3.

References: NIST Special Publication 800-128.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** CM-3 (2)	**HIGH** CM-3 (1) (2)

CM-4 SECURITY IMPACT ANALYSIS

Control: The organization analyzes changes to the information system to determine potential security impacts prior to change implementation.

Supplemental Guidance: Organizational personnel with information security responsibilities (e.g., Information System Administrators, Information System Security Officers, Information System Security Managers, and Information System Security Engineers) conduct security impact analyses. Individuals conducting security impact analyses possess the necessary skills/technical expertise to analyze the changes to information systems and the associated security ramifications. Security impact analysis may include, for example, reviewing security plans to understand security control requirements and reviewing system design documentation to understand control implementation and how specific changes might affect the controls. Security impact analyses may also include assessments of risk to better understand the impact of the changes and to determine if additional security controls are required. Security impact analyses are scaled in accordance with the security categories of the information systems. Related controls: CA-2, CA-7, CM-3, CM-9, SA-4, SA-5, SA-10, SI-2.

Control Enhancements:

(1) *SECURITY IMPACT ANALYSIS | SEPARATE TEST ENVIRONMENTS*

The organization analyzes changes to the information system in a separate test environment before installation in an operational environment, looking for security impacts due to flaws, weaknesses, incompatibility, or intentional malice.

Supplemental Guidance: Related control: SA-11.

(2) *SECURITY IMPACT ANALYSIS | VERIFICATION OF SECURITY FUNCTIONS*

The organization, after the information system is changed, checks the security functions to verify that the functions are implemented correctly, operating as intended, and producing the desired outcome with regard to meeting the security requirements for the system.

Supplemental Guidance: Related control: SA-11.

References: NIST Special Publication 800-128.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** CM-4	**HIGH** CM-4 (1)

CM-5 ACCESS RESTRICTIONS FOR CHANGE

Control: The organization defines, documents, approves, and enforces physical and logical access restrictions associated with changes to the information system.

Supplemental Guidance: Any changes to the hardware, software, and/or firmware components of information systems can potentially have significant effects on the overall security of the systems. Therefore, organizations permit only qualified and authorized individuals to access information systems for purposes of initiating changes, including upgrades and modifications. Additionally, organizations maintain records of access to ensure configuration change control is implemented and to support after-the-fact actions should organizations discover unauthorized changes. Access restrictions for change also include software libraries. Access restrictions include, for example, physical and logical access controls (see AC-3 and PE-3), workflow automation, media libraries, abstract layers (e.g., changes implemented into third-party interfaces rather than directly into

information systems), and change windows (e.g., changes occur only during specified times, making unauthorized changes easy to discover). Related controls: AC-3, AC-6, PE-3.

Control Enhancements:

(1) *ACCESS RESTRICTIONS FOR CHANGE | AUTOMATED ACCESS ENFORCEMENT / AUDITING*

The organization employs automated mechanisms to enforce access restrictions and to support auditing of the enforcement actions.

Supplemental Guidance: Related controls: AU-2, AU-12, CM-3, CM-5, CM-6.

(2) *ACCESS RESTRICTIONS FOR CHANGE | AUDIT SYSTEM CHANGES*

The organization conducts audits of information system changes [*Assignment: organization-defined frequency*] and [*Assignment: organization-defined circumstances*] to determine whether unauthorized changes have occurred.

Supplemental Guidance: Indications that warrant auditing of information system changes and the specific circumstances justifying such audits may be obtained from activities carried out by organizations during the configuration change process. Related controls: AU-6, AU-7, CM-3, CM-5, PE-6, PE-8.

(3) *ACCESS RESTRICTIONS FOR CHANGE | SIGNED COMPONENTS*

The information system prevents the installation of [*Assignment: organization-defined software and firmware components*] that are not signed with a certificate that is recognized and approved by the organization.

Supplemental Guidance: Software and firmware components prevented from installation unless signed with recognized and approved certificates include, for example, software and firmware version updates, patches, service packs, device drivers, and basic input output system (BIOS) updates. Organizations can identify applicable software and firmware components by type, by specific items, or a combination of both. Related controls: AU-10, SC-13.

(4) *ACCESS RESTRICTIONS FOR CHANGE | TWO-PERSON RULE*

The organization enforces a two-person rule for implementing changes to [*Assignment: organization-defined information system components and system-level information*].

Supplemental Guidance: Organizations employ a two-person rule to ensure that any changes to selected information system components and information cannot occur unless two qualified individuals implement such changes. The two individuals possess sufficient skills/expertise to determine if the proposed changes are correct implementations of approved changes. Related controls: AC-5, CM-3.

(5) *ACCESS RESTRICTIONS FOR CHANGE | LIMIT PRODUCTION / OPERATIONAL PRIVILEGES*

The organization:

(a) Limits information system developer privileges to change hardware, software, and firmware components and system information within a production/operational environment; and

(b) Reviews and reevaluates information system developer privileges [*Assignment: organization-defined frequency*].

Supplemental Guidance: Information system developers include system integrators. Related control: AC-2.

(6) *ACCESS RESTRICTIONS FOR CHANGE | LIMIT LIBRARY PRIVILEGES*

The organization limits privileges to change software resident within software libraries.

Supplemental Guidance: Software libraries include privileged programs. Related control: AC-2.

(7) *ACCESS RESTRICTIONS FOR CHANGE | AUTOMATIC IMPLEMENTATION OF SECURITY SAFEGUARDS*

[Withdrawn: Incorporated into SI-7].

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** CM-5	**HIGH** CM-5 (1) (2) (3)

CM-6 CONFIGURATION SETTINGS

Control: The organization:

a. Establishes and documents configuration settings for information technology products employed within the information system using [*Assignment: organization-defined security configuration checklists*] that reflect the most restrictive mode consistent with operational requirements;

b. Implements the configuration settings;

c. Identifies, documents, and approves exceptions from established configuration settings for [*Assignment: organization-defined information system components*] based on [*Assignment: organization-defined operational requirements*]; and

d. Monitors and controls changes to the configuration settings in accordance with organizational policies and procedures.

Supplemental Guidance: Configuration settings are the configurable security-related parameters of information technology products that are part of information systems, including for example, the hardware, software, and firmware in servers, workstations, and network devices. Products for which security-related configuration settings can be defined include, for example, mainframes, workstations, servers (e.g., database, electronic mail, authentication, web, proxy, file, domain name) , input/output devices (e.g., scanners, copiers, and printers), network components (e.g., firewalls, routers, gateways, voice and data switches, wireless access points, network appliances, sensors), operating systems, middleware, and applications. Security-related parameters are those parameters impacting the security state of information systems including the parameters required to satisfy other security control requirements. Security-related parameters include, for example: (i) registry settings; (ii) account, file, directory permission settings; and (iii) settings for functions, ports, protocols, services, and remote connections. Organizations establish organization-wide configuration settings and subsequently derive specific settings for information systems. The established settings become part of the systems configuration baseline.

Common secure configurations (also referred to as security configuration checklists, lockdown and hardening guides, security reference guides, security technical implementation guides) provide recognized, standardized, and established benchmarks that stipulate secure configuration settings for specific information technology platforms/products and instructions for configuring those information system components to meet operational requirements. Common secure configurations can be developed by a variety of organizations including, for example, information technology product developers, manufacturers, vendors, consortia, academia, industry, federal agencies, and other organizations in the public and private sectors. Common secure configurations include the United States Government Configuration Baseline (USGCB) which affects the implementation of CM-6 and other controls such as AC-19 and CM-7. The Security Content Automation Protocol (SCAP) and the defined standards within the protocol (e.g., Common Configuration Enumeration) provide an effective method to uniquely identify, track, and control configuration settings. OMB establishes federal policy on configuration requirements for federal information systems. Related controls: AC-19, CM-2, CM-3, CM-7, SI-4.

Control Enhancements:

(1) *CONFIGURATION SETTINGS | AUTOMATED CENTRAL MANAGEMENT / APPLICATION / VERIFICATION*

The organization employs automated mechanisms to centrally manage, apply, and verify configuration settings.

Supplemental Guidance: Related controls: CA-7, CM-4.

(2) *CONFIGURATION SETTINGS | RESPOND TO UNAUTHORIZED CHANGES*

The organization employs [*Assignment: organization-defined security safeguards*] to respond to unauthorized changes to [*Assignment: organization-defined configuration settings*].

Supplemental Guidance: Responses to unauthorized changes to configuration settings can include, for example, alerting designated organizational personnel, restoring established

configuration settings, or in extreme cases, halting affected information system processing. Related controls: IR-4, SI-7.

(3) *CONFIGURATION SETTINGS | UNAUTHORIZED CHANGE DETECTION*

[Withdrawn: Incorporated into SI-7].

(4) *CONFIGURATION SETTINGS | CONFORMANCE DEMONSTRATION*

[Withdrawn: Incorporated into CA-2 and CA-7].

References: OMB Memoranda 07-11, 07-18, 08-22; NIST Special Publications 800-70, 800-128; Web: NVD.NIST.GOV; WWW.NSA.GOV.

Priority and Baseline Allocation:

P1	**LOW** CM-6	**MOD** CM-6	**HIGH** CM-6 (1) (2)

CM-7 LEAST FUNCTIONALITY

Control: The organization configures the information system to provide only essential capabilities and specifically prohibits or restricts the use of the following functions, ports, protocols, and/or services: [*Assignment: organization-defined prohibited or restricted functions, ports, protocols, and/or services*].

Supplemental Guidance: Information systems can provide a wide variety of functions and services. Some of the functions and services, provided by default, may not be necessary to support essential organizational operations (e.g., key missions, functions). Additionally, it is sometimes convenient to provide multiple services from single information system components, but doing so increases risk over limiting the services provided by any one component. Where feasible, organizations limit component functionality to a single function per device (e.g., email servers or web servers, but not both). Organizations review functions and services provided by information systems or individual components of information systems, to determine which functions and services are candidates for elimination (e.g., Voice Over Internet Protocol, Instant Messaging, auto-execute, and file sharing). Organizations consider disabling unused or unnecessary physical and logical ports/protocols (e.g., Universal Serial Bus, File Transfer Protocol, and Hyper Text Transfer Protocol) on information systems to prevent unauthorized connection of devices, unauthorized transfer of information, or unauthorized tunneling. Organizations can utilize network scanning tools, intrusion detection and prevention systems, and end-point protections such as firewalls and host-based intrusion detection systems to identify and prevent the use of prohibited functions, ports, protocols, and services. Related controls: AC-6, CM-2, RA-5, SC-7.

Control Enhancements:

(1) *LEAST FUNCTIONALITY | PERIODIC REVIEW*

The organization:

(a) Reviews the information system [*Assignment: organization-defined frequency*] to identify unnecessary and nonsecure functions, ports, protocols, and services; and

(b) Disables [*Assignment: organization-defined functions, ports, protocols, and services within the information system deemed to be unnecessary or nonsecure*].

Supplemental Guidance: The organization can either make a determination of the relative security of the function, port, protocol, and/or service or base the security decision on the assessment of other entities. Bluetooth, FTP, and peer-to-peer networking are examples of less than secure protocols. Related controls: AC-6, AC-18, CM-7, IA-2.

(2) *LEAST FUNCTIONALITY | PREVENT PROGRAM EXECUTION*

The information system employs automated mechanisms to prevent program execution in accordance with [*Selection (one or more): authorized software programs; unauthorized software programs; rules authorizing the terms and conditions of software program usage*].

Supplemental Guidance: Related controls: CM-8, PM-5.

(3) *LEAST FUNCTIONALITY | REGISTRATION COMPLIANCE*

The organization ensures compliance with [*Assignment: organization-defined registration requirements for functions, ports, protocols, and services*].

Supplemental Guidance: Organizations use the registration process to manage, track, and provide oversight for information systems and implemented functions, ports, protocols, and services.

(4) *LEAST FUNCTIONALITY | UNAUTHORIZED SOFTWARE*

The organization:

(a) Identifies [*Assignment: organization-defined software not authorized to execute on the information system*];

(b) Employs an allow-all, deny-by-exception policy to prohibit the execution of unauthorized software on the information system; and

(c) Reviews and updates the list of unauthorized software [*Assignment: organization-defined frequency*].

Supplemental Guidance: Related controls: CM-2, CM-8, PM-5.

(5) *LEAST FUNCTIONALITY | AUTHORIZED SOFTWARE*

The organization:

(a) Identifies [*Assignment: organization-defined software authorized to execute on the information system*];

(b) Employs a deny-all, permit-by-exception policy to allow the execution of authorized software on the information system; and

(c) Reviews and updates the list of authorized software [*Assignment: organization-defined frequency*].

Supplemental Guidance: Related controls: CM-2, CM-8, PM-5.

References: None.

Priority and Baseline Allocation:

P1	**LOW** CM-7	**MOD** CM-7 (1) (4)	**HIGH** CM-7 (1) (2) (5)

CM-8 INFORMATION SYSTEM COMPONENT INVENTORY

Control: The organization develops, documents, and maintains an inventory of information system components that:

a. Accurately reflects the current information system;

b. Is consistent with the authorization boundary of the information system;

c. Is at the level of granularity deemed necessary for tracking and reporting;

d. Includes [*Assignment: organization-defined information deemed necessary to achieve effective property accountability*]; and

e. Is available for review and audit by [*Assignment: organization-defined personnel*].

Supplemental Guidance: Information deemed necessary for effective property accountability includes, for example, hardware inventory specifications, software license information, software version numbers, information system/component owners, and for networked components or devices, machine names and network addresses. Inventory specifications include, for example, manufacturer, device type, model, serial number, and physical location. Related controls: CM-2, CM-6, PM-5.

Control Enhancements:

(1) *INFORMATION SYSTEM COMPONENT INVENTORY | UPDATES DURING INSTALLATIONS / REMOVALS*

The organization updates the inventory of information system components as an integral part of component installations, removals, and information system updates.

(2) *INFORMATION SYSTEM COMPONENT INVENTORY | AUTOMATED MAINTENANCE*

The organization employs automated mechanisms to help maintain an up-to-date, complete, accurate, and readily available inventory of information system components.

Supplemental Guidance: Organizations maintain information system inventories to the extent feasible. Virtual machines, for example, can be difficult to monitor because such machines are not visible to the network when not in use. In such cases, organizations maintain as up-to-date, complete, and accurate an inventory as is deemed reasonable. Related control: SI-7.

(3) *INFORMATION SYSTEM COMPONENT INVENTORY | AUTOMATED UNAUTHORIZED COMPONENT DETECTION*

The organization:

(a) Employs automated mechanisms [*Assignment: organization-defined frequency*] to detect the addition of unauthorized components into the information system; and

(b) Performs [*Selection (one or more): disables network access by such components; notifies [Assignment: organization-defined personnel*]].

Supplemental Guidance: This control enhancement is applied in addition to the monitoring for unauthorized remote connections and mobile devices. Monitoring for unauthorized system components may be accomplished on an ongoing basis or by the periodic scanning of systems for that purpose. Automated mechanisms can be implemented within information systems or in other separate devices. Related controls: AC-17, AC-18, AC-19, CA-7, CM-8, SI-4, SI-7, RA-5.

(4) *INFORMATION SYSTEM COMPONENT INVENTORY | PROPERTY ACCOUNTABILITY INFORMATION*

The organization includes in property accountability information for information system components, a means for identifying by [*Selection (one or more): name; position; role*] individuals responsible for administering those components.

(5) *INFORMATION SYSTEM COMPONENT INVENTORY | ALL COMPONENTS WITHIN AUTHORIZATION BOUNDARY*

The organization verifies that all components within the authorization boundary of the information system are either inventoried as a part of the system or recognized by another system as a component within that system.

(6) *INFORMATION SYSTEM COMPONENT INVENTORY | ASSESSED CONFIGURATIONS / APPROVED DEVIATIONS*

The organization includes assessed component configurations and any approved deviations to current deployed configurations in the information system component inventory.

Supplemental Guidance: This control enhancement focuses on configuration settings established by organizations for information system components, the specific components that have been assessed to determine compliance with the required configuration settings, and any approved deviations from established configuration settings. Related controls: CM-2, CM-6.

References: NIST Special Publication 800-128.

Priority and Baseline Allocation:

P1	**LOW** CM-8	**MOD** CM-8 (1) (5)	**HIGH** CM-8 (1) (2) (3) (4) (5)

CM-9 CONFIGURATION MANAGEMENT PLAN

Control: The organization develops, documents, and implements a configuration management plan for the information system that:

a. Addresses roles, responsibilities, and configuration management processes and procedures;

b. Establishes a process for identifying configuration items throughout the system development life cycle and for managing the configuration of the configuration items; and

c. Defines the configuration items for the information system and places the configuration items under configuration management.

Supplemental Guidance: Configuration items are the information system items (hardware, software, firmware, and documentation) to be configuration managed. As information systems continue through the system development life cycle, new configuration items may be identified and some existing configuration items may no longer need to be under configuration control. Configuration management plans satisfy the requirements in organizational configuration management policies while being tailored to individual information systems. Configuration management plans define detailed processes and procedures for how configuration management is used to support system development life cycle activities at the information system level. The plans describe how to move changes through change management processes, how to update configuration settings/baselines, how to maintain information system component inventories, how to control development, test, and operational environments, and how to develop, release, and update key documents. Configuration management approval processes include designation of key management stakeholders responsible for reviewing and approving proposed changes to information systems, and personnel that conduct security impact analyses prior to the implementation of changes to the systems. Related controls: CM-2, CM-3, CM-4, CM-5, CM-8, SA-10.

Control Enhancements:

(1) *CONFIGURATION MANAGEMENT PLAN | ASSIGNMENT OF RESPONSIBILITY*

The organization assigns responsibility for developing the configuration management process to organizational personnel that are not directly involved in system development.

Supplemental Guidance: In the absence of dedicated configuration management teams assigned within organizations, system developers may be tasked to develop configuration management processes using personnel who are not directly involved in system development or integration.

References: NIST Special Publication 800-128.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** CM-9	**HIGH** CM-9

CM-10 SOFTWARE USAGE RESTRICTIONS

Control: The organization:

a. Uses software and associated documentation in accordance with contract agreements and copyright laws;

b. Employs tracking systems for software and associated documentation protected by quantity licenses to control copying and distribution; and

c. Controls and documents the use of peer-to-peer file sharing technology to ensure that this capability is not used for the unauthorized distribution, display, performance, or reproduction of copyrighted work.

Supplemental Guidance: Tracking systems can include, for example, simple spreadsheets or fully automated, specialized applications depending on organizational needs. Related controls: AC-17, CM-8, SC-7.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** CM-10	**MOD** CM-10	**HIGH** CM-10

CM-11 USER-INSTALLED SOFTWARE

Control: The organization enforces explicit rules governing the installation of software by users.

Supplemental Guidance: If provided the necessary privileges, users have the ability to install software in organizational information systems. To maintain control over the types of software installed, organizations identify permitted and prohibited software installations. Permitted software installations may include, for example, updates and security patches to existing software. Prohibited software installations may include, for example, software with unknown or suspect pedigrees or software that organizations consider potentially malicious. Related controls: AC-3, CM-2, CM-3, CM-5, CM-7, PL-4.

Control Enhancements:

(1) *USER-INSTALLED SOFTWARE | AUTOMATED ALERTS FOR UNAUTHORIZED INSTALLATIONS*

The organization employs automated mechanisms to alert [*Assignment: organization-defined personnel*] on the unauthorized installation of software.

Supplemental Guidance: Related controls: CA-7, SI-4.

References: None.

Priority and Baseline Allocation:

P1	**LOW** CM-11	**MOD** CM-11	**HIGH** CM-11

FAMILY: CONTINGENCY PLANNING

CP-1 CONTINGENCY PLANNING POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented contingency planning policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the contingency planning policy and associated contingency planning controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the CP family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: Federal Continuity Directive 1; NIST Special Publications 800-12, 800-34, 800-100.

Priority and Baseline Allocation:

P1	**LOW** CP-1	**MOD** CP-1	**HIGH** CP-1

CP-2 CONTINGENCY PLAN

Control: The organization:

a. Develops a contingency plan for the information system that:

- Identifies essential missions and business functions and associated contingency requirements;
- Provides recovery objectives, restoration priorities, and metrics;
- Addresses contingency roles, responsibilities, assigned individuals with contact information;
- Addresses maintaining essential missions and business functions despite an information system disruption, compromise, or failure;
- Addresses eventual, full information system restoration without deterioration of the security safeguards originally planned and implemented; and
- Is reviewed and approved by [*Assignment: organization-defined personnel*];

b. Distributes copies of the contingency plan to [*Assignment: organization-defined key contingency personnel (identified by name and/or by role) and organizational elements*];

c. Coordinates contingency planning activities with incident handling activities;

d. Reviews the contingency plan for the information system [*Assignment: organization-defined frequency*];

e. Revises the contingency plan to address changes to the organization, information system, or environment of operation and problems encountered during contingency plan implementation, execution, or testing; and

f. Communicates contingency plan changes to [*Assignment: organization-defined key contingency personnel (identified by name and/or by role) and organizational elements*].

Supplemental Guidance: Contingency planning for information systems is part of an overall organizational program for achieving continuity of operations for mission/business operations. Contingency planning addresses both information system restoration and implementation of alternative mission/business processes when systems are compromised. Information system recovery objectives reflect applicable laws, Executive Orders, directives, policies, standards, regulations, and guidelines. In addition to information system availability, contingency plans also address other security-related events resulting in a reduction in mission/business effectiveness, such as malicious attacks compromising the confidentiality or integrity of information systems. Actions addressed in contingency plans include, for example, orderly/graceful degradation, information system shutdown, fall back to a manual mode, alternate information flows, and operating in modes reserved for when systems are under attack. Related controls: AC-14, CP-6, CP-7, CP-8, CP-9, CP-10, IR-4, IR-8, PM-8, PM-11.

Control Enhancements:

(1) *CONTINGENCY PLAN | COORDINATE WITH RELATED PLANS*

The organization coordinates contingency plan development with organizational elements responsible for related plans.

Supplemental Guidance: Plans related to contingency plans for organizational information systems include, for example, Business Continuity Plans, Disaster Recovery Plans, Continuity of Operations Plans, Crisis Communications Plans, Critical Infrastructure Plans, Cyber Incident Response Plans, and Occupant Emergency Plans.

(2) *CONTINGENCY PLAN | CAPACITY PLANNING*

The organization conducts capacity planning so that necessary capacity for information processing, telecommunications, and environmental support exists during contingency operations.

(3) *CONTINGENCY PLAN | RESUME ESSENTIAL MISSIONS / BUSINESS FUNCTIONS*

The organization plans for the resumption of essential missions and business functions within [*Assignment: organization-defined time period*] of contingency plan activation.

Supplemental Guidance: Organizations may choose to carry out the contingency planning activities in this control enhancement as part of organizational business continuity planning including, for example, as part of business impact analyses. Related controls: CP-10, PE-12.

(4) *CONTINGENCY PLAN | RESUME ALL MISSIONS / BUSINESS FUNCTIONS*

The organization plans for the resumption of all missions and business functions within [*Assignment: organization-defined time period*] of contingency plan activation.

Supplemental Guidance: Organizations may choose to carry out the contingency planning activities in this control enhancement as part of organizational business continuity planning including, for example, as part of business impact analyses. Related controls: CP-10, PE-12.

(5) *CONTINGENCY PLAN | CONTINUE ESSENTIAL MISSIONS / BUSINESS FUNCTIONS*

The organization plans for the continuance of essential missions and business functions with little or no loss of operational continuity and sustains that continuity until full information system restoration at primary processing and/or storage sites.

Supplemental Guidance: Organizations may choose to carry out the contingency planning activities in this control enhancement as part of organizational business continuity planning including, for example, as part of business impact analyses. Related controls: CP-10, PE-12.

(6) *CONTINGENCY PLAN | ALTERNATE PROCESSING / STORAGE SITE*

The organization plans for the transfer of essential missions and business functions to alternate processing and/or storage sites with little or no loss of operational continuity and sustains that continuity through restoration to primary processing and/or storage sites.

Supplemental Guidance: Related controls: CP-10, PE-12.

(7) *CONTINGENCY PLAN | COORDINATE WITH EXTERNAL SERVICE PROVIDERS*

The organization coordinates its contingency plan with the contingency plans of external service providers to ensure contingency requirements can be satisfied.

(8) *CONTINGENCY PLAN | IDENTIFY CRITICAL ASSETS*

The organization identifies critical information system assets supporting organizational missions and business functions.

Supplemental Guidance: Organizations may choose to carry out the contingency planning activities in this control enhancement as part of organizational business continuity planning including, for example, as part of business impact analyses. Organizations identify critical information system assets so that additional safeguards and countermeasures can be employed (above and beyond those safeguards and countermeasures routinely implemented) to ensure organizational missions/business functions can continue to be conducted during contingency operations. In addition, the identification of critical assets facilitates the prioritization of organizational resources. Critical information system assets include technical and operational aspects. Technical aspects include, for example, information technology services, information system components, information technology products, and mechanisms. Operational aspects include, for example, procedures (manually executed operations) and personnel (individuals operating technical safeguards and/or executing manual procedures). Organizational program protection plans can provide assistance in identifying critical assets.

References: Federal Continuity Directive 1; NIST Special Publication 800-34.

Priority and Baseline Allocation:

P1	**LOW** CP-2	**MOD** CP-2 (1) (3) (8)	**HIGH** CP-2 (1) (2) (3) (4) (5) (8)

CP-3 CONTINGENCY TRAINING

Control: The organization provides contingency training to information system users consistent with assigned roles and responsibilities:

a. Before authorizing access to the information system or performing assigned duties;

b. When required by information system changes; and

c. [*Assignment: organization-defined frequency*] thereafter.

Supplemental Guidance: Contingency training provided by organizations is linked to the assigned roles and responsibilities of organizational personnel to ensure the appropriate content and level of detail is included in such training. For example, regular users may only need to know when and where to report for duty during contingency operations and if normal duties are affected; system administrators may require additional training on how to set up information systems at alternate processing and storage sites; and managers/senior leaders may receive more specific training on how to conduct mission essential functions in designated off-site locations and how to establish communications with other governmental entities for purposes of coordination on contingency-related activities. Training for contingency roles/responsibilities reflects the specific continuity requirements in the contingency plan. Related controls: AT-2, AT-3, CP-2, IR-2.

Control Enhancements:

(1) *CONTINGENCY TRAINING | SIMULATED EVENTS*

The organization incorporates simulated events into contingency training to facilitate effective response by personnel in crisis situations.

(2) *CONTINGENCY TRAINING | AUTOMATED TRAINING ENVIRONMENTS*

The organization employs automated mechanisms to provide a more thorough and realistic training environment.

References: NIST Special Publications 800-16, 800-50.

Priority and Baseline Allocation:

P2	**LOW** CP-3	**MOD** CP-3	**HIGH** CP-3 (1)

CP-4 CONTINGENCY PLAN TESTING

Control: The organization:

a. Tests the contingency plan for the information system [*Assignment: organization-defined frequency*] using [*Assignment: organization-defined tests*] to determine the effectiveness of the plan and the organizational readiness to execute the plan;

b. Reviews the contingency plan test results; and

c. Initiates corrective actions.

Supplemental Guidance: Methods for testing contingency plans to determine the effectiveness of the plans and to identify potential weaknesses in the plans include, for example, walk-through and tabletop exercises, checklists, simulations (parallel, full interrupt), and comprehensive exercises. Organizations conduct testing based on the continuity requirements in contingency plans and include a determination of the effects on organizational operations, assets, and individuals arising due to contingency operations. Related controls: CP-2, CP-3, IR-3.

Control Enhancements:

(1) *CONTINGENCY PLAN TESTING | COORDINATE WITH RELATED PLANS*

The organization coordinates contingency plan testing with organizational elements responsible for related plans.

Supplemental Guidance: Plans related to contingency plans for organizational information systems include, for example, Business Continuity Plans, Disaster Recovery Plans, Continuity of Operations Plans, Crisis Communications Plans, Critical Infrastructure Plans, Cyber Incident Response Plans, and Occupant Emergency Plans. Related controls: IR-8, PM-8.

(2) *CONTINGENCY PLAN TESTING | ALTERNATE PROCESSING SITE*

The organization tests the contingency plan at the alternate processing site:

(a) To familiarize contingency personnel with the facility and available resources; and

(b) To evaluate the capabilities of the alternate processing site to support contingency operations.

Supplemental Guidance: Related control: CP-7.

(3) *CONTINGENCY PLAN TESTING | AUTOMATED TESTING*

The organization employs automated mechanisms to more thoroughly and effectively test the contingency plan.

Supplemental Guidance: Automated mechanisms provide more thorough and effective testing of contingency plans, for example: (i) by providing more complete coverage of contingency issues; (ii) by selecting more realistic test scenarios and environments; and (iii) by effectively stressing the information system and supported missions.

(4) *CONTINGENCY PLAN TESTING | FULL RECOVERY / RECONSTITUTION*

The organization includes a full recovery and reconstitution of the information system to a known state as part of contingency plan testing.

Supplemental Guidance: Related controls: CP-10, SC-24.

References: FIPS Publication 199; NIST Special Publications 800-34, 800-84.

Priority and Baseline Allocation:

P2	**LOW** CP-4	**MOD** CP-4 (1)	**HIGH** CP-4 (1) (2) (4)

CP-5 CONTINGENCY PLAN UPDATE

[Withdrawn: Incorporated into CP-2].

CP-6 ALTERNATE STORAGE SITE

Control: The organization:

a. Establishes an alternate storage site including necessary agreements to permit the storage and recovery of information system backup information; and

b. Ensures that the alternate storage site provides information security safeguards equivalent to that of the primary site.

Supplemental Guidance: Items covered by alternate storage site agreements include, for example, environmental conditions at alternate sites, access rules, physical and environmental protection requirements, and coordination of delivery/retrieval of backup media. Alternate storage sites reflect the continuity requirements in contingency plans to maintain essential missions/business functions despite disruption, compromise, or failure in organizational information systems. Related controls: CP-2, CP-7, CP-9, CP-10, MP-4.

Control Enhancements:

(1) *ALTERNATE STORAGE SITE | SEPARATION FROM PRIMARY SITE*

The organization ensures that the established alternate storage site is separated from the primary storage site to reduce susceptibility to the same hazards.

Supplemental Guidance: Hazards of concern to the organization are typically defined in an organizational assessment of risk.

(2) *ALTERNATE STORAGE SITE | RECOVERY TIME / POINT OBJECTIVES*

The organization configures the alternate storage site to facilitate recovery operations in accordance with recovery time and recovery point objectives.

(3) *ALTERNATE STORAGE SITE | ACCESSIBILITY*

The organization identifies potential accessibility problems to the alternate storage site in the event of an area-wide disruption or disaster and outlines explicit mitigation actions.

Supplemental Guidance: Explicit mitigation actions include, for example: (i) duplicating backup information at other alternate storage sites if access problems occur at originally-designated alternate sites; or, (ii) planning for physical access to retrieve backup information if electronic accessibility to the alternate site is disrupted.

References: NIST Special Publication 800-34.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** CP-6 (1) (3)	**HIGH** CP-6 (1) (2) (3)

CP-7 ALTERNATE PROCESSING SITE

Control: The organization:

a. Establishes an alternate processing site including necessary agreements to permit the transfer and resumption of information system operations for essential missions/business functions within [*Assignment: organization-defined time period consistent with recovery time and recovery point objectives*] when the primary processing capabilities are unavailable;

b. Ensures that equipment and supplies required to transfer and resume operations are available at the alternate site or contracts are in place to support delivery to the site in time to support the organization-defined time period for transfer/resumption; and

c. Ensures that the alternate processing site provides information security safeguards equivalent to that of the primary site.

Supplemental Guidance: Items covered by alternate processing site agreements include, for example, environmental conditions at alternate sites, access rules, physical and environmental protection requirements, and coordination for the transfer/assignment of personnel. Alternate processing sites reflect the continuity requirements in contingency plans to maintain essential missions/business functions despite disruption, compromise, or failure in organizational information systems. Related controls: CP-2, CP-6, CP-8, CP-9, CP-10, MA-6.

Control Enhancements:

(1) *ALTERNATE PROCESSING SITE | SEPARATION FROM PRIMARY SITE*

The organization identifies an alternate processing site that is separated from the primary processing site to reduce susceptibility to the same hazards.

Supplemental Guidance: Hazards that might affect the information system are typically defined in the organizational assessment of risk.

(2) *ALTERNATE PROCESSING SITE | ACCESSIBILITY*

The organization identifies potential accessibility problems to the alternate processing site in the event of an area-wide disruption or disaster and outlines explicit mitigation actions.

(3) *ALTERNATE PROCESSING SITE | PRIORITY OF SERVICE*

The organization develops alternate processing site agreements that contain priority-of-service provisions in accordance with the organization's availability requirements.

(4) *ALTERNATE PROCESSING SITE | CONFIGURATION FOR USE*

The organization configures the alternate processing site so that the site is ready to be used as the operational site supporting essential missions and business functions.

(5) *ALTERNATE PROCESSING SITE | EQUIVALENT INFORMATION SECURITY SAFEGUARDS*

[Withdrawn: Incorporated into CP-7].

(6) *ALTERNATE PROCESSING SITE | INABILITY TO RETURN TO PRIMARY SITE*

The organization plans and prepares for circumstances that preclude returning to the primary processing site.

References: NIST Special Publication 800-34.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** CP-7 (1) (2) (3)	**HIGH** CP-7 (1) (2) (3) (4)

CP-8 TELECOMMUNICATIONS SERVICES

Control: The organization establishes alternate telecommunications services including necessary agreements to permit the resumption of information system operations for essential missions and business functions within [*Assignment: organization-defined time period*] when the primary telecommunications capabilities are unavailable at either the primary or alternate processing or storage sites.

Supplemental Guidance: This control applies to telecommunications services (data and voice) for primary and alternate processing and storage sites. Alternate telecommunications services reflect the continuity requirements in contingency plans to maintain essential missions/business functions despite the loss of primary telecommunications services. Organizations may specify different time periods for primary/alternate sites. Alternate telecommunications services include, for example, additional organizational or commercial ground-based circuits/lines or satellites in lieu of ground-based communications. Organizations consider factors such as availability, quality of service, and access when entering into alternate telecommunications agreements. Related controls: CP-2, CP-6, CP-7.

Control Enhancements:

(1) *TELECOMMUNICATIONS SERVICES | PRIORITY OF SERVICE PROVISIONS*

The organization:

(a) Develops primary and alternate telecommunications service agreements that contain priority-of-service provisions in accordance with the organization's availability requirements; and

(b) Requests Telecommunications Service Priority for all telecommunications services used for national security emergency preparedness in the event that the primary and/or alternate telecommunications services are provided by a common carrier.

(2) *TELECOMMUNICATIONS SERVICES | SINGLE POINTS OF FAILURE*

The organization obtains alternate telecommunications services with consideration for reducing the likelihood of sharing a single point of failure with primary telecommunications services.

(3) *TELECOMMUNICATIONS SERVICES | SEPARATION OF PRIMARY / ALTERNATE PROVIDERS*

The organization obtains alternate telecommunications service providers that are separated from primary service providers to reduce susceptibility to the same hazards.

Supplemental Guidance: Organizations seek to reduce common susceptibilities by, for example, minimizing shared infrastructure between telecommunications service providers and achieving sufficient geographic separation between services.

(4) *TELECOMMUNICATIONS SERVICES | PROVIDER CONTINGENCY PLAN*

The organization:

(a) Requires primary and alternate telecommunications service providers to have contingency plans;

(b) Reviews provider contingency plans to ensure that the plans meet organizational contingency requirements; and

(c) Obtains evidence of contingency testing/training by providers [*Assignment: organization-defined frequency*].

(5) *TELECOMMUNICATIONS SERVICES | ALTERNATE TELECOMMUNICATION SERVICE TESTING*

The organization tests alternate telecommunication services [*Assignment: organization-defined frequency*].

References: NIST Special Publication 800-34; National Communications Systems Directive 3-10; Web: TSP.NCS.GOV.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** CP-8 (1) (2)	**HIGH** CP-8 (1) (2) (3) (4)

CP-9 INFORMATION SYSTEM BACKUP

Control: The organization:

a. Conducts backups of user-level information contained in the information system [*Assignment: organization-defined frequency consistent with recovery time and recovery point objectives*];

b. Conducts backups of system-level information contained in the information system [*Assignment: organization-defined frequency consistent with recovery time and recovery point objectives*];

c. Conducts backups of information system documentation including security-related documentation [*Assignment: organization-defined frequency consistent with recovery time and recovery point objectives*]; and

d. Protects the confidentiality, integrity, and availability of backup information at storage locations.

Supplemental Guidance: System-level information includes, for example, system-state information, operating system and application software, and licenses. User-level information includes any

information other than system-level information. Mechanisms employed by organizations to protect the integrity of information system backups include, for example, digital signatures and cryptographic hashes. Protection of system backup information while in transit is beyond the scope of this control. Information system backups reflect the requirements in contingency plans as well as other organizational requirements for backing up information. Related controls: CP-2, CP-6, MP-4, MP-5, SC-13.

Control Enhancements:

(1) *INFORMATION SYSTEM BACKUP | TESTING FOR RELIABILITY / INTEGRITY*

The organization tests backup information [*Assignment: organization-defined frequency*] to verify media reliability and information integrity.

Supplemental Guidance: Related control: CP-4.

(2) *INFORMATION SYSTEM BACKUP | TEST RESTORATION USING SAMPLING*

The organization uses a sample of backup information in the restoration of selected information system functions as part of contingency plan testing.

Supplemental Guidance: Related control: CP-4.

(3) *INFORMATION SYSTEM BACKUP | SEPARATE STORAGE FOR CRITICAL INFORMATION*

The organization stores backup copies of [*Assignment: organization-defined critical information system software and other security-related information*] in a separate facility or in a fire-rated container that is not collocated with the operational system.

Supplemental Guidance: Critical information system software includes, for example, operating systems, cryptographic key management systems, and intrusion detection/prevention systems. Security-related information includes, for example, organizational inventories of hardware, software, and firmware components. Related controls: CM-2, CM-8.

(4) *INFORMATION SYSTEM BACKUP | PROTECTION FROM UNAUTHORIZED MODIFICATION*

[Withdrawn: Incorporated into CP-9].

(5) *INFORMATION SYSTEM BACKUP | TRANSFER TO ALTERNATE SITE*

The organization transfers information system backup information to the alternate storage site [*Assignment: organization-defined time period and transfer rate consistent with the recovery time and recovery point objectives*].

Supplemental Guidance: Related control: CP-7.

(6) *INFORMATION SYSTEM BACKUP | REDUNDANT SECONDARY SYSTEM*

The organization accomplishes information system backup by maintaining a redundant secondary system that is not collocated with the primary system and that can be activated without loss of information or disruption to operations.

Supplemental Guidance: Related control: CP-7, CP-10.

(7) *INFORMATION SYSTEM BACKUP | TWO-PERSON RULE*

The organization enforces a two-person rule for the deletion or destruction of [*Assignment: organization-defined backup information*].

Supplemental Guidance: Organizations employ a two-person rule to ensure that the deletion or destruction of backup information cannot occur unless two qualified individuals carry out the task. Individuals deleting/destroying backup information possess sufficient skills/expertise to determine if the proposed deletion/destruction of backup information reflects organizational policies and procedures. Related controls: AC-3, MP-2.

References: NIST Special Publication 800-34.

Priority and Baseline Allocation:

P1	**LOW** CP-9	**MOD** CP-9 (1)	**HIGH** CP-9 (1) (2) (3) (5)

CP-10 INFORMATION SYSTEM RECOVERY AND RECONSTITUTION

Control: The organization provides for the recovery and reconstitution of the information system to a known state after a disruption, compromise, or failure.

Supplemental Guidance: Recovery is executing information system contingency plan activities to restore organizational missions/business functions. Reconstitution takes place following recovery and includes activities for returning organizational information systems to fully operational states. Recovery and reconstitution operations reflect mission and business priorities, recovery point/time and reconstitution objectives, and established organizational metrics consistent with contingency plan requirements. Reconstitution includes the deactivation of any interim information system capabilities that may have been needed during recovery operations. Reconstitution also includes assessments of fully restored information system capabilities, reestablishment of continuous monitoring activities, potential information system reauthorizations, and activities to prepare the systems against future disruptions, compromises, or failures. Recovery/reconstitution capabilities employed by organizations can include both automated mechanisms and manual procedures. Related controls: CA-2, CA-6, CA-7, CP-2, CP-6, CP-7, CP-9, SC-24.

Control Enhancements:

(1) *INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | CONTINGENCY PLAN TESTING*

[Withdrawn: Incorporated into CP-4].

(2) *INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | TRANSACTION RECOVERY*

The information system implements transaction recovery for systems that are transaction-based.

Supplemental Guidance: Transaction-based information systems include, for example, database management systems and transaction processing systems. Mechanisms supporting transaction recovery include, for example, transaction rollback and transaction journaling.

(3) *INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | COMPENSATING SECURITY CONTROLS*

The organization provides [*Assignment: organization-defined compensating security controls*] for [*Assignment: organization-defined circumstances that can inhibit recovery and reconstitution to a known state*].

Supplemental Guidance: Circumstances requiring compensating controls include, for example, the inability of organizational personnel to reach recovery sites, hardware failures at recovery sites, inability to restore organizational information systems from backup media, or inability of redundant systems to failover into known states.

(4) *INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | RESTORE WITHIN TIME PERIOD*

The organization provides the capability to restore information system components within [*Assignment: organization-defined restoration time-periods*] from configuration-controlled and integrity-protected information representing a known, operational state for the components.

Supplemental Guidance: Restoration of information system components includes, for example, reimaging which, restores components to known, operational states. Related control: CM-2.

(5) *INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | FAILOVER CAPABILITY*

The organization provides [*Selection: real-time; near-real-time*] [*Assignment: organization-defined failover capability for the information system*].

Supplemental Guidance: Failover capability includes, for example, incorporating mirrored information system operations at alternate processing sites or periodic data mirroring at regular intervals defined by recovery time periods of organizations.

(6) *INFORMATION SYSTEM RECOVERY AND RECONSTITUTION | COMPONENT PROTECTION*

The organization protects backup and restoration hardware, firmware, and software.

Supplemental Guidance: Protection of backup and restoration hardware, firmware, and software components includes both physical and technical safeguards. Backup and restoration software includes, for example, router tables, compilers, and other security-relevant system software. Related controls: AC-3, AC-6, PE-3.

References: NIST Special Publication 800-34.

Priority and Baseline Allocation:

P1	**LOW** CP-10	**MOD** CP-10 (2) (3)	**HIGH** CP-10 (2) (3) (4) (5)

CP-11 PREDICTABLE FAILURE PREVENTION

Control: The organization:

a. Determines mean time to failure (MTTF) for [*Assignment: organization-defined information system components*] in specific environments of operation; and

b. Provides substitute information system components and a means to exchange active and standby components at [*Assignment: organization-defined MTTF substitution criteria*].

Supplemental Guidance: While MTTF is primarily a reliability issue, this control addresses potential failures of specific information system components that provide security capability. Failure rates reflect installation-specific consideration, not industry-average. Organizations define criteria for substitution of information system components based on MTTF value with consideration for resulting potential harm from component failures. Transfer of responsibilities between active and standby components does not compromise safety, operational readiness, or security capability (e.g., preservation of state variables). Standby components remain available at all times except for maintenance issues or recovery failures in progress. Related controls: CP-2, CP-10, MA-6.

Control Enhancements:

(1) *PREDICTABLE FAILURE PREVENTION | TRANSFERRING COMPONENT RESPONSIBILITIES*

The organization takes information system components out of service by transferring component responsibilities to substitute components no later than [*Assignment: organization-defined fraction or percentage*] of mean time to failure.

(2) *PREDICTABLE FAILURE PREVENTION | TIME LIMIT ON PROCESS EXECUTION WITHOUT SUPERVISION*

The organization does not allow processes to execute without supervision for more than [*Assignment: organization-defined time period*].

Supplemental Guidance: This control enhancement addresses processes for which normal execution periods can be determined and situations in which organizations exceed such periods. Supervision includes, for example, operating system timers, automated responses, or manual oversight and response when information system process anomalies occur.

(3) *PREDICTABLE FAILURE PREVENTION | MANUAL TRANSFER BETWEEN COMPONENTS*

The organization manually initiates transfers between active and standby information system components at least once per [*Assignment: organization-defined frequency*] if the mean time to failure exceeds [*Assignment: organization-defined time period*].

(4) *PREDICTABLE FAILURE PREVENTION | STANDBY COMPONENT INSTALLATION / NOTIFICATION*

The organization, if information system component failures are detected:

(a) Ensures that the standby components are successfully and transparently installed within [*Assignment: organization-defined time period*]; and

(b) [*Selection (one or more): activates [Assignment: organization-defined alarm]; automatically shuts down the information system*].

Supplemental Guidance: Automatic or manual transfer of components from standby to active mode can occur, for example, upon detection of component failures.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** Not Selected	**HIGH** CP-11

CP-12 ALTERNATE COMMUNICATIONS PROTOCOLS

Control: The information system provides the capability to employ [*Assignment: organization-defined alternative communications protocols*] in support of maintaining continuity of operations.

Supplemental Guidance: Contingency plans and the associated training and testing for those plans, incorporate an alternate communications protocol capability as part of increasing the resilience of organizational information systems. Alternate communications protocols include, for example, switching from Transmission Control Protocol to User Datagram Protocol communications or to a special purpose protocol used in conjunction with the Internet Protocol.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

CP-13 SAFE MODE

Control: The information system, when [*Assignment: organization-defined conditions*] are detected, enters a safe mode of operation with [*Assignment: organization-defined restrictions of safe mode of operation*].

Supplemental Guidance: For information systems supporting critical missions/business functions including, for example, military operations and weapons systems, civilian space operations, nuclear power plant operations, and air traffic control operations (especially real-time operational environments), organizations may choose to identify certain conditions under which those systems revert to a pre-defined safe mode of operation. The safe mode of operation, which can be activated automatically or manually, restricts the types of activities or operations information systems could execute when those conditions are encountered. Restriction include, for example, allowing only certain functions that could be carried out under limited power or with reduced communications bandwidth.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: IDENTIFICATION AND AUTHENTICATION

IA-1 IDENTIFICATION AND AUTHENTICATION POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented identification and authentication policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the identification and authentication policy and associated identification and authentication controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the IA family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: FIPS Publication 201; NIST Special Publications 800-12, 800-63, 800-73, 800-76, 800-78, 800-100.

Priority and Baseline Allocation:

P1	**LOW** IA-1	**MOD** IA-1	**HIGH** IA-1

IA-2 IDENTIFICATION AND AUTHENTICATION (ORGANIZATIONAL USERS)

Control: The information system uniquely identifies and authenticates organizational users (or processes acting on behalf of organizational users).

Supplemental Guidance: Organizational users include employees or individuals that organizations deem to have equivalent status of employees (e.g., contractors, guest researchers). This control applies to all accesses other than: (i) accesses that are explicitly identified and documented in AC-14; and (ii) accesses that occur through authorized use of group authenticators without individual authentication. Organizations may require unique identification of individuals in group accounts (e.g., shared privilege accounts) or for detailed accountability of individual activity. Organizations employ passwords, tokens, or biometrics to authenticate user identities, or in the case multifactor authentication, some combination thereof. Access to organizational information systems is defined as either local access or network access. Local access is any access to organizational information systems by users (or processes acting on behalf of users) where such access is obtained by direct connections without the use of networks. Network access is access to organizational information systems by users (or processes acting on behalf of users) where such access is obtained through network connections (i.e., non-local accesses). Remote access is a type of network access which involves communication through external networks (e.g., the Internet). Internal networks include local area networks, wide area networks, and virtual private networks (VPNs) under organizational control. The VPN is considered internal if organizations establish the network connection between organization-controlled endpoints in a manner that does not depend on external networks across which the VPN transits to protect the confidentiality and integrity of information transmitted. Identification and authentication requirements by other than organizational users are described in IA-8.

Organizations can satisfy the identification and authentication requirements in this control by complying with the requirements in Homeland Security Presidential Directive 12 consistent with the specific organizational implementation plans. In addition to identifying and authenticating users at the information-system level (i.e., at logon), organizations also employ identification and authentication mechanisms at the application level, when necessary, to provide increased information security. Related controls: AC-2, AC-3, AC-14, AC-17, AC-18, IA-4, IA-5, IA-8.

Control Enhancements:

(1) *IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO PRIVILEGED ACCOUNTS*

The information system employs multifactor authentication for network access to privileged accounts.

Supplemental Guidance: Related control: AC-6.

(2) *IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO NON-PRIVILEGED ACCOUNTS*

The information system employs multifactor authentication for network access to non-privileged accounts.

(3) *IDENTIFICATION AND AUTHENTICATION | LOCAL ACCESS TO PRIVILEGED ACCOUNTS*

The information system employs multifactor authentication for local access to privileged accounts.

Supplemental Guidance: Related control: AC-6.

(4) *IDENTIFICATION AND AUTHENTICATION | LOCAL ACCESS TO NON-PRIVILEGED ACCOUNTS*

The information system employs multifactor authentication for local access to non-privileged accounts.

(5) *IDENTIFICATION AND AUTHENTICATION | INDIVIDUAL AND GROUP AUTHENTICATORS*

The organization requires individuals to be authenticated with an individual authenticator in conjunction with using a group authenticator.

(6) *IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO PRIVILEGED ACCOUNTS - SEPARATE DEVICE*

The information system employs multifactor authentication for network access to privileged accounts such that one of the factors is provided by a device separate from the system and the device meets [*Assignment: organization-defined strength of mechanism requirements*].

Supplemental Guidance: Devices separate from information systems include, for example, hardware tokens providing time-based or challenge-response authenticators and smart cards such as the U.S. Government personal identity verification card and the Department of Defense common access card. Organizations employ separate authentication devices so that even if the information system that the user is using to remotely gain access is compromised, that compromise will not affect the device. Related control: AC-6.

(7) *IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO NON-PRIVILEGED ACCOUNTS - SEPARATE DEVICE*

The information system employs multifactor authentication for network access to non-privileged accounts such that one of the factors is provided by a device separate from the system and the device meets [*Assignment: organization-defined strength of mechanism requirements*]..

Supplemental Guidance: Devices separate from information systems include, for example, hardware tokens providing time-based or challenge-response authenticators and smart cards such as the U.S. Government personal identity verification card and the Department of Defense common access card. Organizations employ separate authentication devices so that even if the information system that the user is using to remotely gain access is compromised, that compromise will not affect the device.

(8) *IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO PRIVILEGED ACCOUNTS - REPLAY RESISTANT*

The information system employs [*Assignment: organization-defined replay-resistant authentication mechanisms*] for network access to privileged accounts.

Supplemental Guidance: Authentication processes resist replay attacks if it is impractical to achieve successful authentications by replaying previous authentication messages. Replay-resistant techniques include, for example, protocols that use nonces or challenges such as Transport Layer Security (TLS) and time synchronous or challenge-response one-time authenticators.

(9) *IDENTIFICATION AND AUTHENTICATION | NETWORK ACCESS TO NON-PRIVILEGED ACCOUNTS - REPLAY RESISTANT*

The information system employs [*Assignment: organization-defined replay-resistant authentication mechanisms*] for network access to non-privileged accounts.

Supplemental Guidance: Authentication processes resist replay attacks if it is impractical to achieve successful authentications by recording/replaying previous authentication messages. Replay-resistant techniques include, for example, protocols that use nonces or challenges such as Transport Layer Security (TLS) and time synchronous or challenge-response one-time authenticators.

(10) *IDENTIFICATION AND AUTHENTICATION | SINGLE SIGN-ON*

The information system provides a single sign-on capability (or equivalent) for [*Assignment: organization-defined list of information system accounts and services*].

Supplemental Guidance: Single sign-on enables users to log in once and gain access to multiple information system resources without additional interactive logins. Organizations balance the operational efficiencies provided by single sign-on capabilities with the increased risk from disclosures of single authenticators providing access to multiple system resources.

References: HSPD 12; OMB Memorandum 04-04; FIPS Publication 201; NIST Special Publications 800-63, 800-73, 800-76, 800-78.

Priority and Baseline Allocation:

P1	**LOW** IA-2 (1)	**MOD** IA-2 (1) (2) (3) (8)	**HIGH** IA-2 (1) (2) (3) (4) (8) (9)

IA-3 DEVICE-TO-DEVICE IDENTIFICATION AND AUTHENTICATION

Control: The information system uniquely identifies and authenticates [*Assignment: organization-defined specific and/or types of devices*] before establishing a [*Selection (one or more): local; remote; network*] connection.

Supplemental Guidance: Organizational devices requiring unique device-to-device identification and authentication may be defined by type, by device, or by a combination of type/device. Information systems typically use either shared known information (e.g., Media Access Control [MAC] or Transmission Control Protocol/Internet Protocol [TCP/IP] addresses) for device identification or organizational authentication solutions (e.g., IEEE 802.1x and Extensible Authentication Protocol [EAP], Radius server with EAP-Transport Layer Security [TLS] authentication, Kerberos) to identify/authenticate devices on local and/or wide area networks. Organizations determine the required strength of authentication mechanisms by the security categories of information systems. Related controls: AC-17, AC-18, AC-19, CA-3, IA-4, IA-5.

Control Enhancements:

(1) *DEVICE-TO-DEVICE IDENTIFICATION AND AUTHENTICATION | CRYPTOGRAPHIC BIDIRECTIONAL AUTHENTICATION*

The information system authenticates [*Assignment: organization-defined specific devices and/or types of devices*] before establishing [*Selection (one or more): local; remote; network*] connection using bidirectional authentication that is cryptographically based.

Supplemental Guidance: A local connection is any connection with a device communicating without the use of a network. A network connection is any connection with a device that communicates through a network (e.g., local area or wide area network, Internet). A remote connection is any connection with a device communicating through an external network (e.g., the Internet). Bidirectional authentication provides stronger safeguards to validate the identity of other devices for connections that are of greater risk (e.g., remote connections). Related controls: SC-8, SC-9, SC-12, SC-13.

(2) *DEVICE-TO-DEVICE IDENTIFICATION AND AUTHENTICATION | CRYPTOGRAPHIC BIDIRECTIONAL AUTHENTICATION*

[Withdrawn: Incorporated into IA-3].

(3) *DEVICE-TO-DEVICE IDENTIFICATION AND AUTHENTICATION | DYNAMIC ADDRESS ALLOCATION*

The organization:

(a) Standardizes dynamic address allocation lease information and the lease duration assigned to devices in accordance with [*Assignment: organization-defined lease information and lease duration*]; and

(b) Audits lease information when assigned to a device.

Supplemental Guidance: DHCP-enabled clients obtaining *leases* for IP addresses from DHCP servers, is a typical example of dynamic address allocation for devices. Related controls: AU-2, AU-3, AU-12.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** IA-3	**HIGH** IA-3

IA-4 IDENTIFIER MANAGEMENT

Control: The organization manages information system identifiers by:

a. Receiving authorization from [*Assignment: organization-defined personnel*] to assign an individual, group, role, or device identifier;

b. Selecting an identifier that identifies an individual, group, role, or device;

c. Assigning the identifier to the intended individual, group, role, or device;

d. Preventing reuse of identifiers for [*Assignment: organization-defined time period*]; and

e. Disabling the identifier after [*Assignment: organization-defined time period of inactivity*].

Supplemental Guidance: Common device identifiers include, for example, media access control (MAC), Internet protocol (IP) addresses, or device-unique token identifiers. Management of individual identifiers is not applicable to shared information system accounts (e.g., guest and anonymous accounts). Typically, individual identifiers are the names of the information system accounts associated with those individuals. In such instances, the account management activities of AC-2 use account names provided by AC-4. This control also addresses individual identifiers not necessarily associated with information system accounts (e.g., identifiers used in physical security control databases accessed by badge reader systems for access to information systems). Preventing reuse of identifiers implies preventing the assignment of previously used individual, group, role, or device identifiers to different individuals, groups, roles, or devices. Related controls: AC-2, IA-2, IA-3, IA-5, IA-8, SC-39.

Control Enhancements:

(1) *IDENTIFIER MANAGEMENT | PROHIBIT ACCOUNT IDENTIFIERS AS PUBLIC IDENTIFIERS*

The organization prohibits the use of information system account identifiers as public identifiers for individual electronic mail accounts (i.e., individual identifier portion of the electronic mail address).

Supplemental Guidance: The organization implements this control enhancement to the extent that the information system allows. Related control: AT-2.

(2) *IDENTIFIER MANAGEMENT | SUPERVISOR AUTHORIZATION*

The organization requires that registration to receive an individual identifier include authorization by a supervisor, and be done in person before a designated registration authority.

(3) *IDENTIFIER MANAGEMENT | MULTIPLE FORMS OF CERTIFICATION*

The organization requires multiple forms of certification of individual identification such as documentary evidence or a combination of documents and biometrics be presented to the registration authority.

(4) *IDENTIFIER MANAGEMENT | IDENTIFY USER STATUS*

The organization manages individual identifiers by uniquely identifying the individual as [*Assignment: organization-defined characteristic identifying individual status*].

Supplemental Guidance: Characteristics identifying the status of individuals include, for example, contractors and foreign nationals. Related control: AT-2.

(5) *IDENTIFIER MANAGEMENT | DYNAMIC MANAGEMENT*

The information system dynamically manages identifiers.

Supplemental Guidance: In contrast to conventional approaches to identification which presume static accounts for preregistered users, many distributed information systems including, for example, service-oriented architectures, rely on establishing identities at run time for entities that were previously unknown. In these situations, organizations anticipate and provision for the dynamic establishment of identities. Pre-established trust relationships and mechanisms with appropriate authorities to validate identities and related credentials are essential. Related control: AC-16.

(6) *IDENTIFIER MANAGEMENT | CROSS-ORGANIZATION MANAGEMENT*

The organization coordinates with [*Assignment: organization-defined external organizations*] for cross-organization management of identifiers.

Supplemental Guidance: Cross-organization identifier management provides the capability for organizations to appropriately identify individuals, groups, roles, or devices when conducting cross-organization activities involving the processing, storage, or transmission of information.

References: FIPS Publication 201; NIST Special Publications 800-73, 800-76, 800-78.

Priority and Baseline Allocation:

P1	**LOW** IA-4	**MOD** IA-4	**HIGH** IA-4

IA-5 AUTHENTICATOR MANAGEMENT

Control: The organization manages information system authenticators by:

a. Verifying, as part of the initial authenticator distribution, the identity of the individual, group, role, or device receiving the authenticator;

b. Establishing initial authenticator content for authenticators defined by the organization;

c. Ensuring that authenticators have sufficient strength of mechanism for their intended use;

d. Establishing and implementing administrative procedures for initial authenticator distribution, for lost/compromised or damaged authenticators, and for revoking authenticators;

e. Changing default content of authenticators upon information system installation;

f. Establishing minimum and maximum lifetime restrictions and reuse conditions for authenticators (if appropriate);

g. Changing/refreshing authenticators [*Assignment: organization-defined time period by authenticator type*];

h. Protecting authenticator content from unauthorized disclosure and modification;

i. Requiring individuals to take, and having devices implement, specific security safeguards to protect authenticators; and

j. Changing authenticators for group/role accounts when membership to those accounts changes.

Supplemental Guidance: Individual authenticators include, for example, passwords, tokens, biometrics, PKI certificates, and key cards. Initial authenticator content is the actual content (e.g., the initial password) as opposed to requirements about authenticator content (e.g., minimum

password length). In many cases, developers ship information system components with factory default authentication credentials to allow for initial installation and configuration. Default authentication credentials are often well known, easily discoverable, and present a significant security risk. The requirement to protect individual authenticators may be implemented via control PL-4 or PS-6 for authenticators in the possession of individuals and by controls AC-3, AC-6, and SC-28 for authenticators stored within organizational information systems (e.g., passwords stored in hashed or encrypted formats, files containing encrypted or hashed passwords accessible with administrator privileges). Information systems support individual authenticator management by organization-defined settings and restrictions for various authenticator characteristics including, for example, minimum password length, password composition, validation time window for time synchronous one time tokens, and number of allowed rejections during verification stage of biometric authentication. Specific actions to safeguard authenticators include, for example, maintaining possession of individual authenticators, not loaning or sharing authenticators with others, and reporting lost or compromised authenticators immediately. Authenticator management includes issuing and revoking, when no longer needed, authenticators for temporary access such as that required for remote maintenance. Device authenticators include, for example, certificates and passwords. Related controls: AC-2, AC-3, AC-6, CM-6, IA-2, IA-4, IA-8, PL-4, PS-5, PS-6, SC-12, SC-13, SC-17, SC-28.

Control Enhancements:

(1) *AUTHENTICATOR MANAGEMENT | PASSWORD-BASED AUTHENTICATION*

The information system, for password-based authentication:

(a) Enforces minimum password complexity of [*Assignment: organization-defined requirements for case sensitivity, number of characters, mix of upper-case letters, lower-case letters, numbers, and special characters, including minimum requirements for each type*];

(b) Enforces at least [*Assignment: organization-defined number of changed characters*] when new passwords are created;

(c) Stores and transmits only encrypted representations of passwords;

(d) Enforces password minimum and maximum lifetime restrictions of [Assignment: organization-defined numbers for lifetime minimum, lifetime maximum]; and

(e) Prohibits password reuse for [Assignment: organization-defined number] generations.

Supplemental Guidance: This control enhancement applies to single factor authentication of individuals using passwords and in a similar manner, when passwords are part of multifactor authenticators. This control enhancement typically does *not* apply when passwords are used to unlock hardware authenticators. The implementation of such password mechanisms may not meet all of the requirements in the enhancement. Encrypted representations of passwords include, for example, encrypted versions of passwords and one-way cryptographic hashes of passwords. Related control: IA-6.

(2) *AUTHENTICATOR MANAGEMENT | PKI-BASED AUTHENTICATION*

The information system, for PKI-based authentication:

(a) Validates certificates by constructing a certification path with status information to an accepted trust anchor;

(b) Enforces authorized access to the corresponding private key; and

(c) Maps the authenticated identity to the account of the individual.

Supplemental Guidance: Status information for certification paths includes, for example, certificate revocation lists or certificate status protocol responses. Related control: IA-6.

(3) *AUTHENTICATOR MANAGEMENT | IN PERSON REGISTRATION*

The organization requires that the registration process to receive [*Assignment: organization-defined types of and/or specific authenticators*] be carried out in person before [*Assignment: organization-defined registration authority*] with authorization by *[Assignment: organization-defined personnel*].

(4) *AUTHENTICATOR MANAGEMENT | AUTOMATED TOOLS FOR STRENGTH DETERMINATION*

The organization employs automated tools to determine if authenticators are sufficiently strong to resist attacks intended to discover or otherwise compromise the authenticators.

Supplemental Guidance: Related controls: CA-2, CA-7, RA-5.

(5) *AUTHENTICATOR MANAGEMENT | CHANGE AUTHENTICATORS PRIOR TO DELIVERY*

The organization requires developers of information system components to provide unique authenticators or change default authenticators prior to delivery.

Supplemental Guidance: This control enhancement extends the requirement for organizations to change default authenticators upon information system installation, by requiring developers to provide unique authenticators or change default authenticators for system components prior to delivery. Developers assign unique authenticators to specific information system components (i.e., delivered information technology products) with distinct serial numbers. Requirements for unique authenticators can be included in acquisition documents prepared by organizations when procuring information systems or information system components. Related control: CM-6.

(6) *AUTHENTICATOR MANAGEMENT | PROTECTION OF AUTHENTICATORS*

The organization protects authenticators commensurate with the security category of the information to which use of the authenticator permits access.

Supplemental Guidance: For information systems containing multiple security categories of information without reliable physical or logical separation between categories, authenticators used to grant access to the systems are protected commensurate with the highest security category of information on the systems.

(7) *AUTHENTICATOR MANAGEMENT | NO EMBEDDED UNENCRYPTED STATIC AUTHENTICATORS*

The organization ensures that unencrypted static authenticators are not embedded in applications or access scripts or stored on function keys.

Supplemental Guidance: Organizations exercise caution in determining whether embedded or stored authenticators are in encrypted or unencrypted form. If authenticators are used in the manner stored, then those representations are considered unencrypted authenticators. This is irrespective of whether that representation is perhaps an encrypted version of something else (e.g., a password).

(8) *AUTHENTICATOR MANAGEMENT | MULTIPLE INFORMATION SYSTEM ACCOUNTS*

The organization implements [*Assignment: organization-defined security safeguards*] to manage the risk of compromise due to individuals having accounts on multiple information systems.

Supplemental Guidance: When individuals have accounts on multiple information systems, there is the risk that the compromise of one account may lead to the compromise of other accounts if individuals use the same authenticators. Possible alternatives include, for example: (i) having different authenticators on all systems; (ii) employing some form of single sign-on mechanism; or (iii) including some form of one-time passwords on all systems.

(9) *AUTHENTICATOR MANAGEMENT | CROSS-ORGANIZATION MANAGEMENT*

The organization coordinates with [*Assignment: organization-defined external organizations*] for cross-organization management of authenticators.

Supplemental Guidance: Cross-organization authenticator management provides the capability for organizations to appropriately authenticate individuals, groups, roles, or devices when conducting cross-organization activities involving the processing, storage, or transmission of information.

(10) *AUTHENTICATOR MANAGEMENT | DYNAMIC AUTHENTICATOR ASSOCIATION*

The information system dynamically associates authenticators with identifiers.

Supplemental Guidance: In contrast to conventional approaches to identification which presume static accounts for preregistered users, many distributed information systems including, for example, service-oriented architectures, rely on establishing identities at run time for entities that were previously unknown. In these situations, organizations anticipate and provision for the dynamic association of authenticators with identities. Pre-established trust relationships and mechanisms with appropriate authorities to validate identities and related credentials are essential.

(11) *AUTHENTICATOR MANAGEMENT | HARDWARE TOKEN-BASED AUTHENTICATION*

The information system, for token-based authentication, employs mechanisms that satisfy [*Assignment: organization-defined token quality requirements*].

Supplemental Guidance: Hardware token-based authentication typically refers to the use of PKI-based tokens, such as the US Government Personal Identity Verification (PIV) card. Organizations define specific requirements for tokens, such as working with a particular PKI.

(12) *AUTHENTICATOR MANAGEMENT | BIOMETRIC AUTHENTICATION*

The information system, for biometric-based authentication, employs mechanisms that satisfy [*Assignment: organization-defined biometric quality requirements*].

References: OMB Memorandum 04-04; FIPS Publication 201; NIST Special Publications 800-73, 800-63, 800-76, 800-78.

Priority and Baseline Allocation:

P1	**LOW** IA-5 (1)	**MOD** IA-5 (1) (2) (3)	**HIGH** IA-5 (1) (2) (3)

IA-6 AUTHENTICATOR FEEDBACK

Control: The information system obscures feedback of authentication information during the authentication process to protect the information from possible exploitation/use by unauthorized individuals.

Supplemental Guidance: The feedback from information systems does not provide information that would allow unauthorized individuals to compromise authentication mechanisms. Obscuring the feedback of authentication information includes, for example, displaying asterisks when users types passwords into input devices. Related control: PE-18.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** IA-6	**MOD** IA-6	**HIGH** IA-6

IA-7 CRYPTOGRAPHIC MODULE AUTHENTICATION

Control: The information system implements mechanisms for authentication to a cryptographic module that meet the requirements of applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance for such authentication.

Supplemental Guidance: This control reinforces the requirements for organizational information systems implementing cryptographic protections using cryptographic modules. If cryptography is required, information systems are required to authenticate to the associated cryptographic modules implementing the cryptography. Related controls: SC-12, SC-13.

Control Enhancements: None.

References: FIPS Publication 140-2; Web: CSRC.NIST.GOV/CRYPTVAL.

Priority and Baseline Allocation:

P1	**LOW** IA-7	**MOD** IA-7	**HIGH** IA-7

IA-8 IDENTIFICATION AND AUTHENTICATION (NON-ORGANIZATIONAL USERS)

Control: The information system uniquely identifies and authenticates non-organizational users (or processes acting on behalf of non-organizational users).

Supplemental Guidance: Non-organizational users include information system users other than organizational users explicitly covered by IA-2. These individuals are uniquely identified and authenticated for accesses other than those accesses explicitly identified and documented in AC-14. In accordance with the E-Authentication E-Government initiative, authentication of non-organizational users accessing federal information systems may be required to protect federal, proprietary, or privacy-related information (with exceptions noted for national security systems). Organizations use risk assessments to determine authentication needs and consider scalability, practicality, and security in balancing the need to ensure ease of use for access to federal information and information systems with the need to protect and adequately mitigate risk. IA-2 addresses identification and authentication requirements for access to information systems by organizational users. Related controls: AC-2, AC-14, AC-17, AC-18, IA-2, IA-4, IA-5, MA-4, RA-3, SA-12, SC-9.

Control Enhancements: None.

References: OMB Memorandum 04-04; Web: WWW.CIO.GOV/EAUTHENTICATION; NIST Special Publication 800-63.

Priority and Baseline Allocation:

P1	**LOW** IA-8	**MOD** IA-8	**HIGH** IA-8

IA-9 SERVICE IDENTIFICATION AND AUTHENTICATION

Control: The organization identifies and authenticates [*Assignment: organization-defined information system services*] using [*Assignment: organization-defined security safeguards*].

Supplemental Guidance: This control supports service-oriented architectures and other distributed, architectural approaches requiring the identification and authentication of information system services. In such architectures, external services often appear dynamically. Therefore, information systems should be able to determine in a dynamic manner, if external providers and associated services are authentic. Safeguards implemented by organizational information systems to validate provider and service authenticity include, for example, information or code signing, provenance graphs, and/or electronic signatures indicating or including the sources of services.

Control Enhancements:

(1) *SERVICE IDENTIFICATION AND AUTHENTICATION | INFORMATION EXCHANGE*

The organization ensures that service providers receive, validate, and transmit identification and authentication information.

(2) *SERVICE IDENTIFICATION AND AUTHENTICATION | TRANSMISSION OF DECISIONS*

The organization ensures that identification and authentication decisions are transmitted between [*Assignment: organization-defined services*] consistent with organizational policies.

Supplemental Guidance: For distributed architectures (e.g., service-oriented architectures), the decisions regarding the validation of identification and authentication claims may be made by services separate from the services acting on those decisions. In such situations, it is necessary to provide the identification and authentication decisions (as opposed to the actual identifiers and authenticators) to the services that need to act on those decisions. Related controls: SC-8, SC-9.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

IA-10 ALTERNATIVE AUTHENTICATION

Control: The organization employs [*Assignment: organization-defined alternative or supplemental authentication techniques or mechanisms*] for [*Assignment: organization-defined authentication requirements*] when the primary means of authentication is unavailable or compromised.

Supplemental Guidance: To ensure mission/business continuity, organizations implement alternative or supplemental authentication techniques or mechanisms. These techniques or mechanisms may be less effective than the primary means of authentication (e.g., not as easy to use, not as scalable, or not as secure). However, having the capability to readily employ these alternative/supplemental authentication techniques or mechanisms enhances overall mission/business continuity that might otherwise be adversely impacted if organizational operations had to be curtailed until the primary authentication means were once again available and secure. This control applies at the discretion of organizations, to the authentication of individuals, groups, roles, devices, and services. Related controls: IA-2, IA-3, IA-8, IA-10.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

IA-11 ADAPTIVE IDENTIFICATION AND AUTHENTICATION

Control: The organization requires that individuals attempting to access the system employ [*Assignment: organization-defined supplemental authentication techniques or mechanisms*] under specific [*Assignment: organization-defined circumstances or situations*].

Supplemental Guidance: Adversaries may compromise individual authentication mechanisms and subsequently attempt to impersonate legitimate users. This situation can potentially occur with any authentication mechanisms employed by organizations. To address this threat, organizations may employ specific techniques/mechanisms and establish protocols to assess suspicious behavior (e.g., individuals accessing information that they do not typically access as part of their normal duties, roles, or responsibilities, accessing greater quantities of information than the individuals would routinely access, or attempting to access information from suspicious network addresses). In these situations when certain pre-established conditions or triggers occur, information systems can require selected individuals to provide additional authentication information. Related controls: AU-6, SI-4.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

IA-12 REAUTHENTICATION

Control: The organization requires users and devices to reauthenticate when [*Assignment: organization-defined circumstances or situations requiring reauthentication*].

Supplemental Guidance: In addition to the reauthentication requirements associated with session locks, organizations may require reauthentication of individuals and/or devices in other situations including, for example: (i) when authenticators change; (ii), when roles change; (iii) when security categories of information systems change; (iv), when the execution of privileged functions occurs; or (v) periodically. Related control: AC-11.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: INCIDENT RESPONSE

IR-1 INCIDENT RESPONSE POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented incident response policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the incident response policy and associated incident response controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the IR family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-61, 800-83, 800-100.

Priority and Baseline Allocation:

P1	**LOW** IR-1	**MOD** IR-1	**HIGH** IR-1

IR-2 INCIDENT RESPONSE TRAINING

Control: The organization provides incident response training to information system users consistent with assigned roles and responsibilities:

a. Before authorizing access to the information system or performing assigned duties;

b. When required by information system changes; and

c. [*Assignment: organization-defined frequency*] thereafter.

Supplemental Guidance: Incident response training provided by organizations is linked to the assigned roles and responsibilities of organizational personnel to ensure the appropriate content and level of detail is included in such training. For example, regular users may only need to know who to call or how to recognize an incident on the information system; system administrators may require additional training on how to handle/remediate incidents; and incident responders may receive more specific training on forensics, reporting, system recovery, and restoration. Incident response training includes user training in the identification and reporting of suspicious activities, both from external and internal sources. Related controls: AT-3, CP-3, IR-8.

Control Enhancements:

(1) *INCIDENT RESPONSE TRAINING | SIMULATED EVENTS*

The organization incorporates simulated events into incident response training to facilitate effective response by personnel in crisis situations.

(2) *INCIDENT RESPONSE TRAINING | AUTOMATED TRAINING ENVIRONMENTS*

The organization employs automated mechanisms to provide a more thorough and realistic training environment.

References: NIST Special Publications 800-16, 800-50.

Priority and Baseline Allocation:

P2	**LOW** IR-2	**MOD** IR-2	**HIGH** IR-2 (1) (2)

IR-3 INCIDENT RESPONSE TESTING

Control: The organization tests the incident response capability for the information system [*Assignment: organization-defined frequency*] using [*Assignment: organization-defined tests*] to determine the incident response effectiveness and documents the results.

Supplemental Guidance: Organizations test incident response capabilities to determine the overall effectiveness of the capabilities and to identify potential weaknesses or deficiencies. Incident response testing includes, for example, the use of checklists, walk-through or tabletop exercises, simulations (parallel/full interrupt), and comprehensive exercises. Incident response testing can also include a determination of the effects on organizational operations (e.g., reduction in mission capabilities), organizational assets, and individuals due to incident response. Related controls: CP-4, IR-8.

Control Enhancements:

(1) *INCIDENT RESPONSE TESTING | AUTOMATED TESTING*

The organization employs automated mechanisms to more thoroughly and effectively test the incident response capability.

Supplemental Guidance: Organizations use automated mechanisms to more thoroughly and effectively test incident response capabilities for example: (i) by providing more complete coverage of incident response issues; (ii) by selecting more realistic test scenarios and test environments; and (iii) by stressing the response capability. Related control: AT-2.

(2) *INCIDENT RESPONSE TESTING | COORDINATION WITH RELATED PLANS*

The organization coordinates incident response testing with organizational elements responsible for related plans.

Supplemental Guidance: Organizational plans related to incident response testing include, for example, Business Continuity Plans, Contingency Plans, Disaster Recovery Plans, Continuity of Operations Plans, Crisis Communications Plans, Critical Infrastructure Plans, and Occupant Emergency Plans.

References: NIST Special Publications 800-84, 800-115.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** IR-3 (2)	**HIGH** IR-3 (1) (2)

IR-4 INCIDENT HANDLING

Control: The organization:

a. Implements an incident handling capability for security incidents that includes preparation, detection and analysis, containment, eradication, and recovery;

b. Coordinates incident handling activities with contingency planning activities; and

c. Incorporates lessons learned from ongoing incident handling activities into incident response procedures, training, and testing/exercises, and implements the resulting changes accordingly.

Supplemental Guidance: Organizations recognize that incident response capability is dependent on the capabilities of organizational information systems and the mission/business processes being supported by those systems. Therefore, organizations consider incident response as part of the

definition, design, and development of mission/business processes and information systems. Incident-related information can be obtained from a variety of sources including, for example, audit monitoring, network monitoring, physical access monitoring, user/administrator reports, and reported supply chain events. Effective incident handling capability includes coordination among many organizational entities including for example, mission/business owners, information system owners, authorizing officials, human resources offices, physical and personnel security offices, legal departments, operations personnel, procurement offices, and the risk executive (function). Related controls: AU-6, CM-6, CP-2, CP-4, IR-2, IR-3, IR-8, PE-6, SC-5, SC-7, SI-3, SI-4, SI-7.

Control Enhancements:

(1) *INCIDENT HANDLING | AUTOMATED INCIDENT HANDLING PROCESSES*

The organization employs automated mechanisms to support the incident handling process.

Supplemental Guidance: Automated mechanisms supporting incident handling processes include, for example, online incident management systems.

(2) *INCIDENT HANDLING | DYNAMIC RECONFIGURATION*

The organization includes dynamic reconfiguration of [*Assignment: organization-defined information system components*] as part of the incident response capability.

Supplemental Guidance: Dynamic reconfiguration includes, for example, changes to router rules, access control lists, intrusion detection/prevention system parameters, and filter rules for firewalls and gateways. Organizations perform dynamic reconfiguration of information systems, for example, to stop attacks, to misdirect attackers, and to isolate portions systems, thus limiting the extent of the damage from breaches or compromises. Organizations include timeframes for achieving the reconfiguration of information systems in the definition of the reconfiguration capability, considering the potential need for rapid response in order to effectively address sophisticated cyber threats. Related controls: AC-2, AC-4, AC-16, CM-2, CM-3, CM-4.

(3) *INCIDENT HANDLING | CONTINUITY OF OPERATIONS*

The organization identifies [*Assignment: organization-defined classes of incidents*] and [*Assignment: organization-defined actions to take in response to classes of incidents*] to ensure continuation of organizational missions and business functions.

Supplemental Guidance: Classes of incidents include, for example, malfunctions due to design/implementation errors and omissions, targeted malicious attacks, and untargeted malicious attacks. Appropriate incident response actions include, for example, graceful degradation, information system shutdown, fall back to manual mode/alternative technology whereby the system operates differently, employing deceptive measures, alternate information flows, or operating in a mode that is reserved solely for when systems are under attack.

(4) *INCIDENT HANDLING | INFORMATION CORRELATION*

The organization correlates incident information and individual incident responses to achieve an organization-wide perspective on incident awareness and response.

(5) *INCIDENT HANDLING | AUTOMATIC DISABLING OF INFORMATION SYSTEM*

The organization implements a configurable capability to automatically disable the information system if [*Assignment: organization-defined security violations*] are detected.

(6) *INCIDENT HANDLING | INSIDER THREATS - SPECIFIC CAPABILITIES*

The organization implements incident handling capability for insider threats.

Supplemental Guidance: While many organizations address insider threat incidents as an inherent part of their organizational incident response capability, this control enhancement provides additional emphasis on this type of threat and the need for specific incident handling capabilities (as defined within organizations) to provide appropriate and timely responses.

(7) *INCIDENT HANDLING | INSIDER THREATS - INTRA-ORGANIZATION COORDINATION*

The organization coordinates incident handling capability for insider threats across [*Assignment: organization-defined components or elements of the organization*].

Supplemental Guidance: Incident handling for insider threat incidents (including preparation, detection and analysis, containment, eradication, and recovery) requires close coordination among a variety of organizational components or elements to be effective. These components

or elements include, for example, mission/business owners, information system owners, human resources offices, procurement offices, personnel/physical security offices, operations personnel, and risk executive (function). In addition, organizations may require external support from federal, state, and local law enforcement agencies.

(8) *INCIDENT HANDLING | CORRELATION WITH EXTERNAL ORGANIZATIONS*

The organization coordinates with [*Assignment: organization-defined external organizations*] to correlate and share [*Assignment: organization-defined incident information*] to achieve a cross-organization perspective on incident awareness and more effective incident responses.

Supplemental Guidance: The coordination of incident information with external providers including, for example, mission/business partners, customers, and suppliers, can provide significant benefits. Cross-organizational coordination with respect to incident handling can serve as an important risk management capability that allows organizations to leverage critical information from a variety of sources to effectively respond to information security-related incidents potentially affecting the organization's operations, assets, and individuals.

(9) *INCIDENT HANDLING | DYNAMIC RESPONSE CAPABILITY*

The organization employs [*Assignment: organization-defined dynamic response capabilities*] to effectively respond to security incidents.

Supplemental Guidance: This control enhancement addresses the deployment of replacement or new capabilities in a timely manner in response to security incidents (e.g., adversary actions during hostile cyber attacks). This includes capabilities implemented at the mission/business process level (e.g., activating alternative mission/business processes) and at the information system level. Related controls: CP-2, CP-10.

(10) *INCIDENT HANDLING | SUPPLY CHAIN COORDINATION*

The organization coordinates incident-handling activities involving supply chain events with other organizations involved in the supply chain.

Supplemental Guidance: Organizations involved in supply chain activities include, for example, system/product developers, integrators, manufacturers, packagers, assemblers, distributors, vendors, and resellers. Supply chain incidents include, for example, compromises/breaches involving information system components, information technology products, development processes or personnel, and distribution processes or warehousing facilities.

References: NIST Special Publication 800-61.

Priority and Baseline Allocation:

P1	**LOW** IR-4	**MOD** IR-4 (1)	**HIGH** IR-4 (1) (4)

IR-5 INCIDENT MONITORING

Control: The organization tracks and documents information system security incidents.

Supplemental Guidance: Documenting information system security incidents includes, for example, maintaining records about each incident, the status of the incident, and other pertinent information necessary for forensics, evaluating incident details, trends, and handling. Incident information can be obtained from a variety of sources including, for example, incident reports, incident response teams, audit monitoring, network monitoring, physical access monitoring, and user/administrator reports. Related controls: AU-6, IR-8, PE-6, SC-5, SC-7, SI-3, SI-4, SI-7.

Control Enhancements:

(1) *INCIDENT MONITORING | AUTOMATED TRACKING / DATA COLLECTION / ANALYSIS*

The organization employs automated mechanisms to assist in the tracking of security incidents and in the collection and analysis of incident information.

Supplemental Guidance: Automated mechanisms for tracking security incidents and collecting/analyzing incident information include, for example, the Einstein network

monitoring device and monitoring online Computer Incident Response Centers (CIRCs) or other electronic databases of incidents. Related controls: AU-7, IR-4.

References: NIST Special Publication 800-61.

Priority and Baseline Allocation:

P1	**LOW** IR-5	**MOD** IR-5	**HIGH** IR-5 (1)

IR-6 INCIDENT REPORTING

Control: The organization:

a. Requires personnel to report suspected security incidents to the organizational incident response capability within [*Assignment: organization-defined time-period*]; and

b. Reports security incident information to [*Assignment: organization-defined authorities*].

Supplemental Guidance: The intent of this control is to address both specific incident reporting requirements within an organization and the formal incident reporting requirements for federal agencies and their subordinate organizations. The types of security incidents reported, the content and timeliness of the reports, and the designated reporting authorities reflect applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Current federal policy requires that all federal agencies (unless specifically exempted from such requirements) report security incidents to the United States Computer Emergency Readiness Team (US-CERT) within specified time frames designated in the US-CERT Concept of Operations for Federal Cyber Security Incident Handling. Related controls: IR-4, IR-5, IR-8.

Control Enhancements:

(1) *INCIDENT REPORTING | AUTOMATED REPORTING*

The organization employs automated mechanisms to assist in the reporting of security incidents.

Supplemental Guidance: Related control: IR-7.

(2) *INCIDENT REPORTING | VULNERABILITIES RELATED TO INCIDENTS*

The organization reports information system vulnerabilities associated with reported security incidents to [*Assignment: organization-defined personnel*].

(3) *INCIDENT REPORTING | COORDINATION WITH SUPPLY CHAIN*

The organization provides security incident information to other organizations involved in the supply chain for information systems or information system components related to the incident.

Supplemental Guidance: Organizations involved in supply chain activities include, for example, system/product developers, integrators, manufacturers, packagers, assemblers, distributors, vendors, and resellers. Supply chain incidents include, for example, compromises/breaches involving information system components, information technology products, development processes or personnel, and distribution processes or warehousing facilities. Organizations determine the appropriate information to share considering the value gained from support by external organizations with the potential for harm due to sensitive information being released to outside organizations of perhaps questionable trustworthiness.

References: NIST Special Publication 800-61: Web: WWW.US-CERT.GOV.

Priority and Baseline Allocation:

P1	**LOW** IR-6	**MOD** IR-6 (1)	**HIGH** IR-6 (1)

IR-7 INCIDENT RESPONSE ASSISTANCE

Control: The organization provides an incident response support resource, integral to the organizational incident response capability, that offers advice and assistance to users of the information system for the handling and reporting of security incidents.

Supplemental Guidance: Incident response support resources provided by organizations include, for example, help desks, assistance groups, and access to forensics services, when required. Related controls: AT-2, IR-4, IR-6, IR-8.

Control Enhancements:

(1) *INCIDENT RESPONSE ASSISTANCE | AUTOMATION SUPPORT FOR AVAILABILITY OF INFORMATION / SUPPORT*

The organization employs automated mechanisms to increase the availability of incident response-related information and support.

Supplemental Guidance: Automated mechanisms can provide a push and/or pull capability for users to obtain incident response assistance. For example, individuals might have access to a website to query the assistance capability, or conversely, the assistance capability may have the ability to proactively send information to users (general distribution or targeted) as part of increasing understanding of current response capabilities and support.

(2) *INCIDENT RESPONSE ASSISTANCE | COORDINATION WITH EXTERNAL PROVIDERS*

The organization:

(a) Establishes a direct, cooperative relationship between its incident response capability and external providers of information system protection capability; and

(b) Identifies organizational incident response team members to the external providers.

Supplemental Guidance: External providers of information system protection capability include, for example, the Computer Network Defense program within the U.S. Department of Defense. External providers help to protect, monitor, analyze, detect, and respond to unauthorized activity within organizational information systems and networks.

References: None.

Priority and Baseline Allocation:

P3	**LOW** IR-7	**MOD** IR-7 (1)	**HIGH** IR-7 (1)

IR-8 INCIDENT RESPONSE PLAN

Control: The organization:

a. Develops an incident response plan that:

- Provides the organization with a roadmap for implementing its incident response capability;
- Describes the structure and organization of the incident response capability;
- Provides a high-level approach for how the incident response capability fits into the overall organization;
- Meets the unique requirements of the organization, which relate to mission, size, structure, and functions;
- Defines reportable incidents;
- Provides metrics for measuring the incident response capability within the organization.
- Defines the resources and management support needed to effectively maintain and mature an incident response capability; and
- Is reviewed and approved by [*Assignment: organization-defined personnel*];

b. Distributes copies of the incident response plan to [*Assignment: organization-defined incident response personnel (identified by name and/or by role) and organizational elements*];

c. Reviews the incident response plan [*Assignment: organization-defined frequency*];

d. Revises the incident response plan to address system/organizational changes or problems encountered during plan implementation, execution, or testing; and

e. Communicates incident response plan changes to [*Assignment: organization-defined incident response personnel (identified by name and/or by role) and organizational elements*].

Supplemental Guidance: It is important that organizations develop and implement a coordinated approach to incident response. Organizational missions, business functions, strategies, goals, and objectives for incident response help determine the structure of incident response capabilities. As part of a comprehensive incident response capability, organizations consider the coordination and sharing of information with external organizations, including, for example, external service providers and organizations involved in the supply chain for organizational information systems.

Control Enhancements: None.

References: NIST Special Publication 800-61.

Priority and Baseline Allocation:

P1	**LOW** IR-8	**MOD** IR-8	**HIGH** IR-8

IR-9 INFORMATION SPILLAGE RESPONSE

Control: The organization responds to information spills by:

a. Identifying the specific information causing the information system contamination;

b. Alerting [*Assignment: organization-defined personnel*] of the information spill using a secure method of communication;

c. Isolating the contaminated information system;

d. Eradicating the information from the contaminated information system;

e. Identifying other information systems that may have been subsequently contaminated; and

f. Performing other [*Assignment: organization-defined actions*].

Supplemental Guidance: Information spillage refers to instances where sensitive information (e.g., classified information, export-controlled information) is inadvertently placed on information systems that are not authorized to process such information. Such information spills often occur when information that is initially thought to be of lower sensitivity is transmitted to an information system and then is subsequently determined to be of higher sensitivity. At that point, corrective action is required. The nature of the organizational response is generally based upon the degree of sensitivity of the spilled information (e.g., security category or classification level), the security capabilities of the information system, the specific nature of contaminated storage media, and the access authorizations (e.g., security clearances) of individuals with authorized access to the contaminated system.

Control Enhancements:

(1) *INFORMATION SPILLAGE RESPONSE | RESPONSIBLE PERSONNEL*

The organization identifies [*Assignment: organization-defined personnel*] with responsibility for responding to information spills.

(2) *INFORMATION SPILLAGE RESPONSE | TRAINING*

The organization provides information spillage response training [*Assignment: organization-defined frequency*].

(3) *INFORMATION SPILLAGE RESPONSE | POST-SPILL OPERATIONS*

The organization implements [*Assignment: organization-defined procedures*] to ensure that organizational personnel impacted by information spills can continue to carry out assigned tasks while contaminated systems are undergoing corrective actions.

Supplemental Guidance: Correction actions for information systems contaminated due to information spillages may be very time consuming. During those periods, personnel may not have access to the contaminated systems, which may potentially affect their ability to conduct organizational business.

(4) *INFORMATION SPILLAGE RESPONSE | EXPOSURE TO UNAUTHORIZED PERSONNEL*

The organization employs [*Assignment: organization-defined security safeguards*] for personnel exposed to information not within assigned access authorizations.

Supplemental Guidance: Security safeguards include, for example, making personnel exposed to spilled information aware of the federal laws, directives, policies, and/or regulations regarding the information and the restrictions imposed based on exposure to such information.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: MAINTENANCE

MA-1 SYSTEM MAINTENANCE POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented information system maintenance policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the information system maintenance policy and associated system maintenance controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the MA family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** MA-1	**MOD** MA-1	**HIGH** MA-1

MA-2 CONTROLLED MAINTENANCE

Control: The organization:

a. Schedules, performs, documents, and reviews records of, maintenance and repairs on information system components in accordance with manufacturer or vendor specifications and/or organizational requirements;

b. Approves and monitors all maintenance activities, whether performed on site or remotely and whether the equipment is serviced on site or removed to another location;

c. Requires that [*Assignment: organization-defined personnel*] explicitly approve the removal of the information system or system components from organizational facilities for off-site maintenance or repairs;

d. Sanitizes equipment to remove all information from associated media prior to removal from organizational facilities for off-site maintenance or repairs;

e. Checks all potentially impacted security controls to verify that the controls are still functioning properly following maintenance or repair actions; and

f. Includes [*Assignment: organization-defined maintenance-related information*] in organizational maintenance records.

Supplemental Guidance: This control addresses the information security aspects of the information system maintenance program and applies to all types of maintenance to any system component (including applications) conducted by any local or non-local entity (e.g., in-contract, warranty, in-house, software maintenance agreement). System maintenance also includes those components not directly associated with information processing and/or data/information retention such as scanners,

copiers, and printers. Information necessary for creating effective maintenance records includes, for example: (i) date and time of maintenance; (ii) name of individuals or group performing the maintenance; (iii) name of escort, if necessary; (iv) a description of the maintenance performed; and (v) information system components/equipment removed or replaced (including identification numbers, if applicable). The level of detail included in maintenance records can be informed by the security categories of organizational information systems. Organizations consider supply chain issues associated with replacement components for information systems. Related controls: CM-3, CM-4, MA-4, MP-6, PE-16, SA-12, SI-2.

Control Enhancements:

(1) *CONTROLLED MAINTENANCE | RECORD CONTENT*

[Withdrawn: Incorporated into MA-2]**.**

(2) *CONTROLLED MAINTENANCE | AUTOMATED MAINTENANCE ACTIVITIES*

The organization:

(a) Employs automated mechanisms to schedule, conduct, and document maintenance and repairs as required; and

(b) Produces up-to date, accurate, complete, and available records of all maintenance and repair actions, needed, in process, and completed.

Supplemental Guidance: Related controls: CA-7, MA-3.

References: None.

Priority and Baseline Allocation:

P2	**LOW** MA-2	**MOD** MA-2	**HIGH** MA-2 (2)

MA-3 MAINTENANCE TOOLS

Control: The organization approves, controls, and monitors information system maintenance tools.

Supplemental Guidance: This control addresses security-related issues associated with maintenance tools used specifically for diagnostic and repair actions on organizational information systems. Maintenance tools can include hardware, software, and firmware items. Maintenance tools can include, for example, hardware/software diagnostic test equipment and hardware/software packet sniffers. This control does not cover hardware/software components that may support information system maintenance, yet are a part of the system, for example, the software implementing "ping," "ls," "ipconfig," or the hardware and software implementing the monitoring port of an Ethernet switch. Related controls: MA-2, MA-5, MP-6.

Control Enhancements:

(1) *MAINTENANCE TOOLS | INSPECT TOOLS*

The organization inspects all maintenance tools carried into a facility by maintenance personnel for obvious improper modifications.

Supplemental Guidance: Related control: SI-7.

(2) *MAINTENANCE TOOLS | INSPECT MEDIA*

The organization checks all media containing diagnostic and test programs for malicious code before the media are used in the information system.

Supplemental Guidance: Related control: SI-3.

(3) *MAINTENANCE TOOLS | PREVENT UNAUTHORIZED REMOVAL*

The organization prevents the unauthorized removal of maintenance equipment containing organizational information by:

(a) Verifying that there is no organizational information contained on the equipment;

(b) Sanitizing or destroying the equipment;

(c) Retaining the equipment within the facility; or

(d) Obtaining an exemption from [*Assignment: organization-defined personnel*] explicitly authorizing removal of the equipment from the facility.

Supplemental Guidance: Organizational information includes all information specifically owned by organizations and information provided to organizations in which organizations serve as information stewards.

(4) *MAINTENANCE TOOLS | AUTOMATED RESTRICTED TOOL USE*

The organization employs automated mechanisms to restrict the use of maintenance tools to authorized personnel only.

Supplemental Guidance: Related controls: AC-2, AC-3, AC-5, AC-6.

References: NIST Special Publication 800-88.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** MA-3 (1) (2)	**HIGH** MA-3 (1) (2) (3)

MA-4 NON-LOCAL MAINTENANCE

Control: The organization:

a. Approves and monitors non-local maintenance and diagnostic activities;

b. Allows the use of non-local maintenance and diagnostic tools only as consistent with organizational policy and documented in the security plan for the information system;

c. Employs strong authenticators in the establishment of non-local maintenance and diagnostic sessions;

d. Maintains records for non-local maintenance and diagnostic activities; and

e. Terminates all sessions and network connections when non-local maintenance is completed.

Supplemental Guidance: Non-local maintenance and diagnostic activities are those activities conducted by individuals communicating through a network; either an external network (e.g., the Internet) or an internal network. Local maintenance and diagnostic activities are those activities carried out by individuals physically present at the information system or information system component and not communicating across a network connection. Authentication techniques used in the establishment of non-local maintenance and diagnostic sessions reflect the network access requirements in IA-2. Typically, strong authentication requires authenticators that are resistant to replay attacks and employ multifactor authentication. Strong authenticators include, for example, PKI where certificates are stored on a token protected by a password, passphrase, or biometric. Enforcing requirements in MA-4 is accomplished in part, by other controls. Related controls: AC-2, AC-3, AC-6, AC-17, AU-2, AU-3, IA-2, IA-4, IA-5, IA-8, MA-2, MA-5, MP-6, PL-2, SC-7, SC-10, SC-17.

Control Enhancements:

(1) *NON-LOCAL MAINTENANCE | AUDITING AND REVIEW*

The organization audits non-local maintenance and diagnostic sessions and reviews the maintenance records of the sessions.

Supplemental Guidance: Related controls: AU-6, AU-12.

(2) *NON-LOCAL MAINTENANCE | DOCUMENT NON-LOCAL MAINTENANCE*

The organization documents, in the security plan for the information system, the installation and use of non-local maintenance and diagnostic connections.

(3) *NON-LOCAL MAINTENANCE | COMPARABLE SECURITY / SANITIZATION*

The organization:

(a) Requires that non-local maintenance and diagnostic services be performed from an information system that implements a security capability comparable to the capability implemented on the system being serviced; or

(b) Removes the component to be serviced from the information system and prior to non-local maintenance or diagnostic services, sanitizes the component (with regard to organizational information) before removal from organizational facilities, and after the service is performed, inspects and sanitizes the component (with regard to potentially malicious software) before reconnecting the component to the information system.

Supplemental Guidance: Comparable security capability on information systems, diagnostic tools, and equipment providing maintenance services implies that the implemented security controls on those systems, tools, and equipment are at least as comprehensive as the controls on the information system being serviced. Related controls: MA-3, SA-12, SI-3, SI-7.

(4) *NON-LOCAL MAINTENANCE | AUTHENTICATION / SEPARATION OF MAINTENANCE SESSIONS*

The organization protects non-local maintenance sessions by:

(a) Employing [*Assignment: organization-defined authenticators that are replay resistant*]; and

(b) Separating the maintenance sessions from other network sessions with the information system by either:

- Physically separated communications paths; or

- Logically separated communications paths based upon encryption.

Supplemental Guidance: Related control: SC-13.

(5) *NON-LOCAL MAINTENANCE | APPROVALS AND NOTIFICATIONS*

The organization:

(a) Notifies [*Assignment: organization-defined personnel*] of the date and time of planned non-local maintenance; and

(b) Approves each non-local maintenance session.

Supplemental Guidance: Notification may be performed by maintenance personnel. Approval of non-local maintenance sessions is accomplished by organizational personnel with sufficient information security and information system knowledge to determine the appropriateness of the proposed maintenance.

(6) *NON-LOCAL MAINTENANCE | CRYPTOGRAPHIC PROTECTION*

The organization employs cryptographic mechanisms to protect the integrity and confidentiality of non-local maintenance and diagnostic communications.

Supplemental Guidance: Related controls: SC-8, SC-9, SC-13.

(7) *NON-LOCAL MAINTENANCE | REMOTE DISCONNECT VERIFICATION*

The organization employs remote disconnect verification at the termination of non-local maintenance and diagnostic sessions.

Supplemental Guidance: Remote disconnect verification ensures that remote connections from non-local maintenance sessions have been terminated, and are no longer available for use. Related control: SC-13.

References: FIPS Publications 140-2, 197, 201; NIST Special Publications 800-63, 800-88; CNSS Policy 15.

Priority and Baseline Allocation:

P1	**LOW** MA-4	**MOD** MA-4 (1) (2)	**HIGH** MA-4 (1) (2) (3)

MA-5 MAINTENANCE PERSONNEL

Control: The organization:

a. Establishes a process for maintenance personnel authorization and maintains a list of authorized maintenance organizations or personnel;

b. Ensures that personnel performing maintenance on the information system or maintenance personnel in physical proximity to the system have required access authorizations; and

c. Designates organizational personnel with required access authorizations and technical competence to supervise the maintenance activities of personnel who do not possess the required access authorizations.

Supplemental Guidance: This control applies to individuals performing hardware or software maintenance on organizational information systems and to individuals whose maintenance duties place them within the physical protection perimeter of the systems. Individuals who might be located within the physical protection perimeter include, for example, physical plant maintenance personnel and janitorial staff. Technical competence of supervising individuals relates to the maintenance performed on the information systems while having required access authorizations refers to maintenance on and near the systems. Individuals not previously identified as authorized maintenance personnel, such as information technology manufacturers, vendors, and consultants, may require privileged access to organizational information systems, for example, when required to conduct maintenance activities with little or no notice. Based on organizational assessments of risk, organizations may issue temporary credentials to these individuals. Temporary credentials may be for one-time use or for very limited time periods. Related controls: AC-2, IA-8, MP-2, PE-2, PE-3, PE-4, RA-3.

Control Enhancements:

(1) *MAINTENANCE PERSONNEL | INDIVIDUALS WITHOUT APPROPRIATE ACCESS*

The organization implements procedures for the use of maintenance personnel that lack appropriate security clearances or are not U.S. citizens, that include the following requirements:

(a) Maintenance personnel who do not have needed access authorizations, clearances, or formal access approvals are escorted and supervised during the performance of maintenance and diagnostic activities on the information system by approved organizational personnel who are fully cleared, have appropriate access authorizations, and are technically qualified;

(b) Prior to initiating maintenance or diagnostic activities by personnel who do not have needed access authorizations, clearances or formal access approvals, all volatile information storage components within the information system are sanitized and all nonvolatile storage media are removed or physically disconnected from the system and secured; and

(c) In the event an information system component cannot be sanitized, the procedures contained in the security plan for the system are enforced.

Supplemental Guidance: This control enhancement denies individuals who lack appropriate security clearances (i.e., individuals who do not possess security clearances or possess security clearances at a lower level than required) or who are not U.S. citizens, visual and electronic access to any classified information, Controlled Unclassified Information (CUI), or any other sensitive information contained on organizational information systems. Procedures for the use of maintenance personnel can be documented in security plans for the information systems. Related controls: MP-6, PL-2.

(2) *MAINTENANCE PERSONNEL | SECURITY CLEARANCES FOR CLASSIFIED SYSTEMS*

The organization ensures that personnel performing maintenance and diagnostic activities on an information system processing, storing, or transmitting classified information possess security clearances and formal access approvals for at least the highest classification level and for all compartments of information on the system.

Supplemental Guidance: Related control: PS-3.

(3) *MAINTENANCE PERSONNEL | CITIZENSHIP REQUIREMENTS FOR CLASSIFIED SYSTEMS*

The organization ensures that personnel performing maintenance and diagnostic activities on an information system processing, storing, or transmitting classified information are U.S. citizens.

Supplemental Guidance: Related control: PS-3.

(4) *MAINTENANCE PERSONNEL | FOREIGN NATIONALS*

The organization ensures that:

(a) Cleared foreign nationals (i.e., foreign nationals with appropriate security clearances), are used to conduct maintenance and diagnostic activities on classified information systems only when the systems are jointly owned and operated by the United States and foreign allied governments, or owned and operated solely by foreign allied governments; and

(b) Approvals, consents, and detailed operational conditions regarding the use of foreign nationals to conduct maintenance and diagnostic activities on classified information systems are fully documented within Memoranda of Agreements.

Supplemental Guidance: Related control: PS-3.

References: None.

Priority and Baseline Allocation:

P1	**LOW** MA-5	**MOD** MA-5	**HIGH** MA-5 (1)

MA-6 TIMELY MAINTENANCE

Control: The organization obtains maintenance support and/or spare parts for [*Assignment: organization-defined security-critical information system components and/or key information technology components*] within [*Assignment: organization-defined time period*] of failure.

Supplemental Guidance: Organizations specify the information system components that result in increased risk to organizational operations and assets, individuals, other organizations, or the Nation when the security functionality provided by those components is not operational. Security-critical components include, for example, firewalls, guards, gateways, routers, intrusion detection and prevention systems, audit repositories, authentication servers, and intrusion prevention systems. Related controls: CM-8, CP-2, CP-7.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** MA-6	**HIGH** MA-6

FAMILY: MEDIA PROTECTION

MP-1 MEDIA PROTECTION POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented media protection policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the media protection policy and associated media protection controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the MP family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** MP-1	**MOD** MP-1	**HIGH** MP-1

MP-2 MEDIA ACCESS

Control: The organization restricts access to [*Assignment: organization-defined types of digital and/or non-digital media*] to [*Assignment: organization-defined authorized individuals*] using [*Assignment: organization-defined security safeguards*].

Supplemental Guidance: Information system media includes both digital and non-digital media. Digital media includes, for example, diskettes, magnetic tapes, external/removable hard drives, flash drives, compact disks, and digital video disks. Non-digital media includes, for example, paper and microfilm. For media containing information determined by organizations to be in the public domain, to be publicly releasable, or to have limited or no adverse impact on organizations or individuals if accessed by other than authorized personnel, fewer safeguards may be needed. In these situations, physical access controls may provide adequate protection. Related controls: AC-2, AC-3, AC-19, IA-2, MP-4, PE-2, PE-3, PL-2, RA-3.

Control Enhancements:

(1) *MEDIA ACCESS | AUTOMATED RESTRICTED ACCESS*

The organization employs automated mechanisms to restrict access to media storage areas and to audit access attempts and access granted.

Supplemental Guidance: This control enhancement applies primarily to media storage areas within organizations where significant volumes of media are stored and does not apply to every location where some media is stored (e.g., in individual offices). Related controls: AU-2, AU-6.

(2) *MEDIA ACCESS | CRYPTOGRAPHIC PROTECTION*

The information system employs cryptographic mechanisms to protect and restrict access to information on [*Assignment: organization-defined portable digital media*].

Supplemental Guidance: Related controls: AC-19, MP-5, SC-13.

References: FIPS Publication 199; NIST Special Publication 800-111.

Priority and Baseline Allocation:

P1	**LOW** MP-2	**MOD** MP-2 (1)	**HIGH** MP-2 (1)

MP-3 MEDIA MARKING

Control: The organization:

a. Marks, in accordance with organizational policies and procedures, information system media indicating the distribution limitations, handling caveats, and applicable security markings (if any) of the information; and

b. Exempts [*Assignment: organization-defined removable media types*] from marking as long as the exempted items remain within [*Assignment: organization-defined controlled areas*].

Supplemental Guidance: The term *security marking* refers to the application/use of human-readable security attributes. The term *security labeling* refers to the application/use of security attributes with regard to internal data structures within information systems (see AC-16). Information system media includes both digital and non-digital media. Digital media includes, for example, diskettes, magnetic tapes, external/removable hard drives, flash drives, compact disks, and digital video disks. Non-digital media includes, for example, paper and microfilm. Security marking is generally not required for media containing information determined by organizations to be in the public domain or to be publicly releasable. However, some organizations may require markings for public information indicating that the information is publicly releasable. Marking of media reflects applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Related controls: AC-16, PL-2, RA-3.

Control Enhancements: None.

References: FIPS Publication 199.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** MP-3	**HIGH** MP-3

MP-4 MEDIA STORAGE

Control: The organization:

a. Physically controls and securely stores [*Assignment: organization-defined types of digital and/or non-digital media*] within [*Assignment: organization-defined controlled areas*] using [*Assignment: organization-defined security safeguards*];

b. Protects information system media until the media are destroyed or sanitized using approved equipment, techniques, and procedures.

Supplemental Guidance: Information system media includes both digital and non-digital media. Digital media includes, for example, diskettes, magnetic tapes, external/removable hard drives, flash drives, compact disks, and digital video disks. Non-digital media includes, for example, paper and microfilm. This control also applies to mobile computing and communications devices with information storage capability (e.g., notebook computers, personal digital assistants, cellular

telephones, digital cameras, and audio recording devices). Telephone systems are considered information systems and may have the capability to store information on internal media (e.g., on voicemail systems). Since telephone systems generally do not have the security controls typically employed in other information systems, organizational personnel use caution in the types of information stored on such systems. Controlled areas are areas or spaces for which organizations provide sufficient physical and procedural safeguards to meet the requirements established for protecting information and/or information systems. For media containing information determined by organizations to be in the public domain, to be publicly releasable, or to have limited or no adverse impact on organizations or individuals if accessed by other than authorized personnel, fewer safeguards may be needed. In these situations, physical access controls provide adequate protection.

As part of a defense-in-depth strategy, organizations consider encrypting information at rest on selected storage devices. The employment of cryptography is at the discretion of the information owner/steward. Selection of appropriate cryptographic mechanisms is based on the need to protect the confidentiality and integrity of the information. The strength of mechanisms is commensurate with the security category and/or classification of the information. Related controls: AC-3, AC-19, CP-6, CP-9, MP-2, MP-7, PE-3, RA-3, SC-13.

Control Enhancements:

(1) *MEDIA STORAGE | CRYPTOGRAPHIC PROTECTION*

The organization employs cryptographic mechanisms to protect information in storage on [*Assignment: organization-defined digital media*].

Supplemental Guidance: Related control: SC-28.

(2) *MEDIA STORAGE | OFF-LINE STORAGE*

The organization removes from online storage and stores off-line in a secure location [*Assignment: organization-defined user and/or system information*].

Supplemental Guidance: Removing organizational information from online information system storage to off-line storage eliminates the possibility of individuals gaining unauthorized access to the information through a network. Therefore, organizations may choose to move information to off-line storage in lieu of protecting such information in online storage. Related control: SC-28.

References: FIPS Publication 199; NIST Special Publications 800-56, 800-57, 800-111.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** MP-4	**HIGH** MP-4

MP-5 MEDIA TRANSPORT

Control: The organization:

a. Protects and controls [*Assignment: organization-defined types of digital and/or non-digital media*] during transport outside of controlled areas using [*Assignment: organization-defined security safeguards*];

b. Maintains accountability for information system media during transport outside of controlled areas; and

c. Restricts the activities associated with transport of such media to authorized personnel.

Supplemental Guidance: Information system media includes both digital and non-digital media. Non-digital media includes, for example, diskettes, magnetic tapes, removable hard drives, flash drives, compact disks, and digital video disks. Non-digital media includes, for example, paper and microfilm. This control also applies to mobile computing and communications devices with information storage capability (e.g., notebook computers, personal digital assistants, cellular telephones, digital cameras, and audio recording devices) that are transported outside of controlled

areas. Telephone systems are considered information systems and may have the capability to store information on internal media (e.g., on voicemail systems). Since telephone systems generally do not have the security controls typically employed in other information systems, organizational personnel use caution in the types of information stored on such systems, and in particular when those systems are transported outside of controlled areas. Controlled areas are areas or spaces for which organizations provide sufficient physical/procedural safeguards to meet the requirements established for protecting information and/or information systems.

Physical and technical safeguards for media are commensurate with the security category or classification of the information residing on the media and reflect applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Safeguards to protect media during transport include, for example, locked containers and cryptography. Cryptographic mechanisms can provide confidentiality and integrity protections depending upon the mechanisms used. Activities associated with transport include the actual transport as well as those activities such as releasing media for transport and ensuring that media enters the appropriate transport processes. For the actual transport, authorized transport and courier personnel may include individuals from outside the organization (e.g., U.S. Postal Service or a commercial transport or delivery service). Maintaining accountability of media during transport includes, for example, tracking and/or obtaining explicit records of transport activities as the media moves through the transportation system to prevent and detect loss, destruction, or tampering. Organizations establish documentation requirements for activities associated with the transport of information system media in accordance with organizational assessments of risk to include the flexibility to define different record-keeping methods for the different types of media transport as part of an overall system of transport-related records. Related controls: AC-19, CP-9, MP-3, MP-4, RA-3, SC-8, SC-9, SC-13, SC-28.

Control Enhancements:

(1) *MEDIA TRANSPORT | PROTECTION OUTSIDE OF CONTROLLED AREAS*

[Withdrawn: Incorporated into MP-5].

(2) *MEDIA TRANSPORT | DOCUMENTATION OF ACTIVITIES*

[Withdrawn: Incorporated into MP-5].

(3) *MEDIA TRANSPORT | CUSTODIANS*

The organization employs an identified custodian throughout the transport of information system media outside of controlled areas.

Supplemental Guidance: Custodial responsibilities can be transferred from one individual to another as long as an unambiguous custodian is identified at all times.

(4) *MEDIA TRANSPORT | CRYPTOGRAPHIC PROTECTION*

The organization employs cryptographic mechanisms to protect the confidentiality and integrity of information stored on digital media during transport outside of controlled areas.

Supplemental Guidance: This control enhancement also applies to mobile devices. Mobile devices include portable storage media (e.g., USB memory sticks, external hard disk drives) and portable computing and communications devices with storage capability (e.g., notebook computers, personal digital assistants, cellular telephones). Related controls: MP-2, MP-4, SC-13.

References: FIPS Publication 199; NIST Special Publication 800-60.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** MP-5 (4)	**HIGH** MP-5 (3) (4)

MP-6 MEDIA SANITIZATION

Control: The organization:

a. Sanitizes [*Assignment: organization-defined digital and non-digital information system media*] prior to disposal, release out of organizational control, or release for reuse using [*Assignment: organization-defined sanitization techniques and procedures*] in accordance with applicable federal/organizational standards and policies; and

b. Employs sanitization mechanisms with the strength and integrity commensurate with the security category or classification of the information.

Supplemental Guidance: This control applies to all digital and non-digital media subject to disposal or reuse to include media found in devices such as scanners, copiers, and printers. The sanitization process removes information from information system media such that the information cannot be retrieved or reconstructed. Sanitization techniques, including clearing, purging, and destruction, prevent the disclosure of information to unauthorized individuals when such media is reused or released for disposal. Organizations determine the appropriate sanitization methods recognizing that destruction is sometimes necessary when other methods cannot be applied to media requiring sanitization. Organizations use discretion on the employment of approved sanitization techniques and procedures for media containing information deemed to be in the public domain or publicly releasable, or deemed to have no adverse impact on organizations or individuals if released for reuse or disposal. Sanitization of non-digital media includes, for example, removing a classified appendix from an otherwise unclassified document, or redacting selected sections or words from a document by obscuring the redacted sections/words in a manner equivalent in effectiveness to removing them from the document. NSA standards and policies control the sanitization process for media containing classified information. Related controls: MA-2, MA-4, RA-3, SC-4.

Control Enhancements:

(1) *MEDIA SANITIZATION | TRACKING / DOCUMENTING / VERIFYING*

The organization tracks, documents, and verifies media sanitization and disposal actions.

(2) *MEDIA SANITIZATION | EQUIPMENT TESTING*

The organization tests sanitization equipment and procedures [*Assignment: organization-defined frequency*] to verify that the intended sanitization is being achieved.

(3) *MEDIA SANITIZATION | NON-DESTRUCTIVE TECHNIQUES*

The organization applies non-destructive sanitization techniques to portable, removable storage devices prior to connecting such devices to the information system under the following circumstances: [*Assignment: organization-defined circumstances requiring sanitization of portable, removable storage devices*].

Supplemental Guidance: This control enhancement applies to information system media containing classified information, Controlled Unclassified Information (CUI), and other sensitive information. Portable, removable storage devices including, for example, flash drives and other external storage devices, can be the source of malicious code insertions into organizational information systems. Many of these devices are obtained from unknown and potentially untrustworthy sources and may contain various types of malicious code that can be readily transferred to information systems through USB ports or other entry portals. While scanning such devices is always recommended, sanitization provides additional assurance that the device is free of all malicious code to include code capable of initiating zero-day attacks. Organizations consider non-destructive sanitization of portable, removable storage devices when such devices are first purchased from the manufacturer or vendor prior to initial use or when organizations lose a positive chain of custody for the devices. Related control: SI-3.

(4) *MEDIA SANITIZATION | CONTROLLED UNCLASSIFIED INFORMATION*

[Withdrawn: Incorporated into MP-6].

(5) *MEDIA SANITIZATION | CLASSIFIED INFORMATION*

[Withdrawn: Incorporated into MP-6].

(6) *MEDIA SANITIZATION | MEDIA DESTRUCTION*

[Withdrawn: Incorporated into MP-6].

(7) *MEDIA SANITIZATION | TWO-PERSON RULE*

The organization enforces a two-person rule for the sanitization of [*Assignment: organization-defined information system media*].

Supplemental Guidance: Organizations employ a two-person rule to ensure that information system media sanitization cannot occur unless two qualified individuals carry out the task. Individuals sanitizing information system media possess sufficient skills and expertise to determine if the proposed sanitization reflects applicable federal/organizational standards, policies, and procedures. The two-person rule also helps ensure that sanitization occurs as intended, both protecting against errors and false claims of having performed the sanitization actions. Related controls: AC-3, MP-2.

References: FIPS Publication 199; NIST Special Publications 800-60, 800-88; Web: WWW.NSA.GOV/IA/GUIDANCE/MEDIA_DESTRUCTION_GUIDANCE/INDEX.SHTML.

Priority and Baseline Allocation:

P1	**LOW** MP-6	**MOD** MP-6	**HIGH** MP-6 (1) (2) (3)

MP-7 MEDIA USE

Control: The organization restricts the use of [*Assignment: organization-defined types of digital and/or non-digital media*] on [*Assignment: organization-defined information systems or system components*] using [*Assignment: organization-defined security safeguards*].

Supplemental Guidance: Information system media includes both digital and non-digital media. Digital media includes, for example, diskettes, magnetic tapes, external/removable hard drives, flash drives, compact disks, and digital video disks, Non-digital media includes, for example, paper and microfilm. This control also applies to mobile computing and communications devices with information storage capability (e.g., notebook computers, personal digital assistants, cellular telephones, digital cameras, and audio recording devices).Organizations document in policy and procedures, the media requiring restricted use, and the specific safeguards implemented to restrict use. Related control: AC-19.

Control Enhancements:

(1) *MEDIA USE | ORGANIZATIONAL RESTRICTIONS*

The organization employs [*Assignment: organization-defined restrictions*] on the use of [*Assignment: organization-defined type of removable media*] in organizational information systems.

Supplemental Guidance: Organizations can employ technical and non-technical safeguards (e.g., policies, procedures, and rules of behavior) to restrict the use of removable media. Organizations may restrict use of all removable media by techniques such as physical cages on workstations to prohibit access to removable media ports or by disabling or removing the ability to insert, read or write to removable media. Organizations may also restrict the use of removable media to only approved devices including, for example, devices provided by the organization, provided by approved organizations, and not personally owned. And finally, organizations may restrict the use of removable media based on media type, for example, prohibiting the use of writeable, removable media, and implementing this restriction by disabling or removing the capability to write to removable media. Related control: PL-4.

(2) *MEDIA USE | PROHIBITION OF USE WITHOUT OWNER*

The organization prohibits the use of removable media in organizational information systems when the media has no identifiable owner.

Supplemental Guidance: Identifiable owners (e.g., individuals, organizations, or projects) for removable media reduce the risk of using such technologies by allowing organizations to assign responsibility and accountability for addressing known vulnerabilities in the media (e.g., malicious code insertion). Related control: PL-4.

References: FIPS Publication 199; NIST Special Publication 800-111.

Priority and Baseline Allocation:

P1	**LOW** MP-7	**MOD** MP-7 (1) (2)	**HIGH** MP-7 (1) (2)

MP-8 MEDIA DOWNGRADING

Control: The organization:

a. Establishes [*Assignment: organization-defined information system media downgrading process*] that includes employing downgrading mechanisms with [*Assignment: organization-defined strength and integrity*];

b. Ensures that the information system media downgrading process is commensurate with the security category and/or classification level of the information to be removed and the access authorizations of the potential recipients of the downgraded information;

c. Identifies [*Assignment: organization-defined information system media, both digital and non-digital, requiring downgrading*]; and

d. Downgrades the identified information system media using the established process.

Supplemental Guidance: This control applies to all digital and non-digital information system media subject to release outside of the organization, whether or not the media is considered removable. The downgrading process, when applied to information system media, removes information from the media, typically by security category or classification level, such that the information cannot be retrieved or reconstructed. Downgrading of media includes redacting information to enable wider release and distribution. Downgrading of media also ensures that empty space on the media (e.g., slack space within files) is devoid of information.

Control Enhancements:

(1) *MEDIA DOWNGRADING | TRACKING / DOCUMENTING*

The organization tracks and documents media downgrading actions.

(2) *MEDIA DOWNGRADING | EQUIPMENT TESTING*

The organization tests downgrading equipment and procedures to verify correct performance [*Assignment: organization-defined frequency*].

(3) *MEDIA DOWNGRADING | CONTROLLED UNCLASSIFIED INFORMATION*

The organization downgrades information system media containing [*Assignment: organization-defined Controlled Unclassified Information (CUI)*] prior to public release in accordance with applicable federal/organizational standards and policies.

(4) *MEDIA DOWNGRADING | CLASSIFIED INFORMATION*

The organization downgrades information system media containing classified information prior to release to individuals without required access authorizations in accordance with NSA standards and policies.

Supplemental Guidance: Downgrading of classified information uses approved sanitization tools, techniques, and procedures to transfer information confirmed to be unclassified from classified information systems to unclassified media.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: PHYSICAL AND ENVIRONMENTAL PROTECTION

PE-1 PHYSICAL AND ENVIRONMENTAL PROTECTION POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented physical and environmental protection policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the physical and environmental protection policy and associated physical and environmental protection controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the PE family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** PE-1	**MOD** PE-1	**HIGH** PE-1

PE-2 PHYSICAL ACCESS AUTHORIZATIONS

Control: The organization:

a. Develops and maintains a list of individuals with authorized access to the facility where the information system resides;

b. Issues authorization credentials;

c. Reviews and approves the access list and authorization credentials [*Assignment: organization-defined frequency*]; and

d. Removes individuals from the access list when access is no longer required.

Supplemental Guidance: This control applies to organizational employees and visitors. Individuals (e.g., employees, contractors, and others) with permanent physical access authorization credentials are not considered visitors. Authorization credentials include, for example, badges, identification cards, and smart cards. Organizations determine the strength of authorization credentials needed (including level of forge-proof badges, smart cards, or identification cards) consistent with federal standards, policies, and procedures. This control only applies to areas within facilities that have not been designated as publicly accessible. Related controls: PE-3, PE-4, PS-3.

Control Enhancements:

(1) *PHYSICAL ACCESS AUTHORIZATIONS | ACCESS BY POSITION / ROLE*

The organization authorizes physical access to the facility where the information system resides based on position or role.

Supplemental Guidance: Related controls: AC-2, AC-3, AC-6.

(2) *PHYSICAL ACCESS AUTHORIZATIONS | TWO FORMS OF IDENTIFICATION*

The organization requires two forms of identification from [*Assignment: organization-defined list of acceptable forms of identification*] for visitor access to the facility where the information system resides.

Supplemental Guidance: Acceptable forms of government photo identification include, for example, passports, personal identity verification (PIV) cards, and drivers' licenses. In the case of gaining access to facilities using automated mechanisms, organizations may use personal identity verification cards, key cards, PINs, and biometrics. Related controls: IA-2, IA-4, IA-5.

(3) *PHYSICAL ACCESS AUTHORIZATIONS | RESTRICT UNESCORTED ACCESS*

The organization restricts unescorted access to the facility where the information system resides to personnel with required security clearances, formal access authorizations, and validated need for access.

Supplemental Guidance: Related controls: PS-2, PS-6.

References: None.

Priority and Baseline Allocation:

P1	**LOW** PE-2	**MOD** PE-2	**HIGH** PE-2

PE-3 PHYSICAL ACCESS CONTROL

Control: The organization:

a. Enforces physical access authorizations at designated entry/exit points to the facility where the information system resides;

b. Verifies individual access authorizations before granting access to the facility;

c. Controls ingress/egress to the facility using [*Selection (one or more):* [*Assignment: organization-defined physical access devices*]; *guards*];

d. Provides [*Assignment: organization-defined security safeguards*] to control access to areas within the facility officially designated as publicly accessible;

e. Escorts visitors and monitors visitor activity [*Assignment: organization-defined circumstances requiring visitor escorts and monitoring*];

f. Secures keys, combinations, and other physical access devices;

g. Inventories [*Assignment: organization-defined physical access devices*] every [*Assignment: organization-defined frequency*]; and

h. Changes combinations and keys [*Assignment: organization-defined frequency*] and/or when keys are lost, combinations are compromised, or individuals are transferred or terminated.

Supplemental Guidance: This control applies to organizational employees and visitors. Individuals (e.g., employees, contractors, and others) with permanent physical access authorization credentials are not considered visitors. Organizations determine the types of facility guards needed including, for example, professional physical security staff or other personnel such as administrative staff or information system users. Physical access devices include, for example, keys, locks, combinations, and card readers. Safeguards for publicly accessible areas within organizational facilities, include for example, cameras, monitoring by guards, isolating selected information systems/components in secured areas. Components of information systems (e.g., workstations, computer terminals) may be located in areas designated as publicly accessible with organizations safeguarding access to such devices. Related controls: MP-2, MP-4, PE-2, PE-4, PE-5, PS-3, RA-3.

Control Enhancements:

(1) *PHYSICAL ACCESS CONTROL | INFORMATION SYSTEM ACCESS*

The organization enforces physical access authorizations to the information system independent of the physical access controls for the facility at [*Assignment: organization-defined physical spaces containing one or more components of the information system*].

Supplemental Guidance: This control enhancement provides additional physical security for those areas within facilities where there is a concentration of information system components (e.g., server rooms, media storage areas, communications centers). Security requirements for facilities containing information systems that process, store, or transmit federal information reflect applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Related controls: PS-2, PS-3.

(2) *PHYSICAL ACCESS CONTROL | FACILITY / INFORMATION SYSTEM BOUNDARIES*

The organization performs security checks at the physical boundary of the facility or information system for unauthorized exfiltration of information or information system components.

Supplemental Guidance: Organizations determine the extent, frequency, and/or randomness of security checks to adequately mitigate risk associated with exfiltration. Related controls: AC-4, SC-7.

(3) *PHYSICAL ACCESS CONTROL | CONTINUOUS GUARDS / ALARMS / MONITORING*

The organization guards, alarms, and monitors every physical access point to the facility where the information system resides 24 hours per day, 7 days per week.

Supplemental Guidance: Related controls: CP-6, CP-7.

(4) *PHYSICAL ACCESS CONTROL | LOCKABLE CASINGS*

The organization uses lockable physical casings to protect [*Assignment: organization-defined information system components*] from unauthorized physical access.

(5) *PHYSICAL ACCESS CONTROL | TAMPER PROTECTION*

The organization employs [*Assignment: organization-defined security safeguards*] to [*Selection (one or more): detect; prevent*] physical tampering or alteration of [*Assignment: organization-defined hardware components*] within the information system.

Supplemental Guidance: Organizations may implement tamper detection/prevention at selected hardware components or tamper detection at some components and tamper prevention at other components. Tamper detection/prevention activities can employ many types of anti-tamper technologies including, for example, tamper-detection seals and anti-tamper coatings. Anti-tamper programs help to detect hardware alterations through counterfeiting and other supply chain-related risks. Related control: SA-12.

(6) *PHYSICAL ACCESS CONTROL | PENETRATION TESTING*

The organization employs a penetration testing process that includes [*Assignment: organization-defined frequency*], unannounced attempts to bypass or circumvent security controls associated with physical access points to the facility.

Supplemental Guidance: Related controls: CA-2, CA-7.

References: FIPS Publication 201; NIST Special Publications 800-73, 800-76, 800-78; ICD 704; DCID 6/9.

Priority and Baseline Allocation:

P1	**LOW** PE-3	**MOD** PE-3	**HIGH** PE-3 (1)

PE-4 ACCESS CONTROL FOR TRANSMISSION MEDIUM

Control: The organization controls physical access to [*Assignment: organization-defined information system distribution and transmission lines*] within organizational facilities using [*Assignment: organization-defined security safeguards*].

Supplemental Guidance: Physical security safeguards applied to information system distribution and transmission lines help prevent accidental damage, disruption, and physical tampering. In addition, physical safeguards may be necessary to help prevent eavesdropping or in transit modification of unencrypted transmissions. Security safeguards to control physical access to system distribution and transmission lines include, for example: (i) locked wiring closets; (ii) disconnected or locked spare jacks; and/or (iii) protection of cabling by conduit or cable trays. Related controls: MP-2, MP-4, PE-2, PE-3, PE-5, SC-7, SC-8, SC-9.

Control Enhancements: None.

References: NSTISSI No. 7003.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** PE-4	**HIGH** PE-4

PE-5 ACCESS CONTROL FOR OUTPUT DEVICES

Control: The organization controls physical access to information system output devices to prevent unauthorized individuals from obtaining the output.

Supplemental Guidance: Controlling physical access to output devices includes, for example, placing output devices in locked rooms or other secured areas and allowing access to authorized individuals only; and placing output devices in locations that can be monitored by organizational personnel. Monitors, printers, and audio devices are examples of information system output devices. Related controls: PE-2, PE-3, PE-4, PE-18.

Control Enhancements:

(1) *ACCESS CONTROL FOR OUTPUT DEVICES | AUTOMATED ACCESS CONTROL / IDENTITY LINKAGE*

The organization employs automated mechanisms to:

(a) Control access to information system output from [*Assignment: organization-defined output devices*]; and

(b) Link individual identity to receipt of the output.

Supplemental Guidance: Controlling physical access to selected output devices using automated mechanisms includes, for example, installing security functionality on printers, copiers, and facsimile machines that allows organizations to implement authentication (e.g., using a PIN or hardware token) on output devices prior to the release of output to individuals.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** PE-5	**HIGH** PE-5

PE-6 MONITORING PHYSICAL ACCESS

Control: The organization:

a. Monitors physical access to the information system to detect and respond to physical security incidents;

b. Reviews physical access logs [*Assignment: organization-defined frequency*] and, upon occurrence of [*Assignment: organization-defined events or potential indications of events*]; and

c. Coordinates results of reviews and investigations with the organizational incident response capability.

Supplemental Guidance: Organizational incident response capabilities include investigations of and responses to detected physical security incidents. Security incidents include, for example, apparent security violations or suspicious physical access activities. Suspicious physical access activities include, for example: (i) accesses outside of normal work hours; (ii) repeated accesses to areas not normally accessed; (iii) accesses for unusual lengths of time; and (iv) out-of-sequence accesses. Related controls: CA-7, IR-4, IR-8.

Control Enhancements:

(1) *MONITORING PHYSICAL ACCESS | INTRUSION ALARMS / SURVEILLANCE EQUIPMENT*

The organization monitors real-time physical intrusion alarms and surveillance equipment.

(2) *MONITORING PHYSICAL ACCESS | AUTOMATED INTRUSION RECOGNITION / RESPONSES*

The organization employs automated mechanisms to recognize [*Assignment: organization-defined classes/types of intrusions*] and initiate [*Assignment: organization-defined response actions*].

Supplemental Guidance: Related control: SI-4.

(3) *MONITORING PHYSICAL ACCESS | VIDEO SURVEILLANCE*

The organization employs video surveillance of [*Assignment: organization-defined operational areas*].

References: None.

Priority and Baseline Allocation:

P1	**LOW** PE-6	**MOD** PE-6 (1)	**HIGH** PE-6 (1) (2)

PE-7 VISITOR CONTROL

[Withdrawn: Incorporated into PE-2 and PE-3].

PE-8 VISITOR ACCESS RECORDS

Control: The organization:

a. Maintains visitor access records to the facility where the information system resides; and

b. Reviews visitor access records [*Assignment: organization-defined frequency*].

Supplemental Guidance: Visitor access records include, for example, names and organizations of persons visiting, visitor signatures, forms of identification, dates of access, entry and departure times, purposes of visits, and names and organizations of persons visited. Visitor access records are not required for publicly accessible areas.

Control Enhancements:

(1) *VISITOR ACCESS RECORDS | AUTOMATED RECORDS MAINTENANCE / REVIEW*

The organization employs automated mechanisms to facilitate the maintenance and review of visitor access records.

(2) *VISITOR ACCESS RECORDS | PHYSICAL ACCESS RECORDS*

[Withdrawn: Incorporated into PE-2].

References: None.

Priority and Baseline Allocation:

P3	**LOW** PE-8	**MOD** PE-8	**HIGH** PE-8 (1)

PE-9 POWER EQUIPMENT AND CABLING

Control: The organization protects power equipment and power cabling for the information system from damage and destruction.

Supplemental Guidance: Related control: PE-4.

Control Enhancements:

(1) *POWER EQUIPMENT AND CABLING | REDUNDANT CABLING*

The organization employs redundant power cabling paths that are physically separated by [*Assignment: organization-defined distance*].

(2) *POWER EQUIPMENT AND CABLING | AUTOMATIC VOLTAGE CONTROLS*

The organization employs automatic voltage controls for [*Assignment: organization-defined critical information system components*].

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** PE-9	**HIGH** PE-9

PE-10 EMERGENCY SHUTOFF

Control: The organization:

a. Provides the capability of shutting off power to the information system or individual system components in emergency situations;

b. Places emergency shutoff switches or devices in [*Assignment: organization-defined location by information system or system component*] to facilitate safe and easy access for personnel; and

c. Protects emergency power shutoff capability from unauthorized activation.

Supplemental Guidance: This control applies to facilities containing concentrations of information system resources including, for example, data centers, server rooms, and mainframe computer rooms. Related control: PE-15.

Control Enhancements:

(1) *EMERGENCY SHUTOFF | ACCIDENTAL / UNAUTHORIZED ACTIVATION*

[Withdrawn: Incorporated into PE-10].

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** PE-10	**HIGH** PE-10

PE-11 EMERGENCY POWER

Control: The organization provides a short-term uninterruptible power supply to facilitate [*Selection (one or more): an orderly shutdown of the information system; transition of the information system to long-term alternate power*] in the event of a primary power source loss.

Supplemental Guidance: Related controls: AT-3, CP-2, CP-7.

Control Enhancements:

(1) *EMERGENCY POWER | LONG-TERM ALTERNATE POWER SUPPLY - MINIMAL OPERATIONAL CAPABILITY*

The organization provides a long-term alternate power supply for the information system that is capable of maintaining minimally required operational capability in the event of an extended loss of the primary power source.

Supplemental Guidance: Long-term alternate power supplies for the information system can be either manually or automatically activated.

(2) *EMERGENCY POWER | LONG-TERM ALTERNATE POWER SUPPLY - SELF-CONTAINED*

The organization provides a long-term alternate power supply for the information system that is:

(a) Self-contained;

(b) Not reliant on external power generation; and

(c) Capable of maintaining [*Selection: minimally required operational capability; full operational capability*] in the event of an extended loss of the primary power source.

Supplemental Guidance: Long-term alternate power supplies for organizational information systems are either manually or automatically activated.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** PE-11	**HIGH** PE-11 (1)

PE-12 EMERGENCY LIGHTING

Control: The organization employs and maintains automatic emergency lighting for the information system that activates in the event of a power outage or disruption and that covers emergency exits and evacuation routes within the facility.

Supplemental Guidance: Related controls: CP-2, CP-7.

Control Enhancements:

(1) *EMERGENCY LIGHTING | ESSENTIAL MISSIONS / BUSINESS FUNCTIONS*

The organization provides emergency lighting for all areas within the facility supporting essential missions and business functions.

References: None.

Priority and Baseline Allocation:

P1	**LOW** PE-12	**MOD** PE-12	**HIGH** PE-12

PE-13 FIRE PROTECTION

Control: The organization employs and maintains fire suppression and detection devices/systems for the information system that are supported by an independent energy source.

Supplemental Guidance: Fire suppression and detection devices/systems include, for example, sprinkler systems, handheld fire extinguishers, fixed fire hoses, and smoke detectors.

Control Enhancements:

(1) *FIRE PROTECTION | DETECTION DEVICES / SYSTEMS*

The organization employs fire detection devices/systems for the information system that activate automatically and notify the organization and emergency responders in the event of a fire.

(2) *FIRE PROTECTION | SUPPRESSION DEVICES / SYSTEMS*

The organization employs fire suppression devices/systems for the information system that provide automatic notification of any activation to the organization and emergency responders.

(3) *FIRE PROTECTION | AUTOMATIC FIRE SUPPRESSION*

The organization employs an automatic fire suppression capability for the information system when the facility is not staffed on a continuous basis.

(4) *FIRE PROTECTION | INSPECTIONS*

The organization ensures that the facility undergoes [*Assignment: organization-defined frequency*] inspections by authorized and qualified inspectors and resolves identified deficiencies within [*Assignment: organization-defined time period*].

References: None.

Priority and Baseline Allocation:

P1	**LOW** PE-13	**MOD** PE-13 (1) (2) (3)	**HIGH** PE-13 (1) (2) (3)

PE-14 TEMPERATURE AND HUMIDITY CONTROLS

Control: The organization:

a. Maintains temperature and humidity levels within the facility where the information system resides at [*Assignment: organization-defined acceptable levels*]; and

b. Monitors temperature and humidity levels [*Assignment: organization-defined frequency*].

Supplemental Guidance: Temperature and humidity controls typically apply to facilities containing concentrations of information system resources, for example, data centers, server rooms, and mainframe computer rooms. Related control: AT-3.

Control Enhancements:

(1) *TEMPERATURE AND HUMIDITY CONTROLS | AUTOMATIC CONTROLS*

The organization employs automatic temperature and humidity controls in the facility to prevent fluctuations potentially harmful to the information system.

(2) *TEMPERATURE AND HUMIDITY CONTROLS | MONITORING WITH ALARMS / NOTIFICATIONS*

The organization employs temperature and humidity monitoring that provides an alarm or notification of changes potentially harmful to personnel or equipment.

References: None.

Priority and Baseline Allocation:

P1	**LOW** PE-14	**MOD** PE-14	**HIGH** PE-14

PE-15 WATER DAMAGE PROTECTION

Control: The organization protects the information system from damage resulting from water leakage by providing master shutoff or isolation valves that are accessible, working properly, and known to key personnel.

Supplemental Guidance: Isolation values can be employed in lieu of master shutoff values to shut off water supplies in specific areas of concern, without affecting entire organizations. Related control: AT-3.

Control Enhancements:

(1) *WATER DAMAGE PROTECTION | AUTOMATION SUPPORT*

The organization employs automated mechanisms to protect the information system from water damage.

References: None.

Priority and Baseline Allocation:

P1	**LOW** PE-15	**MOD** PE-15	**HIGH** PE-15 (1)

PE-16 DELIVERY AND REMOVAL

Control: The organization authorizes, monitors, and controls [*Assignment: organization-defined types of information system components*] entering and exiting the facility and maintains records of those items.

Supplemental Guidance: Effectively enforcing authorizations for entry and exit of information system components may require restricting access to delivery areas and possibly isolating the areas from the information system and media libraries. Related controls: CM-3, MA-2, MA-3, MP-5, SA-12.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** PE-16	**MOD** PE-16	**HIGH** PE-16

PE-17 ALTERNATE WORK SITE

Control: The organization:

a. Employs [*Assignment: organization-defined security controls*] at alternate work sites;

b. Assesses as feasible, the effectiveness of security controls at alternate work sites; and

c. Provides a means for employees to communicate with information security personnel in case of security incidents or problems.

Supplemental Guidance: Alternate work sites may include, for example, government facilities or private residences of employees. While commonly distinct from alternative processing sites, alternate work sites may provide readily available alternate locations as part of contingency operations. Organizations may define different sets of security controls for specific alternate work sites or types of sites depending on the work-related activities conducted at those sites. This control supports the contingency planning activities of organizations and the federal telework initiative. Related controls: AC-17, CP-7.

Control Enhancements: None.

References: NIST Special Publication 800-46.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** PE-17	**HIGH** PE-17

PE-18 LOCATION OF INFORMATION SYSTEM COMPONENTS

Control: The organization positions information system components within the facility to minimize potential damage from physical and environmental hazards and to minimize the opportunity for unauthorized access.

Supplemental Guidance: Physical and environmental hazards include, for example, flooding, fire, tornados, earthquakes, hurricanes, acts of terrorism, vandalism, electromagnetic pulse, electrical interference, and other forms of incoming electromagnetic radiation. In addition, organizations consider the location of physical entry points where unauthorized individuals, while not being granted access, might nonetheless be in close proximity to information systems and therefore, increase the potential for unauthorized access to organizational communications (e.g., through the use of wireless sniffers or microphones). Related controls: CP-2, PE-19, RA-3.

Control Enhancements:

(1) *LOCATION OF INFORMATION SYSTEM COMPONENTS | FACILITY SITE*

The organization plans the location or site of the facility where the information system resides with regard to physical and environmental hazards and for existing facilities, considers the physical and environmental hazards in its risk mitigation strategy.

Supplemental Guidance: Related control: PM-8.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** PE-18 (1)	**HIGH** PE-18 (1)

PE-19 INFORMATION LEAKAGE

Control: The organization protects the information system from information leakage due to electromagnetic signals emanations.

Supplemental Guidance: Security categories or classifications of information systems (with respect to confidentiality) and organizational security policies guide the selection of security controls employed to protect systems against information leakage due to electromagnetic signals emanations.

Control Enhancements:

(1) *INFORMATION LEAKAGE | NATIONAL EMISSIONS / TEMPEST POLICIES AND PROCEDURES*

The organization ensures that information system components, associated data communications, and networks are protected in accordance with national emissions and TEMPEST policies and procedures based on the security category or classification of the information.

References: FIPS Publication 199.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

PE-20 PORT AND I/O DEVICE ACCESS

Control: The organization physically disables or removes [*Assignment: organization-defined connection ports or input/output devices*] on [*Assignment: organization-defined information systems or information system components*].

Supplemental Guidance: Connection ports include, for example, Universal Serial Bus (USB) and Firewire (IEEE 1394). Input/output (I/O) devices include, for example, Compact Disk (CD) and Digital Video Disk (DVD) drives. Physically disabling or removing such connection ports and I/O devices helps prevent exfiltration of information from information systems and the introduction of malware into systems from those ports/devices.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: PLANNING

PL-1 SECURITY PLANNING POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented security planning policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the security planning policy and associated security planning controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the PL family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-18, 800-100.

Priority and Baseline Allocation:

P1	**LOW** PL-1	**MOD** PL-1	**HIGH** PL-1

PL-2 SYSTEM SECURITY PLAN

Control: The organization:

a. Develops a security plan for the information system that:

- Is consistent with the organization's enterprise architecture;
- Explicitly defines the authorization boundary for the system;
- Describes the operational context of the information system in terms of missions and business processes;
- Provides the security categorization of the information system including supporting rationale;
- Describes the operational environment for the information system;
- Describes relationships with or connections to other information systems;
- Provides an overview of the security requirements for the system;
- Describes the security controls in place or planned for meeting those requirements including a rationale for the tailoring and supplementation decisions; and
- Is reviewed and approved by the authorizing official or designated representative prior to plan implementation;

b. Distributes copies of the security plan to [*Assignment: organization-defined personnel (identified by name and/or by role) and organizational elements*];

c. Reviews the security plan for the information system [*Assignment: organization-defined frequency*];

d. Updates the plan to address changes to the information system/environment of operation or problems identified during plan implementation or security control assessments; and

e. Communicates security plan changes to [*Assignment: organization-defined personnel (identified by name and/or by role) and organizational elements*].

Supplemental Guidance: Security plans relate security requirements to a set of security controls and control enhancements. Security plans also define the intent of the security controls and control enhancements with regard to meeting those security requirements but do not provide descriptions of the specific design or implementation of the controls/enhancements. Security plans contain sufficient information (including the specification of parameter values for assignment/selection statements in security controls and control enhancements either explicitly or by reference) to enable a design and implementation that is unambiguously compliant with the intent of the plans and subsequent determinations of risk to organizational operations and assets, individuals, other organizations, and the Nation if the plan is implemented as intended. Effective security plans make extensive use of references (i.e., pointers) to policies, procedures, and additional documents (e.g., design and implementation specifications) where more detailed information is contained. This reduces the documentation requirements associated with security programs and maintains security-related information in other management and operational areas related to enterprise architecture and system development life cycle activities. For example, security plans typically do not contain detailed contingency/incident response plan information but instead provide explicitly or by reference, sufficient information in order to define what needs to be accomplished by those plans. Related controls: AC-2, AC-6, AC-14, AC-17, AC-20, CA-2, CA-3, CA-7, CM-9, CP-2, IR-8, MA-4, MA-5, PL-7, PM-1, PM-7, PM-8, PM-9, PM-11, SA-5.

Control Enhancements:

(1) *SYSTEM SECURITY PLAN | CONCEPT OF OPERATIONS*

[Withdrawn: Incorporated into PL-7].

(2) *SYSTEM SECURITY PLAN | FUNCTIONAL ARCHITECTURE*

[Withdrawn: Incorporated into PL-8].

(3) *SYSTEM SECURITY PLAN | PLAN / COORDINATE WITH OTHER ORGANIZATIONAL ENTITIES*

The organization plans and coordinates security-related activities affecting the information system before conducting such activities in order to reduce the impact on other organizational entities.

Supplemental Guidance: Security-related activities include, for example, security assessments, audits, information system hardware and software maintenance, and contingency plan testing. Advance planning and coordination includes emergency and nonemergency (i.e., planned or nonurgent unplanned) situations. Related controls: CP-4, IR-4.

References: NIST Special Publication 800-18.

Priority and Baseline Allocation:

P1	**LOW** PL-2	**MOD** PL-2 (3)	**HIGH** PL-2 (3)

PL-3 SYSTEM SECURITY PLAN UPDATE

[Withdrawn: Incorporated into PL-2].

PL-4 RULES OF BEHAVIOR

Control: The organization:

a. Establishes and makes readily available to all individuals using the information system, the rules that describe their responsibilities and expected behavior with regard to information and information system usage; and

b. Receives signed acknowledgment from users indicating that they have read, understand, and agree to abide by the rules of behavior, before authorizing access to information and the information system.

Supplemental Guidance: This control enhancement applies to organizational users. Organizational users are employees or individuals deemed to have equivalent status of employees including, for example, contractors, guest researchers, individuals detailed from other organizations, and/or individuals from allied nations. Organizations consider rules of behavior based on user roles and responsibilities, differentiating, for example, between rules that apply to privileged users and rules that apply to general users. Establishing rules of behavior for some types of non-organizational users including, for example, individuals who simply receive data/information from federal information systems, is often not feasible given the large number of such users and the limited nature of their interactions with the systems. Rules of behavior for both organizational and non-organizational users can also be established in AC-8, System Use Notification. Organizations can use electronic signatures for acknowledging rules of behavior. Related controls: AC-8, IA-2, IA-4, PS-6.

Control Enhancements:

(1) *RULES OF BEHAVIOR | SOCIAL MEDIA AND NETWORKING RESTRICTIONS*

The organization includes in the rules of behavior, explicit restrictions on the use of social media and networking sites, posting information on commercial websites, and sharing information system account information.

Supplemental Guidance: This control enhancement addresses rules of behavior related to use of social media and networking sites: (i) when using such media and sites for official duties; (ii) when organizational information is involved in the social media/networking transactions; and (iii) when accessing social media /networking sites from organizational information systems. Organizations also address specific rules that prevent the ability to obtain, or infer, non-public organizational information from such sites.

References: NIST Publication 800-18.

Priority and Baseline Allocation:

P1	**LOW** PL-4	**MOD** PL-4 (1)	**HIGH** PL-4 (1)

PL-5 PRIVACY IMPACT ASSESSMENT

[Withdrawn: Incorporated into Appendix J, AR-2].

PL-6 SECURITY-RELATED ACTIVITY PLANNING

[Withdrawn: Incorporated into PL-2].

PL-7 SECURITY CONCEPT OF OPERATIONS

Control: The organization:

a. Develops a security Concept of Operations (CONOPS) for the information system containing at a minimum, how the organization intends to operate the system from the perspective of information security; and

b. Reviews and updates the CONOPS [*Assignment: organization-defined frequency*].

Supplemental Guidance: The security CONOPS may be included in the security plan for the information system or in other system development life cycle-related documents, as appropriate. Related control: PL-2.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

PL-8 SECURITY ARCHITECTURE

Control: The organization develops an information security architecture for the information system that:

a. Describes the overall philosophy and approach to be taken with regard to protecting the confidentiality, integrity, and availability of organizational information; and

b. Describes how the security architecture is integrated into and supports the enterprise architecture.

Supplemental Guidance: This control addresses actions taken by organizations in the design and development of information systems. The information security architecture at the individual information system level is consistent with and complements the more global, organization-wide information security architecture described in PM-7 that is integral to and developed as part of the enterprise architecture. The information security architecture includes an architectural description, the placement/allocation of security functionality, security-related information for external interfaces, information being exchanged across the interfaces, and the protection mechanisms associated with each interface. Establishing, developing, documenting, and maintaining under strict configuration control, a baseline configuration for organizational information systems is critical to implementing and maintaining an effective information security architecture. The information security architecture development is coordinated with the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) to ensure that security controls needed to support privacy requirements are identified and effectively implemented. PL-8 is primarily directed at organizations (i.e., internally focused) to help ensure that organizations develop an information security architecture for the information system and that the security architecture is integrated with or tightly coupled to the enterprise architecture through the organization-wide information security architecture. In contrast, SA-17 is primarily directed at external information system or information technology product developers (although SA-17 could be used internally within organizations for in-house development). SA-17, which is complementary to PL-8, is selected when organizations outsource the development of information systems or information system components to external entities and there is a need to demonstrate/show consistency with the organization's enterprise architecture and information security architecture. Related controls: CM-2, CM-6, PM-7, SA-5, SA-17, Appendix J.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: PERSONNEL SECURITY

PS-1 PERSONNEL SECURITY POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented personnel security policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the personnel security policy and associated personnel security controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the PS family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** PS-1	**MOD** PS-1	**HIGH** PS-1

PS-2 POSITION CATEGORIZATION

Control: The organization:

a. Assigns a risk designation to all positions;

b. Establishes screening criteria for individuals filling those positions; and

c. Reviews and revises position risk designations [*Assignment: organization-defined frequency*].

Supplemental Guidance: Position risk designations reflect Office of Personnel Management policy and guidance. Position screening criteria include explicit information security role appointment requirements (e.g., training, security clearances). Related controls: AT-3, PL-2, PS-3.

Control Enhancements: None.

References: 5 C.F.R. 731.106(a).

Priority and Baseline Allocation:

P1	**LOW** PS-2	**MOD** PS-2	**HIGH** PS-2

PS-3 PERSONNEL SCREENING

Control: The organization:

a. Screens individuals prior to authorizing access to the information system; and

b. Rescreens individuals according to [*Assignment: organization-defined conditions requiring rescreening and, where re-screening is so indicated, the frequency of such rescreening*].

Supplemental Guidance: Personnel screening and rescreening activities reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, guidance, and specific criteria established for the risk designations of assigned positions. Organizations may define different rescreening conditions and frequencies for personnel accessing information systems based on types of information processed, stored, or transmitted by the systems. Related controls: AC-2, IA-4, PE-2, PS-2.

Control Enhancements:

(1) *PERSONNEL SCREENING | CLASSIFIED INFORMATION*

The organization ensures that every individual accessing an information system processing, storing, or transmitting classified information is cleared and indoctrinated to the highest classification level of the information on the system.

Supplemental Guidance: Related controls: AC-3, AC-4.

(2) *PERSONNEL SCREENING | FORMAL INDOCTRINATION*

The organization ensures that every individual accessing an information system processing, storing, or transmitting types of classified information which require formal indoctrination, is formally indoctrinated for all of the relevant types of information on the system.

Supplemental Guidance: Types of classified information requiring formal indoctrination include, for example, Special Access Program (SAP), Restricted Data (RD), and Sensitive Compartment Information (SCI). Related controls: AC-3, AC-4.

(3) *PERSONNEL SCREENING | ADDITIONAL SCREENING CRITERIA*

The organization establishes and employs [*Assignment: organization-defined additional screening criteria and processes*] for individuals who have access to [*Assignment: organization-defined information and information systems that process, store or transmit that information*].

(4) *PERSONNEL SCREENING | INFORMATION WITH SPECIAL PROTECTION MEASURES*

The organization ensures that access to information requiring special protection is granted only to individuals who:

(a) Have a valid access authorization that is demonstrated by assigned official government duties; and

(b) Satisfy associated personnel security criteria.

Supplemental Guidance: Organizational information requiring special protection includes, for example, privacy information, proprietary information, and Sources and Methods Information (SAMI). Personnel security criteria include, for example, position sensitivity background screening requirements.

References: 5 C.F.R. 731.106; FIPS Publications 199, 201; NIST Special Publications 800-73, 800-76, 800-78; ICD 704.

Priority and Baseline Allocation:

P1	**LOW** PS-3	**MOD** PS-3	**HIGH** PS-3

PS-4 PERSONNEL TERMINATION

Control: The organization, upon termination of individual employment:

a. Terminates information system access [*Assignment: organization-defined time period*] following the termination action;

b. Includes [*Assignment: organization-defined information security items*] in exit interviews;

c. Retrieves all security-related organizational information system-related property; and

d. Retains access to organizational information and information systems formerly controlled by terminated individual.

Supplemental Guidance: Information system-related property includes, for example, hardware authentication tokens, system administration technical manuals, keys, identification cards, and building passes. Exit interviews ensure that individuals understand any security constraints imposed by being former employees and that proper accountability is achieved for information system-related property. Exit interviews may not be possible for some employees (e.g., in cases related to job abandonment, illnesses, and nonavailability of supervisors). Exit interviews are important for individuals with security clearances. Timely execution of termination actions is essential for employees or contractors terminated for cause. Related controls: AC-2, IA-4, PE-2, PS-5.

Control Enhancements:

(1) *PERSONNEL TERMINATION | POST-EMPLOYMENT REQUIREMENTS*

The organization:

(a) Notifies employees of applicable, legally-binding post-employment requirements for protection of organizational information;

(b) Requires employees to sign an acknowledgment of these requirements as part of granting initial access to covered information;

(c) Requires employees to re-sign the acknowledgment [*Assignment: organization-defined frequency*]; and

(d) Requires terminated employees to re-sign the acknowledgment as part of the organizational termination process.

(2) *PERSONNEL TERMINATION | AUTOMATED NOTIFICATION*

The organization employs automated mechanisms to notify [*Assignment: organization-defined personnel, positions, and/or roles*] upon termination of an employee.

References: None.

Priority and Baseline Allocation:

P2	**LOW** PS-4	**MOD** PS-4	**HIGH** PS-4 (1) (2)

PS-5 PERSONNEL TRANSFER

Control: The organization:

a. Reviews logical and physical access authorizations to information systems/facilities when individuals are reassigned or transferred to other positions within the organization;

b. Initiates [*Assignment: organization-defined transfer or reassignment actions*] within [*Assignment: organization-defined time period following the formal transfer action*];

c. Confirms on-going operational need for current access authorizations; and

d. Modifies access authorization as needed to correspond with any changes in operational need due to reassignment or transfer.

Supplemental Guidance: This control applies when reassignments or transfers of employees are permanent or of such extended durations as to make the actions warranted. Organizations define actions appropriate for the types of reassignments or transfers, whether permanent or extended. Actions that may be required for personnel transfers or reassignments to other positions within organizations include, for example: (i) returning old and issuing new keys, identification cards, and building passes; (ii) closing information system accounts and establishing new accounts; (iii) changing information system access authorizations (i.e., privileges); and (iv) providing for access to official records to which employees had access at previous work locations and in previous information system accounts. Related controls: AC-2, IA-4, PE-2, PS-4.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P2	**LOW** PS-5	**MOD** PS-5	**HIGH** PS-5

PS-6 ACCESS AGREEMENTS

Control: The organization:

a. Ensures that individuals requiring access to organizational information and information systems sign appropriate access agreements prior to being granted access; and

b. Reviews/updates the access agreements [*Assignment: organization-defined frequency*].

Supplemental Guidance: Access agreements include, for example, nondisclosure agreements, acceptable use agreements, rules of behavior, and conflict-of-interest agreements. Signed access agreements include an acknowledgement that individuals have read, understand, and agree to abide by the constraints associated with organizational information systems to which access is authorized. Organizations can use electronic signatures to acknowledge access agreements unless specifically prohibited by organizational policy. Related control: PL-4, PS-2, PS-3, PS-8.

Control Enhancements:

(1) *ACCESS AGREEMENTS | INFORMATION REQUIRING SPECIAL PROTECTION*
[Withdrawn: Incorporated into PS-3].

(2) *ACCESS AGREEMENTS | CLASSIFIED INFORMATION REQUIRING SPECIAL PROTECTION*

The organization ensures that access to classified information requiring special protection is granted only to individuals who:

(a) Have a valid access authorization that is demonstrated by assigned official government duties;

(b) Satisfy associated personnel security criteria; and

(c) Have read, understand, and signed a nondisclosure agreement.

Supplemental Guidance: Classified information requiring special protection includes, for example, collateral information, Special Access Program (SAP) information, and Sensitive Compartmented Information (SCI). Personnel security criteria reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Related control: PS-3.

References: None.

Priority and Baseline Allocation:

P3	**LOW** PS-6	**MOD** PS-6	**HIGH** PS-6

PS-7 THIRD-PARTY PERSONNEL SECURITY

Control: The organization:

a. Establishes personnel security requirements including security roles and responsibilities for third-party providers;

b. Requires third-party providers to comply with personnel security policies and procedures of the organization;

c. Documents personnel security requirements; and

d. Monitors provider compliance.

Supplemental Guidance: Third-party providers include, for example, service bureaus, contractors, and other organizations providing information system development, information technology services, outsourced applications, and network and security management. Organizations explicitly include personnel security requirements in acquisition-related documents. Related controls: PS-2, PS-3, PS-6, SA-9.

Control Enhancements:

(1) *THIRD-PARTY PERSONNEL SECURITY | NOTIFICATIONS*

The organization requires third-party providers to notify [*Assignment: organization-defined personnel*] of any personnel transfers or terminations of third-party personnel working at organizational facilities with organizational credentials, badges, or information system privileges within [*Assignment: organization-defined time period*].

Supplemental Guidance: Third-party providers may have personnel working at organizational facilities with credentials, badges, or information system privileges issued by organizations. Third-party notifications of personnel changes ensure appropriate termination of privileges and credentials. Organizations define the transfers and terminations deemed reportable by security-related characteristics that include, for example, functions, roles, and nature of credentials/privileges associated with individuals transferred or terminated. Related controls: PS-4, PS-5, SA-9.

References: NIST Special Publication 800-35.

Priority and Baseline Allocation:

P1	**LOW** PS-7	**MOD** PS-7 (1)	**HIGH** PS-7 (1)

PS-8 PERSONNEL SANCTIONS

Control: The organization employs a formal sanctions process for personnel failing to comply with established information security policies and procedures.

Supplemental Guidance: Organizational sanctions processes reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Sanctions processes are described in access agreements and can be included as part of general personnel policies and procedures for organizations. Related controls: PL-4, PS-6.

Control Enhancements: None.

(1) *PERSONNEL SANCTIONS | NOTIFICATIONS*

The organization notifies [*Assignment: organization-defined individuals, functions, and/or roles*] of the application of a formal employee sanctions process, identifying the individual sanctioned and the reason for the sanction.

References: None.

Priority and Baseline Allocation:

P3	**LOW** PS-8	**MOD** PS-8 (1)	**HIGH** PS-8 (1)

FAMILY: RISK ASSESSMENT

RA-1 RISK ASSESSMENT POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented risk assessment policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the risk assessment policy and associated risk assessment controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the RA family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-30,800-100.

Priority and Baseline Allocation:

P1	**LOW** RA-1	**MOD** RA-1	**HIGH** RA-1

RA-2 SECURITY CATEGORIZATION

Control: The organization:

a. Categorizes information and the information system in accordance with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance;

b. Documents the security categorization results (including supporting rationale) in the security plan for the information system; and

c. Ensures the security categorization decision is reviewed and approved by the authorizing official or authorizing official designated representative.

Supplemental Guidance: Clearly defined authorization boundaries are a prerequisite for effective security categorization decisions. Security categories describe the potential adverse impacts to organizational operations, organizational assets, and individuals if organizational information and information systems are comprised through a loss of confidentiality, integrity, or availability. Organizations conduct the security categorization process as an organization-wide activity with the involvement of chief information officers, senior information security officers, information system owners, mission/business owners, and information owners/stewards. Organizations also consider the potential adverse impacts to other organizations and, in accordance with the USA PATRIOT Act of 2001 and Homeland Security Presidential Directives, potential national-level adverse impacts. Security categorization processes carried out by organizations, facilitate the development of inventories of information assets, and along with CM-8, mappings to specific information system components where information is processed, stored, or transmitted. Related controls: CM-8, MP-4, RA-3, SC-7.

Control Enhancements: None.

References: FIPS Publication 199; NIST Special Publications 800-30, 800-39, 800-60.

Priority and Baseline Allocation:

P1	**LOW** RA-2	**MOD** RA-2	**HIGH** RA-2

RA-3 RISK ASSESSMENT

Control: The organization:

a. Conducts an assessment of risk, including the likelihood and magnitude of harm, from the unauthorized access, use, disclosure, disruption, modification, or destruction of the information system and the information it processes, stores, or transmits;

b. Documents risk assessment results in [*Selection: security plan; risk assessment report;* [*Assignment: organization-defined document*]];

c. Reviews risk assessment results [*Assignment: organization-defined frequency*]; and

d. Updates the risk assessment [*Assignment: organization-defined frequency*] or whenever there are significant changes to the information system or environment of operation (including the identification of new threats and vulnerabilities), or other conditions that may impact the security state of the system.

Supplemental Guidance: Clearly defined authorization boundaries are a prerequisite for effective risk assessments. Risk assessments take into account threats, vulnerabilities, likelihood, and impact to organizational operations and assets, individuals, other organizations, and the Nation based on the operation and use of information systems. Risk assessments also take into account risk from external parties (e.g., service providers, contractors operating information systems on behalf of the organization, individuals accessing organizational information systems, outsourcing entities). In accordance with OMB policy and related E-authentication initiatives, authentication of public users accessing federal information systems may also be required to protect nonpublic or privacy-related information. As such, organizational assessments of risk also address public access to federal information systems.

Risk assessments (formal or informal) can be conducted at all three tiers in the risk management hierarchy (i.e., organization level, mission/business process level, or information system level). Risk assessments can also be conducted at various steps in the Risk Management Framework, including, security categorization, security control selection, security control implementation, security control assessment, information system authorization, and security control monitoring. RA-3 is noteworthy in that the control must be partially implemented prior to the implementation of other controls in order to complete the first two steps in the Risk Management Framework. Risk assessments can play an important role in security control selection processes particularly during the application of tailoring guidance, which includes security control supplementation. Related controls: RA-2, PM-9.

Control Enhancements: None.

References: NIST Special Publication 800-30, 800-39.

Priority and Baseline Allocation:

P1	**LOW** RA-3	**MOD** RA-3	**HIGH** RA-3

RA-4 RISK ASSESSMENT UPDATE

[Withdrawn: Incorporated into RA-3].

RA-5 VULNERABILITY SCANNING

Control: The organization:

a. Scans for vulnerabilities in the information system and hosted applications [*Assignment: organization-defined frequency and/or randomly in accordance with organization-defined process*] and when new vulnerabilities potentially affecting the system/applications are identified and reported;

b. Employs vulnerability scanning tools and techniques that promote interoperability among tools and automate parts of the vulnerability management process by using standards for:

- Enumerating platforms, software flaws, and improper configurations;
- Formatting and making transparent, checklists and test procedures; and
- Measuring vulnerability impact;

c. Analyzes vulnerability scan reports and results from security control assessments;

d. Remediates legitimate vulnerabilities [*Assignment: organization-defined response times*] in accordance with an organizational assessment of risk; and

e. Shares information obtained from the vulnerability scanning process and security control assessments with [*Assignment: organization-defined personnel*] to help eliminate similar vulnerabilities in other information systems (i.e., systemic weaknesses or deficiencies).

Supplemental Guidance: Security categorization of information systems guides the frequency and comprehensiveness of vulnerability scans. Organization determine the required vulnerability scanning for all information system components, ensuring that potential sources of vulnerabilities such as networked printers, scanners, and copiers are not overlooked. Vulnerability analyses for custom software applications may require additional approaches such as static analysis, dynamic analysis, binary analysis, or hybrid of the three approaches. Organizations can employ these analysis approaches in a variety of tools (e.g., web-based application scanners, static analysis tools, binary analyzers) and in source code reviews. Vulnerability scanning includes, for example: (i) scanning for patch levels; (ii) scanning for functions, ports, protocols, and services that should not be accessible to users or devices; and (iii) scanning for improperly configured or incorrectly operating information flow control mechanisms. Organizations consider using tools that express vulnerabilities in the Common Vulnerabilities and Exposures (CVE) naming convention and that use the Open Vulnerability Assessment Language (OVAL) to determine/test for the presence of vulnerabilities. Suggested sources for vulnerability information include the Common Weakness Enumeration (CWE) listing and the National Vulnerability Database (NVD). In addition, security control assessments such as red team exercises provide other sources of potential vulnerabilities for which to scan. Organizations also consider using tools that express vulnerability impact by the Common Vulnerability Scoring System (CVSS). Related controls: CA-2, CA-7, CM-4, CM-6, RA-2, RA-3, SA-11, SI-2.

Control Enhancements:

(1) *VULNERABILITY SCANNING | UPDATE TOOL CAPABILITY*

The organization employs vulnerability scanning tools that include the capability to readily update the information system vulnerabilities to be scanned.

Supplemental Guidance: Related controls: SI-3, SI-7.

(2) *VULNERABILITY SCANNING | UPDATE BY FREQUENCY / WHEN IDENTIFIED*

The organization updates the information system vulnerabilities scanned [*Assignment: organization-defined frequency*] or when new vulnerabilities are identified and reported.

Supplemental Guidance: Related controls: SI-3, SI-5.

(3) *VULNERABILITY SCANNING | BREADTH /DEPTH OF COVERAGE*

The organization employs vulnerability scanning procedures that can demonstrate the breadth and depth of coverage (i.e., information system components scanned and vulnerabilities checked).

(4) *VULNERABILITY SCANNING | DISCOVERABLE INFORMATION*

The organization attempts to discern what information about the information system is discoverable by adversaries.

Supplemental Guidance: Related control: AU-13.

(5) *VULNERABILITY SCANNING | PRIVILEGED ACCESS*

The organization includes privileged access authorization to [*Assignment: organization-identified information system components*] for selected [*Assignment: organization-defined vulnerability scanning activities*] to facilitate more thorough scanning.

(6) *VULNERABILITY SCANNING | AUTOMATED TREND ANALYSES*

The organization employs automated mechanisms to compare the results of vulnerability scans over time to determine trends in information system vulnerabilities.

Supplemental Guidance: Related controls: IR-4, IR-5, SI-4.

(7) *VULNERABILITY SCANNING | AUTOMATED DETECTION AND NOTIFICATION OF UNAUTHORIZED COMPONENTS*

The organization employs automated mechanisms [*Assignment: organization-defined frequency*] to detect the presence of unauthorized hardware, software, and firmware on organizational information systems and notify [*Assignment: organization-defined personnel*].

Supplemental Guidance: Related controls: CM-2, CM-8, SI-3, SI-7.

(8) *VULNERABILITY SCANNING | REVIEW HISTORIC AUDIT LOGS*

The organization reviews historic audit logs to determine if a vulnerability identified in the information system has been previously exploited.

(9) *VULNERABILITY SCANNING | PENETRATION TESTING AND ANALYSES*

The organization employs an independent penetration agent or penetration team to:

(a) Conduct a vulnerability analysis on the information system; and

(b) Perform penetration testing on the information system based on the vulnerability analysis to determine the exploitability of identified vulnerabilities.

Supplemental Guidance: A standard method for penetration testing includes: (i) pre-test analysis based on full knowledge of the target information system; (ii) pre-test identification of potential vulnerabilities based on pre-test analysis; and (iii) testing designed to determine exploitability of identified vulnerabilities. Detailed rules of engagement are agreed upon by all parties before the commencement of any penetration testing scenarios. Related control: SA-12.

(10) *VULNERABILITY SCANNING | CORRELATE SCANNING INFORMATION*

The organization correlates the output from vulnerability scanning tools to determine the presence of multi-vulnerability/multi-hop attack vectors.

References: NIST Special Publications 800-40, 800-70, 800-115; Web: CWE.MITRE.ORG; NVD.NIST.GOV.

Priority and Baseline Allocation:

P1	**LOW** RA-5	**MOD** RA-5 (1)	**HIGH** RA-5 (1) (2) (3) (4) (5) (7)

FAMILY: SYSTEM AND SERVICES ACQUISITION

SA-1 SYSTEM AND SERVICES ACQUISITION POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented system and services acquisition policy that includes information security considerations and that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the system and services acquisition policy and associated system and services acquisition controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the SA family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** SA-1	**MOD** SA-1	**HIGH** SA-1

SA-2 ALLOCATION OF RESOURCES

Control: The organization:

a. Determines information security requirements for the information system in mission/business process planning;

b. Determines, documents, and allocates the resources required to protect the information system as part of its capital planning and investment control process; and

c. Establishes a discrete line item for information security in organizational programming and budgeting documentation.

Supplemental Guidance: Related controls: PM-3, PM-11.

Control Enhancements: None.

References: NIST Special Publication 800-65.

Priority and Baseline Allocation:

P1	**LOW** SA-2	**MOD** SA-2	**HIGH** SA-2

SA-3 SYSTEM DEVELOPMENT LIFE CYCLE

Control: The organization:

a. Manages the information system using a documented system development life cycle methodology that incorporates information security considerations;

b. Defines and documents information security roles and responsibilities throughout the system development life cycle;

c. Identifies individuals having information security roles and responsibilities; and

d. Integrates the organizational information security risk management process into the system development life cycle activities.

Supplemental Guidance: To apply needed security controls within the system development life cycle (including the acquisition process) requires a basic understanding of information security, threats, vulnerabilities, and risk to critical missions/business functions. The security engineering principles described in SA-8 cannot be properly applied if individuals that design, code, and test information systems and system components (including information technology products that are used to build those systems/components) do not understand security. Therefore, organizations include qualified personnel, for example, chief information security officers, security architects, security engineers, and information system security officers in system development life cycle activities to ensure that security requirements are incorporated into organizational information systems. It is also equally important that developers include individuals on the development team that possess the requisite security expertise and skills to ensure needed security capabilities are effectively integrated into the information system. Security awareness and training programs can help ensure that individuals having key security roles and responsibilities have the appropriate experience, skills, and expertise to conduct assigned system development life cycle activities. The effective integration of security requirements into the enterprise architecture helps to ensure that important security considerations are addressed early in the system development life cycle—and those considerations are directly related to the mission/business processes defined by organizations. This requirements integration process also facilitates the integration of the information security architecture into the enterprise architecture, consistent with organizational risk management and information security strategies.

Related controls: AT-3, PM-7, SA-8.

Control Enhancements: None.

References: NIST Special Publication 800-64.

Priority and Baseline Allocation:

P1	**LOW** SA-3	**MOD** SA-3	**HIGH** SA-3

SA-4 ACQUISITION PROCESS

Control: The organization includes the following requirements, descriptions, and criteria, either explicitly or by reference, in information system acquisition contracts based on applicable federal laws, Executive Orders, directives, policies, regulations, standards, guidelines, and organizational mission/business needs:

a. Security functional requirements;

b. Security strength requirements;

c. Security assurance requirements;

d. Security-related documentation requirements;

e. Description of the information system development environment and environment in which the system is intended to operate; and

f. Acceptance criteria.

Supplemental Guidance: Security functional requirements include security capabilities, security functions, and security mechanisms. Security strength requirements with regard to capabilities, functions, and mechanisms include degree of correctness, completeness, resistance to direct attack, and resistance to tampering or bypass. Security-related documentation requirements address all phases of the system development life cycle including design, development, implementation, operation, and disposal. Security assurance requirements include: (i) development processes, procedures, practices, methodologies, and techniques supporting achievement of requirements for security functionality and security strength; and (ii) supporting evidence from development and assessment activities providing grounds for confidence that required security functionality has been implemented and required security strength has been achieved). Information systems include the information technology products (i.e., hardware, software, and firmware) that compose those systems. Information system developer is a general term that includes developers or manufacturers of information technology products (including hardware, software, firmware), systems integrators, vendors, and product resellers. Security functionality, assurance, and documentation requirements are expressed as security controls. Requirements in acquisition documents permit the updating of security controls as new threats and vulnerabilities are identified and as new technologies are implemented. Information system documentation provides user and administrator guidance regarding the effective implementation/operation of security controls. The level of detail required in security-related documentation is based on the security category or classification level of the information system and the degree to which organizations depend on the stated security capability to meet overall risk response expectations (as defined in the organizational risk management strategy). Security requirements also include organizationally mandated configuration settings specifying allowed functions, ports, protocols, and services. Related controls: CM-6, PL-2, PS-7, SA-3, SA-5, SA-8, SA-11.

Control Enhancements:

(1) *ACQUISITION PROCESS | FUNCTIONAL PROPERTIES OF SECURITY CONTROLS*

The organization requires that developers provide a description of the functional properties of the security controls to be employed within the information system, information system components, or information system services.

Supplemental Guidance: Functional properties of security controls describe the functionality (i.e., security capability, functions, mechanisms) visible at the interfaces of the controls and specifically exclude functionality and structures internal to the operation of the controls. The purpose of this control enhancement is to ensure that development processes produce design that increases the likelihood of greater security strength. In contrast, the purpose of SA-5 is to ensure that documentation is available to facilitate organizational understanding of testing, implementation, and/or operational issues associated with deployed security controls. Related control: SA-5.

(2) *ACQUISITION PROCESS | DESIGN / IMPLEMENTATION INFORMATION FOR SECURITY CONTROLS*

The organization requires that developers provide design and implementation information for the security controls to be employed within the information system, information system components, or information system services at the following level of detail: [*Selection (one or more): high-level design in terms of subsystems; low-level design in terms of modules; source-code/hardware schematics;* [*Assignment: organization-defined level of detail*]].

Supplemental Guidance: Organizations may require different levels of detail in design and implementation documentation for security controls employed in organizational information systems, system components, and/or system services based on mission/business requirements, requirements for trustworthiness and resiliency, and requirements for analysis and testing. The purpose of this control enhancement is to ensure that development processes produce design that increases the likelihood of greater security strength. In contrast, the purpose of SA-5 is to ensure that documentation is available to facilitate organizational understanding of testing, implementation, and/or operational issues associated with deployed security controls. Related control: SA-5.

(3) *ACQUISITION PROCESS | DEVELOPMENT METHODS / TECHNIQUES / PRACTICES*

The organization requires that developers demonstrate that their development processes follow a system development life cycle approach that employs [*Assignment: organization-defined state-of-the-practice system and security engineering methods, software development methods, quality control processes, and validation techniques*] to reduce vulnerabilities in hardware, software, or firmware components within the information system.

Supplemental Guidance: Related control: SA-12.

(4) *ACQUISITION PROCESS | ASSIGNMENT OF COMPONENTS TO SYSTEMS*

The organization ensures that [*Assignment: organization-defined information system components*] acquired are explicitly assigned to an information system, and that the owner of the system acknowledges this assignment.

Supplemental Guidance: Organizations determine the types of information system components (e.g., microprocessors, motherboards, software, programmable logic controllers, network devices) that are subject to assignment to information systems, and therefore, covered by this control enhancement. Related control: CM-8.

(5) *ACQUISITION PROCESS | COMPONENT CONFIGURATIONS*

The organization requires that information system components are delivered with [*Assignment; organization-defined security configurations*] implemented and that the configurations are the default for any component reinstalls or upgrades.

Supplemental Guidance: Information system components can include hardware, software, and firmware. Security configurations include, for example, the U.S. Government Configuration Baseline (USGCB), and any limitations on functions, ports, protocols, and services. Security characteristics include, for example, requiring that all default passwords have been changed. Related control: CM-8.

(6) *ACQUISITION PROCESS | USE OF INFORMATION ASSURANCE PRODUCTS*

The organization:

(a) Employs only government off-the-shelf (GOTS) or commercial off-the-shelf (COTS) information assurance (IA) and IA-enabled information technology products that compose an NSA-approved solution to protect classified information when the networks used to transmit the information are at a lower classification level than the information being transmitted; and

(b) Ensures that these products have been evaluated and/or validated by the NSA or in accordance with NSA-approved procedures.

Supplemental Guidance: COTS IA or IA-enabled information technology products used to protect classified information by cryptographic means may be required to use NSA-approved key management. Related controls: SC-8, SC-9, SC-12, SC-13.

(7) *ACQUISITION PROCESS | U.S. GOVERNMENT PROTECTION PROFILES*

The organization:

(a) Limits the use of commercially provided information technology products to those products that have been successfully evaluated against a validated U.S. Government Protection Profile for a specific technology type, if such a profile exists; and

(b) Requires, if no U.S. Government Protection Profile exists for a specific technology type but a commercially provided information technology product relies on cryptographic functionality to enforce its security policy, then the cryptographic module is FIPS-validated.

Supplemental Guidance: Related controls: SC-12, SC-13.

(8) *ACQUISITION PROCESS | CONTINUOUS MONITORING PLAN*

The organization requires that developers produce a plan for continuous monitoring of security control effectiveness in the information system.

Supplemental Guidance: The objective of continuous monitoring plans is to determine if the complete set of planned, required, and deployed security controls within information systems continue to be effective over time based on the inevitable changes that occur. Developer continuous monitoring plans can be incorporated into the continuous monitoring strategies and programs implemented by organizations. Related control: CA-7.

References: ISO/IEC 15408; FIPS 140-2; NIST Special Publications 800-23, 800-35, 800-36, 800-64, 800-70; Web: WWW.NIAP-CCEVS.ORG.

Priority and Baseline Allocation:

P1	**LOW** SA-4	**MOD** SA-4 (1) (4)	**HIGH** SA-4 (1) (2) (4)

SA-5 INFORMATION SYSTEM DOCUMENTATION

Control: The organization:

a. Obtains administrator documentation for the information system that describes:
   - Secure configuration, installation, and operation of the information system;
   - Effective use and maintenance of security functions/mechanisms; and
   - Known vulnerabilities regarding configuration and use of administrative (i.e., privileged) functions;

b. Obtains user documentation for the information system that describes:
   - User-accessible security functions/mechanisms and how to effectively use those security functions/mechanisms;
   - Methods for user interaction with the information system, which enables individuals to use the system in a more secure manner; and
   - User responsibilities in maintaining the security of the information and information system;

c. Documents attempts to obtain information system documentation when such documentation is either unavailable or nonexistent and takes [*Assignment: organization-defined actions*] in response;

d. Protects documentation as required, in accordance with the risk management strategy; and

e. Distributes documentation to [*Assignment: organization-defined personnel*].

Supplemental Guidance: The purpose of this control is to help organizational personnel understand the implementation and operation of security controls associated with organizational information systems. In contrast, documentation requirements in SA-4 help to ensure that information system developers implement development processes that routinely produce such documentation and/or artifacts as inherent, essential parts of those processes. Organizations consider establishing specific measures to determine the quality and completeness of the content provided. Information systems can include hardware, software, and firmware components. Information system developer is a general term that includes developers or manufacturers of information technology products (including hardware, software, firmware), systems integrators, vendors, and product resellers. The inability to obtain needed information system documentation may occur, for example, due to the age of the systems or lack of support from developers and contractors. In those situations, organizations may need to recreate selected system documentation if such documentation is essential to the effective implementation and/or operation of security controls. The level of protection provided for selected information system documentation is commensurate with the security category of the system. For example, documentation associated with a key DoD weapons system or command and control system would typically require stronger safeguards than a routine administrative information system. Related controls: CM-6, CM-8, PL-2, PL-4, PS-2, SA-3, SA-4.

Control Enhancements:

(1) *INFORMATION SYSTEM DOCUMENTATION | FUNCTIONAL PROPERTIES OF SECURITY CONTROLS*

The organization obtains developer documentation that describes the functional properties of the security controls employed within the information system.

Supplemental Guidance: Functional properties of security controls describe the functionality (i.e., security functions, mechanisms) visible at the interfaces of the controls and specifically exclude functionality and structures internal to the operation of the controls.

(2) *INFORMATION SYSTEM DOCUMENTATION | SECURITY-RELEVANT EXTERNAL SYSTEM INTERFACES*

The organization obtains developer documentation that describes the security-relevant external interfaces to the information system.

(3) *INFORMATION SYSTEM DOCUMENTATION | HIGH-LEVEL DESIGN*

The organization obtains developer documentation that describes the high-level design of the information system in terms of subsystems.

Supplemental Guidance: An information system can be partitioned into multiple subsystems.

(4) *INFORMATION SYSTEM DOCUMENTATION | LOW-LEVEL DESIGN*

The organization obtains developer documentation that describes the low-level design of the information system in terms of modules.

Supplemental Guidance: Each subsystem within an information system can contain one or more modules.

(5) *INFORMATION SYSTEM DOCUMENTATION | SOURCE CODE*

The organization obtains the source code for the information system.

(6) *INFORMATION SYSTEM DOCUMENTATION | FUNCTIONS / PORTS / PROTOCOLS / SERVICES IN USE*

The organization requires developers of information systems, components, and services to identify early in the system development life cycle, the functions, ports, protocols, and services intended for organizational use.

Supplemental Guidance: This control enhancement enables organizations to maintain on-going situational awareness of the functions, ports, protocols, and services that are being employed in the information system. This includes functions, ports, protocols, and services that are part of distributed information systems, for example, service-oriented architectures or cloud-based information systems. Such information can be useful to organizations when the need arises to understand the tradeoffs involved in blocking specific ports, protocols, or services or when requiring external service providers to do so. SA-9 describes requirements for external system services with organizations noting which functions, ports, protocols, and services are provided from external sources. Related controls: CM-7, SA-9.

References: None.

Priority and Baseline Allocation:

P2	**LOW** SA-5	**MOD** SA-5 (1) (3) (6)	**HIGH** SA-5 (1) (2) (3) (6)

SA-6 SOFTWARE USAGE RESTRICTIONS

[Withdrawn: Incorporated into CM-10 and SI-7].

SA-7 USER-INSTALLED SOFTWARE

[Withdrawn: Incorporated into CM-11 and SI-7].

SA-8 SECURITY ENGINEERING PRINCIPLES

Control: The organization applies information system security engineering principles in the specification, design, development, implementation, and modification of the information system.

Supplemental Guidance: Organizations apply security engineering principles primarily to new development information systems or systems undergoing major upgrades. For legacy systems,

organizations apply security engineering principles to system upgrades and modifications to the extent feasible, given the current state of hardware, software, and firmware within those systems. Security engineering principles include, for example: (i) developing layered protections; (ii) establishing sound security policy, architecture, and controls as the foundation for design; (iii) incorporating security requirements into the system development life cycle; (iv) delineating physical and logical security boundaries; (v) ensuring system developers are trained on how to build secure software; (vi) tailoring security controls to meet organizational and operational needs; (vii) performing threat modeling to identify use cases, threat agents, attack vectors, and attack patterns as well as compensating controls and design patterns needed to mitigate risk; and (viii) reducing risk to acceptable levels, thus enabling informed risk management decisions. Related controls: PM-7, SA-3, SA-4, SA-17, SC-2, SC-3.

Control Enhancements: None.

References: NIST Special Publication 800-27.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SA-8	**HIGH** SA-8

SA-9 EXTERNAL INFORMATION SYSTEM SERVICES

Control: The organization:

a. Requires that providers of external information system services comply with organizational information security requirements and employ [*Assignment: organization-defined security controls*] in accordance with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance;

b. Defines and documents government oversight and user roles and responsibilities with regard to external information system services; and

c. Employs [*Assignment: organization-defined processes, methods, and techniques*] to monitor security control compliance by external service providers on an ongoing basis.

Supplemental Guidance: External information system services are services that are implemented outside of the authorization boundaries of organizational information systems. This includes services that are used by, but not a part of, organizational information systems. Organizations establish relationships with external service providers in a variety of ways, including, for example, through joint ventures, business partnerships, contracts, interagency agreements, lines of business arrangements, licensing agreements, and supply chain exchanges. The responsibility for managing risks from the use of external information system services remains with authorizing officials. For services external to organizations, a chain of trust requires that organizations establish and retain a level of confidence that each participating provider in the potentially complex consumer-provider relationship provides adequate protection for the services rendered. The extent and nature of this chain of trust varies based on the relationships between organizations and the external providers. Organizations document the basis for trust relationships so the relationships can be monitored over time. External information system services documentation includes government, service providers, end user security roles and responsibilities, and service-level agreements. Service-level agreements define expectations of performance for security controls, describe measurable outcomes, and identify remedies and response requirements for identified instances of noncompliance. Related control: CA-3, PS-7.

Control Enhancements:

(1) *EXTERNAL INFORMATION SYSTEMS | RISK ASSESSMENTS / ORGANIZATIONAL APPROVALS*

The organization:

(a) Conducts an organizational assessment of risk prior to the acquisition or outsourcing of dedicated information security services; and

(b) Ensures that the acquisition or outsourcing of dedicated information security services is approved by [*Assignment: organization-defined personnel*].

Supplemental Guidance: Dedicated information security services include, for example, incident monitoring, analysis and response, operation of information security-related devices such as firewalls, or key management services. Related controls: CA-6, RA-3.

(2) *EXTERNAL INFORMATION SYSTEMS | IDENTIFICATION OF FUNCTIONS / PORTS / PROTOCOLS / SERVICES*

The organization requires providers of [*Assignment: organization-defined external information system services*] to identify the functions, ports, protocols, and other services required for the use of such services.

Supplemental Guidance: Information from external service providers regarding the specific functions, ports, protocols, and services used in the provision of such services can be particularly useful when the need arises to understand the tradeoffs involved in restricting certain functions/services or blocking certain ports/protocols. Related control: CM-7.

(3) *EXTERNAL INFORMATION SYSTEMS | ESTABLISH / MAINTAIN CHAIN OF TRUST WITH PROVIDERS*

The organization establishes and maintains a chain of trust with external service providers based on [*Assignment: organization-defined requirements, properties, factors, or conditions defining acceptable chain of trust*].

(4) *EXTERNAL INFORMATION SYSTEMS | CONSISTENT INTERESTS OF CONSUMERS AND PROVIDERS*

The organization employs [*Assignment: organization-defined security safeguards*] to ensure that the interests of [*Assignment: organization-defined external service providers*] reflect organizational interests.

Supplemental Guidance: As organizations increasingly use external service providers, the possibility exists that the interests of the service providers may diverge from organizational interests. In such situations, simply having the correct technical, procedural, or operational safeguards in place may not be sufficient if the service providers that implement and control those safeguards are not operating in a manner consistent with the interests of the consuming organizations. Possible actions that organizations might take to address such concerns include, for example, requiring background checks for selected service provider personnel, examining ownership records, employing only trustworthy service providers (i.e., providers with which organizations have had positive experiences), and conducting periodic/unscheduled visits to service provider facilities.

(5) *EXTERNAL INFORMATION SYSTEMS | PROCESSING, STORAGE, AND SERVICE LOCATION*

The organization restricts the location of [*Selection (one or more): information processing; information/data; information system services*] based on [*Assignment: organization-defined requirements or conditions*].

Supplemental Guidance: The location of information processing, information/data storage, or information system services that are critical to organizations can have a direct impact on the ability of those organizations to successfully execute their missions/business functions. This situation exists when external providers control the location of processing, storage or services. The criteria external providers use for the selection of processing, storage, or service locations may be different from organizational criteria. For example, organizations may want to ensure that data/information storage locations are restricted to certain locations to facilitate incident response activities (e.g., forensic analyses, after-the-fact investigations) in case of information security breaches/compromises. Such incident response activities may be adversely affected by the governing laws or protocols in the locations where processing and storage occur and/or the locations from which information system services emanate.

References: NIST Special Publication 800-35.

Priority and Baseline Allocation:

P1	**LOW** SA-9	**MOD** SA-9 (2)	**HIGH** SA-9 (2) (3)

SA-10 DEVELOPER CONFIGURATION MANAGEMENT

Control: The organization requires that information system developers:

a. Perform configuration management during information system design, development, implementation, and operation;

b. Manage and control changes to the information system at [*Assignment: organization-defined configuration items that have been placed under configuration management*];

c. Implement only organization-approved changes to the information system;

d. Document approved changes to the information system; and

e. Track security flaws and flaw resolution within the information system.

Supplemental Guidance: This control also applies to organizations conducting internal systems development and integration. Organizations consider the quality and completeness of the configuration management activities conducted by developers as evidence of applying effective security safeguards. Information system developer is a general term that includes developers or manufacturers of information technology products (including hardware, software, firmware), systems integrators, vendors, and product resellers. Related controls: CM-3, CM-4, CM-9, SA-12, SI-2.

Control Enhancements:

(1) *DEVELOPER CONFIGURATION MANAGEMENT | SOFTWARE / FIRMWARE INTEGRITY VERIFICATION*

The organization requires that information system developers enable integrity verification of delivered software and firmware.

Supplemental Guidance: This control enhancement enables organizations to detect unauthorized changes to delivered software and firmware components. Integrity checking mechanisms can also address counterfeiting of software and firmware components. Organizations verify the integrity of software and firmware components, for example, through secure one-way hashes provided by developers. Related control: SI-7.

(2) *DEVELOPER CONFIGURATION MANAGEMENT | ALTERNATIVE CONFIGURATION MANAGEMENT PROCESSES*

The organization provides an alternate configuration management process using organizational personnel in the absence of a dedicated developer configuration management team.

Supplemental Guidance: Alternate configuration management processes include organizational personnel that are responsible for reviewing and approving proposed changes to information systems, and security personnel that conduct impact analyses prior to the implementation of any changes to systems.

(3) *DEVELOPER CONFIGURATION MANAGEMENT | HARDWARE INTEGRITY VERIFICATION*

The organization requires that information system developers enable integrity verification of delivered hardware.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SA-10	**HIGH** SA-10

SA-11 DEVELOPER SECURITY TESTING

Control: The organization requires that information system developers:

a. Create and implement a security test and evaluation plan that provides for testing/evaluation:

- At the depth of [*Selection (one or more): security-related functional properties; security-related externally visible interfaces; high-level design; low-level design; implementation representation (source code/hardware schematics)*];

- At the rigor of [*Selection: showing; demonstrating; rigorously demonstrating*];

b. Include testing/evaluation at [*Selection (one or more): unit; integration; system; regression*]; and

c. Produce evidence of the execution of security testing/evaluation plan and the results of the testing/evaluation.

Supplemental Guidance: Developmental security testing occurs at all post-design phases of the system development life cycle. Information systems include information technology products (i.e., hardware, software, and firmware components) that compose those systems. Information system developer is a general term that includes developers or manufacturers of information technology products (including hardware, software, firmware), systems integrators, vendors, and product resellers. Developer testing confirms that: (i) the required security controls are implemented correctly and operating as intended; and (ii) the information system meets the established security requirements. Security test and evaluation plans provide the specific activities that developers plan to carry out including the types of analyses, testing, and reviews of software and firmware components, the degree of rigor to be applied in the analyses, tests, and reviews, and the types of artifacts produced during those processes. Contracts specify the acceptance criteria for security test and evaluation plans, flaw remediation processes, and evidence that plans and processes have been diligently applied. This control also applies to organizations conducting internal systems development and integration. Related controls: CA-2, CM-4, SA-3, SA-4, SA-5, SI-2.

Control Enhancements:

(1) *DEVELOPER SECURITY TESTING | CODE ANALYSIS TOOLS*

The organization requires that information system developers employ [*Selection (one or more): static; dynamic*] code analysis tools to examine the information system for common flaws and document the results of the analysis.

Supplemental Guidance: Static code analysis provides a methodology for security reviews and can be used to enforce security coding practices. Developers consider both the strengths and weaknesses of static analysis tools and can employ additional supporting tools and human reviews, when necessary. Dynamic code analysis provides run-time verification of software programs, using tools capable of monitoring programs for memory corruption, user privilege issues, and other potential security problems. Dynamic code analysis employs run-time tools to help to ensure that security functionality performs in the manner in which it was designed. A specialized type of dynamic analysis, known as fuzz testing, induces program failures by deliberately introducing malformed or random data into software programs. Fuzz testing strategies derive from the intended use of applications and the functional and design specifications for the applications.

(2) *DEVELOPER SECURITY TESTING | THREAT AND VULNERABILITY ANALYSES / FLAW REMEDIATION*

The organization requires that information system developers:

(a) Perform threat and vulnerability analyses and subsequent testing of the as-built information system; and

(b) Remediate security flaws or identify and document such flaws.

Supplemental Guidance: Applications may deviate significantly from the functional and design specifications created during the requirements and design phases of the system development life cycle. Therefore, threat and vulnerability analyses of information technology products and information systems prior to delivery are critical to the effective operation of those products and systems. Threat and vulnerability analyses at this phase of the life cycle help ensure that design or implementation changes have been accounted for, and that any new vulnerabilities created as a result of those changes have been reviewed and mitigated. Related controls: AT-5, RA-5.

(3) *DEVELOPER SECURITY TESTING | INDEPENDENT VERIFICATION OF TESTING / RESULTS*

The organization requires that an independent agent satisfying [*Assignment: organization-defined independence criteria*] verify the implementation of the developer security test and evaluation plan and the evidence produced.

Supplemental Guidance: Independent agents have the necessary qualifications (including skills, expertise, training, and experience) to verify the implementation of developer security test and evaluation plans. Related controls: AT-3, CA-2, CA-7, RA-5, SA-12.

(4) *DEVELOPER SECURITY TESTING | MANUAL CODE REVIEWS*

The organization requires that information system developers perform manual code reviews of the information technology product or information system using [*Assignment: organization-defined processes and/or techniques*].

Supplemental Guidance: While software code analysis tools can do much of the work of finding and flagging vulnerabilities, such tools are not perfect. As a result, manual code reviews are usually reserved for the critical software and firmware components of information systems.

(5) *DEVELOPER SECURITY TESTING | PENETRATION TESTING*

The organization requires that information system developers perform penetration testing of the information system at [*Assignment: organization-defined breadth/depth*] and with [*Assignment: organization-defined constraints*].

Supplemental Guidance: Penetration testing is an assessment methodology in which assessors, using all available information technology product and/or information system documentation (e.g., product/system design specifications, source code, and administrator/operator manuals) and working under specific constraints, attempt to circumvent implemented security features of information technology products and information systems. Penetration testing can include, for example, white, gray, or black box testing with analyses performed by skilled security professionals simulating adversary actions. The objective of penetration testing is to uncover potential vulnerabilities in information technology products and information systems resulting from implementation errors, configuration faults, or other operational deployment weaknesses or deficiencies. Penetration tests can be performed in conjunction with automated and manual code reviews to provide greater levels of analysis than would ordinarily be possible.

(6) *DEVELOPER SECURITY TESTING | UNIT / INTEGRATION / REGRESSION TESTING*

The organization requires that information system developers perform [*Selection (one or more): unit; integration; system; regression*] testing of the information system at [*Assignment: organization-defined breadth/depth*].

Supplemental Guidance: Security properties of information systems may be affected by the interconnection of system components or changes to those components. Such interconnections or changes (e.g., upgrading or replacing operating systems) may adversely affect previously implemented security controls. This control enhancement provides additional types of security testing that developers can conduct to reduce or eliminate potential flaws introduced by the interconnection of components or changes to information systems.

(7) *DEVELOPER SECURITY TESTING | ATTACK SURFACE REVIEWS*

The organization requires that information system developers perform attack surface reviews and correct identified flaws in the information system.

Supplemental Guidance: Attack surfaces of information systems are exposed areas that make those systems more vulnerable to cyber attacks. This includes any accessible areas where weaknesses or deficiencies in information systems (including the hardware, software, and firmware components) provide opportunities for adversaries to exploit vulnerabilities. Attack surface reviews ensure that developers: (i) analyze both design and implementation changes to information systems; and (ii) mitigate attack vectors generated as a result of the changes.

(8) *DEVELOPER SECURITY TESTING | VERIFY SCOPE OF TESTING*

The organization requires that information system developers verify the scope of security testing, evaluation, and analyses [*Selection: showing; demonstrating; rigorously demonstrating complete*] coverage of required security controls for the information system.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** SA-11	**HIGH** SA-11

SA-12 SUPPLY CHAIN PROTECTION

Control: The organization protects against supply chain threats by employing [*Assignment: organization-defined security safeguards*] as part of a comprehensive, defense-in-breadth information security strategy.

Supplemental Guidance: Information systems (including system components that compose those systems) need to be protected throughout the system development life cycle (i.e., during design, development, manufacturing, packaging, assembly, distribution, system integration, operations, maintenance, and retirement). Protection of organizational information systems is accomplished through threat awareness, by the identification, management, and reduction of vulnerabilities at each phase of the life cycle and the use of complementary, mutually reinforcing strategies to respond to risk. Organizations consider implementing a standardized process to address supply chain risk with respect to information systems and to educate the acquisition workforce on threats, risk, and required security controls. Organizations use the acquisition/procurement processes to require supply chain entities to implement necessary safeguards and countermeasures to protect information systems including system components and services, prior to taking delivery of those systems/components or using those services. Related controls: CM-8, PE-16, SA-3, SA-4, SA-8, SA-10, SA-14, SC-29, SC-30, SI-7.

Control Enhancements:

(1) *SUPPLY CHAIN PROTECTION | ACQUISITION STRATEGIES / TOOLS / METHODS*

The organization employs [*Assignment: organization-defined tailored acquisition strategies, contract tools, and procurement methods*] for purchases of [*Assignment: organization-defined information systems, system components, information technology products, or information system services*] from suppliers.

Supplemental Guidance: The use of acquisition and procurement processes by organizations early in the system development life cycle provides an important vehicle to protect the supply chain. Organizations consider defining supplier requirements and creating supplier incentives including, for example, additional vetting of critical information system component/service, suppliers, restrictions on purchases from specific suppliers or countries, and inclusion of specific contract language regarding the prohibition of tainted or counterfeit components. In addition, organizations consider minimizing the time between purchase decisions and required delivery to limit opportunities for adversaries to corrupt information system components or products. Finally, organizations can use controlled distribution, delivery, and warehousing options to reduce supply chain risk.

(2) *SUPPLY CHAIN PROTECTION | SUPPLIER REVIEWS*

The organization conducts supplier reviews prior to entering into contractual agreements to acquire [*Assignment: organization-defined information systems, system components, information technology products, or information system services*].

Supplemental Guidance: Information systems, system components, and information technology products include hardware, software, and firmware. Supplier reviews include, for example: (i) analysis of supplier processes used to design, develop, test, implement, verify, deliver, and support information systems, products, and services; and (ii) assessment of supplier training and experience in developing information systems, components, products, or services with the required security capability. These reviews provide organizations with increased levels of visibility into supplier activities during the system development life cycle to promote more effective supply chain risk management. Supplier reviews can also help determine whether primary suppliers have security safeguards in place and in practice for vetting second and third tier providers, and any other subcontractors.

(3) *SUPPLY CHAIN PROTECTION | TRUSTED SHIPPING AND WAREHOUSING*

[Withdrawn: Incorporated into SA-12].

(4) *SUPPLY CHAIN PROTECTION | DIVERSITY OF SUPPLIERS*

[Withdrawn: Incorporated into SA-12].

(5) *SUPPLY CHAIN PROTECTION | LIMITATION OF HARM*

The organization employs [*Assignment: organization-defined security safeguards*] to limit harm from potential adversaries identifying and targeting the organizational supply chain.

Supplemental Guidance: Supply chain risk is part of the advanced persistent threat. Security safeguards to reduce the probability of adversaries successfully identifying and targeting the supply chain include, for example: (i) avoiding the purchase of custom configurations to reduce the risk of acquiring information systems, components, or products that have been corrupted via supply chain actions targeted at specific organizations; (ii) employing a diverse set of suppliers to limit the potential harm from any given supplier in the supply chain; and (iii) using procurement carve outs.

(6) *SUPPLY CHAIN PROTECTION | MINIMIZING PROCUREMENT TIME*

[Withdrawn: Incorporated into SA-12].

(7) *SUPPLY CHAIN PROTECTION | ASSESSMENTS PRIOR TO SELECTION / ACCEPTANCE / UPDATE*

The organization conducts assessments of [*Assignment: organization-defined information systems, system components, information technology products, or information system services*] prior to selection, acceptance, or update.

Supplemental Guidance: Assessments include, for example, testing, evaluations, reviews, and analyses. Independent, third-party entities or organizational personnel conduct assessments of systems, components, products, and services. Organizations conduct assessments to uncover unintentional vulnerabilities and intentional vulnerabilities including, for example, malware, malicious processes, and counterfeits. Assessments can include, for example, static analyses, dynamic analyses, simulations, white, gray, and black box testing, fuzz testing, penetration testing, and ensuring that components or services are genuine (e.g., using tags, cryptographic hash verifications, or digital signatures). Evidence generated during security assessments is documented for follow-on actions carried out by organizations. Related controls: CA-2, SA-11.

(8) *SUPPLY CHAIN PROTECTION | USE OF ALL-SOURCE INTELLIGENCE*

The organization uses all-source intelligence to analyze potential suppliers of [*Assignment: organization-defined information systems, system components, information technology products, or information system services*].

Supplemental Guidance: All-source intelligence consists of intelligence products and/or organizations and activities that incorporate all sources of information, most frequently including human intelligence, imagery intelligence, measurement and signature intelligence, signals intelligence, and open source data in the production of finished intelligence.

(9) *SUPPLY CHAIN PROTECTION | OPERATIONS SECURITY*

The organization employs [*Assignment: organization-defined Operations Security (OPSEC) safeguards*] in accordance with classification guides to protect supply chain-related information.

Supplemental Guidance: Supply chain information potentially critical to mission/business success includes, for example, user identities, uses for information system components, suppliers, supplier processes, requirements, design specifications, testing and evaluation results, and configurations. This control enhancement expands the scope of OPSEC to include suppliers and potential suppliers. OPSEC is a process of identifying critical information and subsequently analyzing friendly actions attendant to operations and other activities to: (i) identify those actions that can be observed by potential adversaries; (ii) determine indicators that adversaries might obtain that could be interpreted or pieced together to derive critical information in sufficient time to cause harm to organizations; (iii) implement safeguards to eliminate or reduce to an acceptable level, exploitable vulnerabilities; and (iv) consider how aggregated information may compromise the confidentiality of users or uses of the supply chain elements. Related control: PE-21.

(10) *SUPPLY CHAIN PROTECTION | UNAUTHORIZED MODIFICATIONS*

The organization requires that suppliers of [*Assignment: organization-defined information systems, system components, information technology products, or information system services*] implement [*Assignment: organization-defined security safeguards*] to reduce the likelihood of unauthorized modifications at each stage in the supply chain.

Supplemental Guidance: Security safeguards include, for example: (i) security controls for development facilities, development systems, and external connections to development systems; (ii) vetting development personnel; and (iii) use of tamper evident packaging during shipping and warehousing.

(11) *SUPPLY CHAIN PROTECTION | VALIDATE AS GENUINE AND NOT ALTERED*

The organization employs [*Assignment: organization-defined security safeguards*] to validate that the [*Assignment: organization-defined information systems, system components, or information technology products*] received are genuine and have not been altered.

Supplemental Guidance: For some information system components, especially hardware, there are technical means to help determine if the components are genuine or have been altered. Security safeguards used to validate the authenticity of information systems, components, and products include, for example, optical/nanotechnology tagging and side-channel analysis.

(12) *SUPPLY CHAIN PROTECTION | PENETRATION TESTING / ANALYSIS OF SUPPLY CHAIN ELEMENTS*

The organization employs [*Selection (one or more): organizational analysis, independent third-party analysis, organizational penetration testing, independent third-party penetration testing*] of [*Assignment: organization-defined supply chain elements*].

Supplemental Guidance: This control enhancement addresses analysis and/or testing of the supply chain, not just delivered items. Supply chain elements include, for example, supplier development processes, shipping and handling procedures, personnel and physical security programs, or any other programs, processes, procedures, or practices associated with the production and distribution of information systems, components, products, and/or services. Evidence generated during analyses and testing of supply chain elements is documented for follow-on actions carried out by organizations. Related control: RA-5.

(13) *SUPPLY CHAIN PROTECTION | INTER-ORGANIZATIONAL AGREEMENTS*

The organization establishes inter-organizational agreements and procedures with entities involved in the supply chain for [*Assignment: organization-defined information systems*] to provide notification of supply chain compromises.

Supplemental Guidance: Early notification of supply chain compromises that can potentially adversely affect or have adversely affected organizational information systems, including critical system components, is essential in order for organizations to provide appropriate responses to such incidents.

(14) *SUPPLY CHAIN PROTECTION | CRITICAL INFORMATION SYSTEM COMPONENTS*

The organization employs [*Assignment: organization-defined security safeguards*] to ensure an adequate supply of [*Assignment: organization-defined critical information system components*].

Supplemental Guidance: Adversaries can attempt to impede organizational operations by disrupting the supply of critical information system components or corrupting supplier operations. Safeguards to ensure adequate supplies of critical information system components include, for example: (i) the use of multiple suppliers for the identified critical components; and (ii) stockpiling a sufficient number of spare components/parts to ensure operation during mission critical times.

(15) *SUPPLY CHAIN PROTECTION | PROCESSES TO ADDRESS WEAKNESSES OR DEFICIENCIES*

The organization establishes a process to address weaknesses or deficiencies in supply chain elements identified during independent or organizational assessments of such elements.

Supplemental Guidance: Evidence generated during independent or organizational assessments of supply chain elements (e.g., penetration testing, audits, verification/validation activities) is documented and used in follow-on processes implemented by organizations to respond to the risks related to the identified weaknesses and deficiencies. Supply chain elements include, for example, supplier development processes and supplier distribution systems.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** Not Selected	**HIGH** SA-12

SA-13 TRUSTWORTHINESS

[Withdrawn: Incorporated into multiple security controls as described in Appendix E].

SA-14 CRITICAL INFORMATION SYSTEM COMPONENTS

Control: The organization:

a. Identifies critical information system components; and

b. Re-implements or custom develops [*Assignment: organization-defined critical information system components that require re-implementation or custom development*].

Supplemental Guidance: Organizations determine that certain information system components likely cannot be trusted due to specific threats to and vulnerabilities in those components and for which there are no viable security controls to adequately mitigate the resulting risk. Re-implementation or custom development of such components helps to satisfy requirements for higher assurance. This is accomplished by initiating changes to system components (including hardware, software, and firmware) such that the standard attacks by adversaries are less likely to succeed. Related controls: CP-2, SA-8, SA-12.

Control Enhancements: None.

(1) *SUPPLY CHAIN PROTECTION | NO ALTERNATIVE SOURCING*
[Withdrawn: Incorporated into SA-12].

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SA-15 DEVELOPMENT PROCESS, STANDARDS, AND TOOLS

Control: The organization:

a. Requires that information system developers follow a documented development process that:

- Explicitly addresses security requirements;
- Identifies the standards and tools used in the development process; and
- Documents the specific tool options and tool configurations used in the development of the information system; and

b. Reviews the development process, standards, tools, and tool options/configurations to ensure that the process, standards, tools, and tool options/configurations selected and employed will lead to satisfying organizational security requirements.

Supplemental Guidance: Information systems include the information technology products (i.e., hardware, software, and firmware components) that compose those systems. Information system developer is a general term that includes developers and manufacturers of information technology products (including hardware, software, firmware), systems integrators, vendors, and product resellers. Development tools include, for example, programming languages and computer aided

design (CAD) systems. This control also applies to organizations conducting internal systems development and integration. Related controls: SA-3, SA-8.

Control Enhancements:

(1) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | QUALITY METRICS*

The organization requires that information system developers:

(a) Define quality metrics at the beginning of the development process for the information system; and

(b) Provide evidence of meeting the quality metrics [*Selection (one or more):* [*Assignment: organization-defined frequency*]; [*Assignment: organization-defined program review milestones*]; *upon delivery of the information system*].

Supplemental Guidance: Organizations use quality metrics to establish minimum acceptable levels of information system quality. Metrics may include quality gates which are collections of completion criteria or sufficiency standards representing the satisfactory execution of particular phases of the system development project. A quality gate, for example, may require the elimination of all compiler warnings or an explicit determination that the warnings have no impact on the effectiveness of required security capabilities. During the execution phases of development projects, quality gates provide clear, unambiguous indications of progress. Other metrics apply to the entire development project. These metrics can include defining the severity thresholds of vulnerabilities, for example, requiring no known vulnerabilities in the delivered information system with a Common Vulnerability Scoring System (CVSS) severity of Medium or High.

(2) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | SECURITY TRACKING TOOLS*

The organization requires that information system developers select and employ a security tracking tool for use during the development of the information system.

Supplemental Guidance: Information system development teams select and deploy security vulnerability/work item tracking systems that facilitate assignment, sorting, filtering, and tracking of completed work items or tasks associated with system development processes.

(3) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | CRITICALITY ANALYSIS*

The organization requires that information system developers perform a criticality analysis for the information system at [*Assignment: organization-defined breadth/depth*] and at [*Assignment: organization-defined decision points in the system development life cycle*].

Supplemental Guidance: Developers use criticality analyses as the primary method to identify and prioritize mission-critical functions and information system components. An end-to-end functional decomposition of information systems requires identifying and prioritizing mission threads, decomposing the mission threads into mission-critical functions, and identifying the information system components (i.e., hardware, software, and firmware) that implement those functions (i.e., system components that are critical to the mission effectiveness of information systems or system-of-systems through network connections). Identified functions/components are subsequently assigned levels of criticality commensurate with the consequences of failure or compromises on the ability of the information systems to support assigned missions and/or business functions. Decision points for criticality analyses conducted by developers include, for example, milestone reviews. In sharp contrast, software engineering disciplines use object-oriented structures that do not necessarily provide visibility of interactions. Mission threads and workflow analysis mapped to the technical resources being used are required to identify critical information system elements that become high security risks because of their breadth of interaction. Relying solely on functional decomposition can inadvertently lead to missing a mission-critical function because the function is assigned to a particular system component but shared in actuality by many other components.

(4) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | THREAT MODELING / VULNERABILITY ANALYSIS*

The organization requires that developers perform threat modeling and a vulnerability analysis for the information system at [*Assignment: organization-defined breadth/depth*] that:

(a) Uses [*Assignment: organization-defined information concerning impact, environment of operations, known or assumed threats, and acceptable risk levels*];

(b) Employs [*Assignment: organization-defined tools and methods*]; and

(c) Produces evidence that meets [*Assignment: organization-defined acceptance criteria*].

Supplemental Guidance: Related control: SA-4.

(5) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | ATTACK SURFACE REDUCTION*

The organization requires that information system developers reduce the attack surface of the information system.

Supplemental Guidance: Attack surface reduction is closely aligned with developer threat and vulnerability analyses and information system architecture and design, although it addresses security issues from a slightly different perspective. Attack surface reduction is a means of reducing risk by giving attackers less opportunity to exploit weaknesses or deficiencies (i.e., potential vulnerabilities) within information systems. Attack surface reduction includes, for example, applying the principle of least privilege, employing layered defenses, applying the principle of least functionality (i.e., restricting ports, protocols, functions, and services), and eliminating application programming interfaces (APIs) that are vulnerable to cyber attacks. Related control: CM-7.

(6) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | CONTINUOUS IMPROVEMENT*

The organization requires that information system developers implement an explicit process to continuously improve the system development process.

Supplemental Guidance: Information system developers consider the effectiveness/efficiency of current development processes for meeting quality goals and addressing security capabilities in current threat environments.

(7) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | AUTOMATED VULNERABILITY ANALYSIS*

The organization requires that information system developers:

(a) Perform an automated vulnerability analysis using [*Assignment: organization-defined tools*] to discover vulnerabilities in the information system;

(b) Determine the exploitation potential for discovered vulnerabilities;

(c) Determine potential risk mitigations for delivered vulnerabilities; and

(d) Deliver the outputs of the tools and results of the analysis.

Supplemental Guidance: Related control: RA-5.

(8) *DEVELOPMENT PROCESS, STANDARDS, AND TOOLS | REUSE OF THREAT / VULNERABILITY INFORMATION*

The organization requires that information system developers use threat modeling and vulnerability analyses from similar information systems to inform the current development process.

Supplemental Guidance: Analysis of vulnerabilities found in similar software applications can inform potential design or implementation issues for information systems under development. Similar information systems or system components may exist within developer organizations. Authoritative vulnerability information is available from a variety of public and private sector sources including, for example, the National Vulnerability Database.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** Not Selected	**HIGH** SA-15

SA-16 DEVELOPER-PROVIDED TRAINING

Control: The organization requires that information system developers provide [*Assignment: organization-defined training*] on the correct use and operation of the security functions, controls, and/or mechanisms implemented in the system.

Supplemental Guidance: This control applies to external and internal (in-house) information system developers. Training of personnel is an essential element to ensure the effectiveness of security controls implemented within organizational information systems. Training options include, for

example, classroom-style training, web-based/computer-based training, and hands-on training. Organizations can also request sufficient training materials from developers to conduct in-house training or offer self-training to organizational personnel. Organizations determine the type of training necessary and may require different types of training for different security functions, controls, or mechanisms.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** Not Selected	**HIGH** SA-16

SA-17 DEVELOPER SECURITY ARCHITECTURE AND DESIGN

Control: The organization requires that information system developers produce a design specification and security architecture for the system that:

a. Is created as an integral part of the system development process;

b. Is consistent with and supportive of the security architecture within the enterprise architecture;

c. Accurately and completely describes the required security functionality, and the allocation of security controls among physical and logical components; and

d. Expresses how individual security functions, mechanisms, and services work together to provide required security capabilities and a unified approach to protection.

Supplemental Guidance: Information systems include the information technology products (i.e., hardware, software, and firmware components) that compose those systems. Information system developer is a general term that includes developers or manufacturers of information technology products (including hardware, software, firmware), systems integrators, vendors, and product resellers. SA-17 is primarily directed at external information system (and information technology product) developers although it could be used internally as well for in-house development. In contrast, PL-8 is primarily directed at organizations (i.e., internally focused) to help ensure that organizations develop an information security architecture and such security architecture is integrated or tightly coupled to the enterprise architecture. This distinction is important if/when organizations outsource the development of information systems or information system components to external entities and there is a need to demonstrate consistency with the organization's enterprise architecture and information security architecture. Related controls: PL-8, PM-7, SA-3, SA-8.

Control Enhancements:

(1) *DEVELOPER SECURITY ARCHITECTURE AND DESIGN | FORMAL POLICY MODEL*

The organization requires that information system developers:

(a) Produce, as an integral part of the development, a formal policy model describing the [*Assignment: organization-defined elements of organizational security policy*] to be enforced by the information system; and

(b) Prove that the formal policy model is internally consistent and sufficient to enforce the defined elements of the organizational security policy when implemented by the information system.

Supplemental Guidance: Formal models describe specific behaviors or security policies using formal languages, thus enabling the correctness of those behaviors/policies to be formally proven. Not all components of information systems can be modeled, and generally, formal specifications are scoped to specific behaviors or policies of interest (e.g., non discretionary access control policies). Organizations choose the particular formal modeling language and approach based on the nature of the behaviors/policies to be described and the available tools. Formal modeling tools include, for example, Gypsy and Zed.

(2) *DEVELOPER SECURITY ARCHITECTURE AND DESIGN | SECURITY-RELEVANT COMPONENTS*

The organization requires that information system developers:

(a) Define the security-relevant hardware, software, and firmware components of the information system;

(b) Provide a convincing rationale that the definition for security-relevant hardware, software, and firmware components is complete;

Supplemental Guidance: Security-relevant hardware, software, and firmware components represent the portion of information systems that must be trusted to perform correctly in order for the systems to maintain required security properties. Related control: SA-5.

(3) *DEVELOPER SECURITY ARCHITECTURE AND DESIGN | FORMAL CORRESPONDENCE*

The organization requires that information system developers:

(a) Produce, as an integral part of the development, a formal top level specification (FTLS) that specifies the interfaces to security-relevant hardware, software, and firmware components in terms of exceptions, error messages, and effects;

(b) Show via proof to the extent feasible with additional informal demonstration as necessary, that the FTLS is consistent with the formal policy model;

(c) Show via informal demonstration, that the FTLS completely covers the interfaces to security-relevant hardware, software, and firmware components; and

(d) Show that the FTLS is an accurate description of the implemented security-relevant hardware, software, and firmware components.

Supplemental Guidance: Correspondence is a important part of the assurance gained through modeling. It demonstrates that the implementation is an accurate transformation of the model, and that any additional code or implementation details present has no impact on the behaviors or policies being modeled. Formal methods can be used to show that the high-level security properties are satisfied by the formal information system description, and that the formal system description is correctly implemented by a description of some lower level, for example a hardware description. Consistency between FTLS and formal policy models is generally not amenable to being fully proven. Therefore, a combination of formal/informal methods may be needed to show such consistency. Consistency between the FTLS and implementation may require the use of an informal demonstration due to limitations in the applicability of formal methods to prove that the FTLS accurately reflects the implementation. Related control: SA-5.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** Not Selected	**HIGH** SA-17

SA-18 TAMPER RESISTANCE AND DETECTION

Control: The organization implements a tamper protection program for [*Assignment: organization-defined information systems, system components, and information technology products*].

Supplemental Guidance: Anti-tamper technologies and techniques provide a level of protection for critical information systems, system components, and information technology products, against a number of related threats including modification, reverse engineering, and substitution. Strong identification combined with tamper resistance and/or tamper detection is essential to protecting information systems, components, and products during distribution and when in use. Related controls: PE-3, SA-12, SI-7.

Control Enhancements:

(1) *TAMPER RESISTANCE AND DETECTION | MULTIPLE PHASES OF SDLC*

The organization employs anti-tamper technologies and techniques during multiple phases in the system development life cycle including design, development, integration, operations, and maintenance.

Supplemental Guidance: Organizations use a combination of hardware and software techniques for tamper resistance and detection. Organizations employ obfuscation and self-checking, for example, to make reverse engineering and modifications more difficult, time-consuming, and expensive for adversaries. Customization of information systems and system components can make substitutions easier to detect and therefore, limit damage. Related control: SA-3.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SA-19 ANTI-COUNTERFEIT

Control: The organization:

a. Develops and implements anti-counterfeit policy and procedures that include the means to detect and prevent counterfeit parts from entering the information system;

b. Trains [*Assignment: organization-defined personnel*] to detect counterfeit information system components (including hardware, software, and firmware);

c. Maintains configuration control over [*Assignment: organization-defined information system components*] awaiting service/repair and serviced/repaired components awaiting return to service;

d. Disposes of information system components using [*Assignment: organization-defined techniques and methods*] to prevent entry into the gray market; and

e. Reports counterfeit information system components to developers/manufacturers/vendors, contractors, and [*Assignment: organization-defined external reporting organizations*].

Supplemental Guidance: Anti-counterfeiting policy and procedures support tamper resistance and provide a level of protection against the introduction of malware. External reporting organizations include, for example, US-CERT. Related controls: PE-3, SA-12, SI-7.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: SYSTEM AND COMMUNICATIONS PROTECTION

SC-1 SYSTEM AND COMMUNICATIONS PROTECTION POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented system and communications protection policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the system and communications protection policy and associated system and communications protection controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the SC family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** SC-1	**MOD** SC-1	**HIGH** SC-1

SC-2 APPLICATION PARTITIONING

Control: The information system separates user functionality (including user interface services) from information system management functionality.

Supplemental Guidance: Information system management functionality includes, for example, functions necessary to administer databases, network components, workstations, or servers, and typically requires privileged user access. The separation of user functionality from information system management functionality is either physical or logical. Organizations implement separation of system management-related functionality from user functionality by using different computers, different central processing units, different instances of operating systems, different network addresses, virtualization techniques, or combinations of these or other methods, as appropriate. This type of separation includes, for example, web administrative interfaces that use separate authentication methods for users of any other information system resources. Separation of system and user functionality may include isolating administrative interfaces on different domains and with additional access controls. Related controls: SA-4, SA-8, SC-3.

Control Enhancements:

(1) *APPLICATION PARTITIONING | INTERFACES FOR NON-PRIVILEGED USERS*

The information system prevents the presentation of information system management-related functionality at an interface for non-privileged users.

Supplemental Guidance: This control enhancement ensures that administration options (e.g., administrator privileges) are not available to general users (including prohibiting the use of the grey-out option commonly used to eliminate accessibility to such information). Such

restrictions include, for example, not presenting administration options until users establish sessions with administrator privileges. Related control: AC-3.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-2	**HIGH** SC-2

SC-3 SECURITY FUNCTION ISOLATION

Control: The information system isolates security functions from nonsecurity functions.

Supplemental Guidance: The information system isolates security functions from nonsecurity functions by means of an isolation boundary (implemented via partitions and domains) that controls access to and protects the integrity of the hardware, software, and firmware that perform those security functions. Information systems implement code separation (i.e., separation of security functions from non-security functions) in a number of ways, including, for example, through the provision of security kernels via processor rings or processor modes. For non-kernel code, security function isolation is often achieved through file system protections that serve to protect the code on disk, and address space protections that protect executing code. Information systems restrict access to security functions through the use of access control mechanisms and by implementing least privilege capabilities. Related controls: AC-3, AC-6, SA-4, SA-5, SA-8, SC-2, SC-41.

Control Enhancements:

(1) *SECURITY FUNCTION ISOLATION | HARDWARE SEPARATION*

The information system implements underlying hardware separation mechanisms to facilitate security function isolation.

Supplemental Guidance: The hardware ring architecture, commonly implemented within microprocessors, is an example of an underlying hardware separation mechanism.

(2) *SECURITY FUNCTION ISOLATION | ACCESS / FLOW CONTROL FUNCTIONS*

The information system isolates security functions enforcing access and information flow control from both nonsecurity functions and from other security functions.

Supplemental Guidance: Security functions that are potentially isolated from access and flow control enforcement functions include, for example, auditing, intrusion detection, and anti-virus functions.

(3) *SECURITY FUNCTION ISOLATION | MINIMIZE NONSECURITY FUNCTIONALITY*

The organization minimizes the number of nonsecurity functions included within the isolation boundary containing security functions.

Supplemental Guidance: Nonsecurity functions contained within the isolation boundary are considered security-relevant because errors or maliciousness in such software, by virtue of being within the boundary, can impact the security functions of organizational information systems. The design objective is that the specific portions of information systems providing information security are of minimal size/complexity. Minimizing the number of nonsecurity functions in the security-relevant components of information systems allows designers and implementers to focus only on those functions which are necessary to provide the desired security capability (typically access enforcement). By minimizing nonsecurity functions within the isolation boundaries, the amount of code that must be trusted to enforce security policies is reduced, thus contributing to understandability.

(4) *SECURITY FUNCTION ISOLATION | MODULE COUPLING*

The organization implements security functions as largely independent modules that avoid unnecessary interactions between modules by limiting module coupling to [*Assignment: organization-defined level*].

Supplemental Guidance: The reduction in inter-module interactions helps to constrain security functions and to manage complexity. The concepts of coupling and cohesion are important with respect to modularity in software design. Coupling refers to the dependencies that one module has on other modules. Cohesion refers to the relationship between the different functions within a particular module. Good software engineering practices rely on modular decomposition, layering, minimization to reduce and manage complexity, thus producing software modules that are highly cohesive and loosely coupled.

(5) *SECURITY FUNCTION ISOLATION | LAYERED STRUCTURES*

The organization implements security functions as a layered structure minimizing interactions between layers of the design and avoiding any dependence by lower layers on the functionality or correctness of higher layers.

Supplemental Guidance: The implementation of layered structures with minimized interactions among security functions and non-looping layers (i.e., lower-layer functions do not depend on higher-layer functions) further enables the isolation of security functions and management of complexity.

(6) *SECURITY FUNCTION ISOLATION | BOUNDARY PROTECTION MECHANISMS*

The organization employs boundary protection mechanisms to separate [*Assignment: organization-defined information system components*] directly supporting [*Assignment: organization-defined missions and/or business functions*].

Supplemental Guidance: Organizations can isolate information system components performing different missions and/or business functions. Such isolation limits unauthorized information flows among system components and also provides the opportunity to deploy greater levels of protection for selected components. Separating system components with boundary protection mechanisms provides the capability for increased protection of individual components and to more effectively control information flows between those components. This type of enhanced protection limits the potential harm from cyber attacks and errors. The degree of separation provided varies depending upon the mechanisms chosen. Boundary protection mechanisms include, for example, routers, gateways, and firewalls separating system components into physically separate networks or sub-networks, cross-domain devices separating sub-networks, and encrypting information flows among system components using distinct encryption keys.

(7) *SECURITY FUNCTION ISOLATION | MODULE COHESION*

The organization implements security functions as cohesive modules with [*Assignment: organization-defined level of cohesiveness*].

Supplemental Guidance: The concepts of coupling and cohesion are important with respect to modularity in software design. Coupling refers to the dependencies that one module has on other modules. Cohesion refers to the relationship between the different functions within a particular module. Good software engineering practices rely on modular decomposition, layering, minimization to reduce and manage complexity, thus producing software modules that are highly cohesive and loosely coupled.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** Not Selected	**HIGH** SC-3 (6)

SC-4 INFORMATION IN SHARED RESOURCES

Control: The information system prevents unauthorized and unintended information transfer via shared system resources.

Supplemental Guidance: This control prevents information, including encrypted representations of information, produced by the actions of prior users/roles (or the actions of processes acting on behalf of prior users/roles) from being available to any current users/roles (or current processes) that obtain access to shared system resources (e.g., registers, main memory, hard disks) after those

resource have been released back to information systems. The control of information in shared information system resources is also referred to as object reuse. This control does not address: (i) information remanence which refers to residual representation of data that has been nominally erased or removed; (ii) covert channels (including storage or timing channels) where shared resources are manipulated to violate information flow restrictions; or (iii) components within information systems for which there are only single users/roles. Related controls: AC-3, AC-4, MP-6.

Control Enhancements:

(1) *INFORMATION IN SHARED RESOURCES | SECURITY LEVELS*

[Withdrawn: Incorporated into SC-4].

(2) *INFORMATION IN SHARED RESOURCES | CLASSIFICATION LEVELS / SECURITY CATEGORIES*

The information system prevents unauthorized information transfer via shared resources in accordance with organization-defined procedures when system processing explicitly switches between different information classification levels or security categories.

Supplemental Guidance: This control enhancement applies when there are explicit changes in information processing levels during information system operations, for example, during multi-level processing and periods processing with information at different classification levels or security categories. Organization-defined procedures may include, for example, approved sanitization processes for electronically stored information. Related control: MP-6.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-4	**HIGH** SC-4

SC-5 DENIAL OF SERVICE PROTECTION

Control: The information system protects against or limits the effects of the following types of denial of service attacks: [*Assignment: organization-defined types of denial of service attacks or reference to source for such information*] by employing [*Assignment: organization-defined security safeguards*].

Supplemental Guidance: A variety of technologies exist to limit, or in some cases, eliminate the effects of denial of service attacks. For example, boundary protection devices can filter certain types of packets to protect information system components on internal organizational networks from being directly affected by denial of service attacks. Employing increased capacity and bandwidth combined with service redundancy may also reduce the susceptibility to denial of service attacks. Related controls: SC-6, SC-7.

Control Enhancements:

(1) *DENIAL OF SERVICE PROTECTION | RESTRICT INTERNAL USERS*

The information system restricts the ability of individuals to launch [*Assignment: organization-defined denial of service attacks*] against other information systems.

Supplemental Guidance: Restricting the ability of individuals to launch denial of service attacks requires that the mechanisms used for such attacks are unavailable. Individuals of concern can include, for example, hostile insiders or external adversaries that have successfully breached the information system and are using the system as a platform to launch cyber attacks on third parties. Organizations can restrict the ability of individuals to connect and transmit arbitrary information on the transport medium (i.e., network, wireless spectrum). Organizations can also limit the ability of individuals to use excessive information system resources. Protection against individuals having the ability to launch denial of service attacks may be implemented on specific information systems or on boundary devices prohibiting egress to potential target systems.

(2) *DENIAL OF SERVICE PROTECTION | EXCESS CAPACITY / BANDWIDTH / REDUNDANCY*

The information system manages excess capacity, bandwidth, or other redundancy to limit the effects of information flooding denial of service attacks.

Supplemental Guidance: Managing excess capacity ensures that sufficient capacity is available to counter flooding attacks. Managing excess capacity may include, for example, establishing selected usage priorities, quotas, or partitioning.

(3) *DENIAL OF SERVICE PROTECTION | DETECTION / MONITORING*

The organization:

(a) Employs [*Assignment: organization-defined monitoring tools*] to detect indicators of denial of service attacks against the information system; and

(b) Monitors [*Assignment: organization-defined information system resources*] to determine if sufficient resources exist to prevent effective denial of service attacks.

Supplemental Guidance: Organizations consider utilization and capacity of information system resources when managing risk from denial of service due to malicious attacks. Denial of service attacks can originate from external or internal sources. Information system resources sensitive to denial of service include, for example, physical disk storage, memory, and CPU cycles. Common safeguards to prevent denial of service attacks related to storage utilization and capacity include, for example, instituting disk quotas, configuring information systems to automatically alert administrators when specific storage capacity thresholds are reached, using file compression technologies to maximize available storage space, and imposing separate partitions for system and user data. Related controls: CA-7, SI-4.

References: None.

Priority and Baseline Allocation:

P1	**LOW** SC-5	**MOD** SC-5	**HIGH** SC-5

SC-6 RESOURCE AVAILABILITY

Control: The information system protects the availability of resources by allocating [*Assignment: organization-defined resources*] by [*Selection (one or more); priority; quota;* [*Assignment: organization-defined security safeguards*]].

Supplemental Guidance: Priority protection helps prevent lower-priority processes from delaying or interfering with the information system servicing any higher-priority processes. Quotas prevent users or processes from obtaining more than predetermined amounts of resources. This control does not apply to information system components for which there are only single users/roles.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-7 BOUNDARY PROTECTION

Control: The information system:

a. Monitors and controls communications at the external boundary of the system and at key internal boundaries within the system; and

b. Connects to external networks or information systems only through managed interfaces consisting of boundary protection devices arranged in accordance with an organizational security architecture.

Supplemental Guidance: Managed interfaces implemented by organizations provide boundary protection capability using automated mechanisms or devices. Managed interfaces include, for example, gateways, routers, firewalls, guards, or encrypted tunnels implemented within a security architecture (e.g., routers protecting firewalls or application gateways residing on protected subnetworks). Subnetworks that are physically separated from and external to internal networks are commonly referred to as demilitarized zones or DMZs. Restricting and prohibiting interfaces within organizational information systems includes, for example, restricting external web traffic to web servers within managed interfaces and prohibiting external traffic that appears to be spoofing internal addresses. Organizations consider the shared nature of commercial telecommunications services in the implementation of security controls associated with the use of such services. Commercial telecommunications services are commonly based on network components and consolidated management systems shared by all attached commercial customers, and may also include third-party provided access lines and other service elements. Such transmission services may represent sources of increased risk despite contract security provisions. Related controls: AC-4, AC-17, CA-3, CM-7, IR-4, RA-3, SC-5, SC-13.

Control Enhancements:

(1) *BOUNDARY PROTECTION | PHYSICALLY SEPARATED SUBNETWORKS*

The organization physically allocates publicly accessible information system components to subnetworks that are physically separated from and external to internal organizational networks.

Supplemental Guidance: Publicly accessible information system components include, for example, public web servers.

(2) *BOUNDARY PROTECTION | PUBLIC ACCESS*

[Withdrawn: Incorporated into SC-7].

(3) *BOUNDARY PROTECTION | ACCESS POINTS*

The organization limits the number of access points to the information system to allow for more comprehensive monitoring of inbound and outbound communications and network traffic.

Supplemental Guidance: The Trusted Internet Connection (TIC) initiative is an example of limiting the number of managed network access points.

(4) *BOUNDARY PROTECTION | EXTERNAL TELECOMMUNICATIONS SERVICES*

The organization:

(a) Implements a managed interface for each external telecommunication service;

(b) Establishes a traffic flow policy for each managed interface;

(c) Protects the confidentiality and integrity of the information being transmitted;

(d) Documents each exception to the traffic flow policy with a supporting mission/business need and duration of that need;

(e) Reviews exceptions to the traffic flow policy [*Assignment: organization-defined frequency*]; and

(f) Removes traffic flow policy exceptions that are no longer supported by an explicit mission/business need.

Supplemental Guidance: Related controls: SC-8, SC-9, SC-13.

(5) *BOUNDARY PROTECTION | DENY BY DEFAULT / ALLOW BY EXCEPTION*

The information system at managed interfaces, denies network traffic by default and allows network traffic by exception (i.e., deny all, permit by exception).

(6) *BOUNDARY PROTECTION | RESPONSE TO RECOGNIZED FAILURES*

The organization prevents the unauthorized release of information outside of the information system boundary or any unauthorized communication through the information system boundary when there is a recognized operational failure of one or more boundary protection mechanisms at the managed interface.

Supplemental Guidance: Related controls: CP-2, SC-24.

(7) *BOUNDARY PROTECTION | REMOTE DEVICES*

The information system prevents remote devices that have established a non-remote connection with the system from communicating outside of that communications path with resources in external networks.

Supplemental Guidance: This control enhancement is implemented within remote devices (e.g., notebook computers) through configuration settings that are not configurable by users of those devices. Non-remote communications paths from remote devices include, for example, virtual private networks. When non-remote connections are established using virtual private networks, configuration settings prevent split-tunneling. Split tunneling might otherwise be used by remote users to communicate with organizational information systems as extensions of those systems and to communicate with local resources such as printers/file servers. Since remote devices, when connected through non-remote connections, become extensions of the information systems, allowing dual communications paths such as split-tunneling would be, in effect, allowing unauthorized external connections into the systems.

(8) *BOUNDARY PROTECTION | ROUTE TRAFFIC TO AUTHENTICATED PROXY SERVERS*

The information system routes [*Assignment: organization-defined internal communications traffic*] to [*Assignment: organization-defined external networks*] through authenticated proxy servers at managed interfaces.

Supplemental Guidance: External networks are networks outside the control of organizations. Proxy servers support logging individual Transmission Control Protocol (TCP) sessions and blocking specific Uniform Resource Locators (URLs), domain names, and Internet Protocol (IP) addresses. Proxy servers can be configured with organization-defined lists of authorized and unauthorized websites. Related controls: AC-3, AU-2.

(9) *BOUNDARY PROTECTION | RESTRICT OUTGOING COMMUNICATIONS TRAFFIC*

The information system:

(a) Detects and denies outgoing communications traffic posing a threat to external information systems; and

(b) Audits the identity of internal users associated with denied communications.

Supplemental Guidance: Detecting outgoing communications traffic from internal actions that may pose threats to external information systems is sometimes termed extrusion detection. Extrusion detection at information system boundaries as part of managed interfaces includes the analysis of incoming and outgoing network traffic looking for indications of internal threats to the security of external systems. Such threats include, for example, traffic indicative of denial of service attacks and traffic containing malware. Related controls: AU-2, SI-4.

(10) *BOUNDARY PROTECTION | UNAUTHORIZED EXFILTRATION*

The organization prevents the unauthorized exfiltration of information across managed interfaces.

Supplemental Guidance: Safeguards implemented by organizations to prevent unauthorized exfiltration of information from information systems include, for example: (i) strict adherence to protocol formats; (ii) monitoring for beaconing from information systems; (iii) monitoring for steganography; (iv) disconnecting external network interfaces except when explicitly needed; (v) disassembling and reassembling packet headers; and (vi) employing traffic profile analysis to detect deviations from the volume/types of traffic expected within organizations. Devices enforcing strict adherence to protocol formats include, for example, deep packet inspection firewalls and XML gateways. These devices verify adherence to protocol formats and specification at the application layer and serve to identify vulnerabilities that cannot be detected by devices operating at the network or transport layers.

(11) *BOUNDARY PROTECTION | RESTRICT INCOMING COMMUNICATIONS TRAFFIC*

The information system only allows incoming communications from [*Assignment: organization-defined authorized sources*] routed to [*Assignment: organization-defined authorized destinations*].

Supplemental Guidance: This control enhancement provides determinations that source and destination address pairs represent authorized/allowed communications. Such determinations can be based on several factors including, for example, the presence of source/destination address pairs in lists of authorized/allowed communications, the absence of address pairs in

lists of unauthorized/disallowed pairs, or meeting more general rules for authorized/allowed source/destination pairs. Related control: AC-3.

(12) *BOUNDARY PROTECTION | HOST-BASED PROTECTION*

The organization implements [*Assignment: organization-defined host-based boundary protection mechanisms*] at [*Assignment: organization-defined information system components*].

Supplemental Guidance: Host-based boundary protection mechanisms include, for example, host-based firewalls. Information system components employing host-based boundary protection mechanisms include, for example, servers, workstations, and mobile devices.

(13) *BOUNDARY PROTECTION | ISOLATION OF SECURITY TOOLS / MECHANISMS / SUPPORT COMPONENTS*

The organization isolates [*Assignment: organization-defined information security tools, mechanisms, and support components*] from other internal information system components by implementing physically separate subnetworks with managed interfaces to other components of the system.

Supplemental Guidance: Such techniques could prove useful, for example, in ensuring the isolation of computer network defenses from critical operational processing networks to prevent adversaries from discovering the analysis and forensics techniques of organizations. Related controls: SA-8, SC-2, SC-3.

(14) *BOUNDARY PROTECTION | UNAUTHORIZED PHYSICAL CONNECTIONS*

The organization protects against unauthorized physical connections at [*Assignment: organization-defined managed interfaces*].

Supplemental Guidance: Information systems operating at different security categories or classification levels may share common physical and environmental controls, since the systems may share space within organizational facilities. In practice, it is possible that these separate information systems may share common equipment rooms, wiring closets, and cable distribution paths. Protection against unauthorized physical connections can be achieved, for example, by employing clearly identified and physically separated cable trays, connection frames, and patch panels for each side of managed interfaces with physical access controls enforcing limited authorized access to these items. Related controls: PE-4, PE-19.

(15) *BOUNDARY PROTECTION | ROUTE PRIVILEGED NETWORK ACCESSES*

The information system routes all networked, privileged accesses through a dedicated, managed interface for purposes of access control and auditing.

Supplemental Guidance: Related controls: AC-2, AC-3, AC-4, AU-2, SI-4.

(16) *BOUNDARY PROTECTION | PREVENT DISCOVERY OF COMPONENTS / DEVICES*

The information system prevents discovery of specific system components (or devices) composing a managed interface.

Supplemental Guidance: This control enhancement protects network addresses of information system components that are part of managed interfaces from discovery through common tools and techniques used to identify devices on networks. Network addresses are not available for discovery (e.g., network address not published or entered in domain name systems), requiring prior knowledge for access. Another obfuscation technique is to periodically change network addresses.

(17) *BOUNDARY PROTECTION | AUTOMATED ENFORCEMENT OF PROTOCOL FORMATS*

The organization employs automated mechanisms to enforce adherence to protocol formats.

Supplemental Guidance: Automated mechanisms that enforce protocol formats include, for example, deep packet inspection firewalls and XML gateways. Such devices verify adherence to protocol formats/specifications (e.g., IEEE) at the application layer and identify significant vulnerabilities that cannot be detected by devices operating at the network or transport layers. Related controls: AC-4, SC-4.

(18) *BOUNDARY PROTECTION | FAIL SECURE*

The information system fails securely in the event of an operational failure of a boundary protection device.

Supplemental Guidance: Fail secure is a condition achieved by employing information system mechanisms to ensure that in the event of operational failures of boundary protection devices

at managed interfaces (e.g., routers, firewalls, guards, and application gateways residing on protected subnetworks commonly referred to as demilitarized zones), information systems do not enter into unsecure states where intended security properties no longer hold. Failures of boundary protection devices cannot lead to, or cause information external to the devices to enter the devices, nor can failures permit unauthorized information releases. Related controls: CP-2, SC-24.

(19) *BOUNDARY PROTECTION | BLOCKING INBOUND / OUTBOUND COMMUNICATIONS TRAFFIC*

The information system blocks both inbound and outbound communications traffic between [*Assignment: organization-defined communication clients*] that are independently configured by end users and external service providers.

Supplemental Guidance: Communication clients independently configured by end users and external service providers include, for example, instant messaging clients. Traffic blocking does not apply to communication clients that are configured by organizations to perform authorized functions.

(20) *BOUNDARY PROTECTION | DYNAMIC ISOLATION / SEGREGATION*

The information system provides the capability to dynamically isolate/segregate [*Assignment: organization-defined information system components*] from other components of the system.

Supplemental Guidance: The capability to dynamically isolate or segregate certain internal components of organizational information systems is useful when it is necessary to partition or separate certain components of dubious origin from those components possessing greater trustworthiness. Component isolation reduces the attack surface of organizational information systems. Isolation of selected information system components is also a means of limiting the damage from successful cyber attacks when those attacks occur.

References: FIPS Publication 199; NIST Special Publications 800-41, 800-77.

Priority and Baseline Allocation:

P1	**LOW** SC-7	**MOD** SC-7 (1) (3) (4) (5) (7)	**HIGH** SC-7 (1) (3) (4) (5) (6) (7) (8)

SC-8 TRANSMISSION INTEGRITY

Control: The information system protects the integrity of transmitted information.

Supplemental Guidance: This control applies to both internal and external networks. For distributed systems including, for example, service-oriented architectures, this control applies to end-to-end integrity between the system components/services originating the transmitted information and the system components/services receiving the transmitted information. Organizations relying on commercial service providers offering transmission services as commodity items rather than as fully dedicated services, may find it difficult to obtain the necessary assurances regarding the implementation of needed security controls for transmission integrity. When it is infeasible or impractical to obtain the necessary security controls and assurances of control effectiveness through appropriate contracting vehicles, organizations implement appropriate compensating security controls or explicitly accept the additional risk. Related controls: AC-17, PE-4.

Control Enhancements:

(1) *TRANSMISSION INTEGRITY | CRYPTOGRAPHIC OR ALTERNATE PHYSICAL PROTECTION*

The organization employs cryptographic mechanisms implementing [*Selection: FIPS-validated cryptography; NSA-approved cryptography*] to detect changes to information during transmission unless otherwise protected by [*Assignment: organization-defined alternative physical safeguards*].

Supplemental Guidance: Encrypting information for transmission protects information from unauthorized modification. Alternative physical security safeguards include, for example, protected distribution systems. Related control: SC-13.

(2) *TRANSMISSION INTEGRITY | INTEGRITY PRIOR TO TRANSMISSION*

The information system maintains the integrity of information during preparation for transmission and during reception.

Supplemental Guidance: Information can be unintentionally and/or maliciously modified during preparation for transmission or during reception including, for example, during aggregation, protocol transformation points, and packing/unpacking. These unauthorized modifications compromise the integrity of the information. Related control: AU-10.

References: FIPS Publications 140-2, 197; NIST Special Publications 800-52, 800-77, 800-81, 800-113; NSTISSI No. 7003.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-8 (1)	**HIGH** SC-8 (1)

SC-9 TRANSMISSION CONFIDENTIALITY

Control: The information system protects the confidentiality of transmitted information.

Supplemental Guidance: This control applies to both internal and external networks. For distributed systems including, for example, service-oriented architectures, this control applies to end-to-end confidentiality between the system components/services originating the transmitted information and the system components/services receiving the transmitted information. Organizations relying on commercial service providers offering transmission services as commodity items rather than as fully dedicated services may find it difficult to obtain the necessary assurances regarding the implementation of needed security controls for transmission confidentiality. When it is infeasible or impractical to obtain the necessary security controls and assurances of control effectiveness through appropriate contracting vehicles, organizations implement appropriate compensating security controls or explicitly accept the additional risk. Related controls: AC-17, PE-4.

Control Enhancements:

(1) *TRANSMISSION CONFIDENTIALITY | CRYPTOGRAPHIC OR ALTERNATE PHYSICAL PROTECTION*

The organization employs cryptographic mechanisms implementing [*Selection: FIPS-validated cryptography; NSA-approved cryptography*] to prevent unauthorized disclosure of information during transmission unless otherwise protected by [*Assignment: organization-defined alternative physical safeguards*].

Supplemental Guidance: Encrypting information for transmission protects information (e.g., controlled unclassified information) from individuals without authorization or need to know. Alternative physical safeguards include, for example, protected distribution systems. Related control: SC-13.

(2) *TRANSMISSION CONFIDENTIALITY | PRIOR TO TRANSMISSION*

The information system maintains the confidentiality of information during preparation for transmission and during reception.

Supplemental Guidance: Information can be unintentionally and/or maliciously disclosed during preparation for transmission or during reception including, for example, during data aggregation, protocol transformation points, and packing/unpacking. These unauthorized disclosures compromise the confidentiality of the information.

(3) *TRANSMISSION CONFIDENTIALITY | CRYPTOGRAPHIC OR ALTERNATIVE PROTECTION FOR MESSAGE EXTERNALS*

The information system encrypts message externals using [*Selection: FIPS-validated cryptography; NSA-approved cryptography*] unless otherwise protected by [*Assignment: organization-defined alternative physical safeguards*].

Supplemental Guidance: Message externals include, for example, message headers/routing information. This control enhancement prevents the exploitation of message externals and applies to both internal and external networks or links that may be visible to individuals who are not authorized users. Header/routing information is sometimes transmitted unencrypted because the information is not properly identified by organizations as having significant value

or because encrypting the information can result in lower network performance and/or higher costs. Alternative physical safeguards include, for example, protected distribution systems. Related controls: SC-12, SC-13.

(4) *TRANSMISSION CONFIDENTIALITY | CONCEAL / RANDOMIZE COMMUNICATIONS*

The information system conceals or randomizes communications patterns using [*Selection: FIPS-validated cryptography; NSA-approved cryptography*] unless otherwise protected by [*Assignment: organization-defined alternative physical safeguards*].

Supplemental Guidance: Communication patterns include, for example, frequency, periods, amount, and predictability. Changes to communications patterns can reveal information having intelligence value especially when combined with other available information related to missions/business functions supported by organizational information systems. This control enhancement prevents the derivation of intelligence based on communications patterns and applies to both internal and external networks or links that may be visible to individuals who are not authorized users. Encrypting the links and transmitting in continuous, fixed, or random patterns, prevents the derivation of intelligence from the system communications patterns. Alternative physical safeguards include, for example, protected distribution systems. Related controls: SC-12, SC-13.

References: FIPS Publications 140-2, 197; NIST Special Publications 800-52, 800-77, 800-113; CNSS Policy 15; NSTISSI No. 7003.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-9 (1)	**HIGH** SC-9 (1)

SC-10 NETWORK DISCONNECT

Control: The information system terminates the network connection associated with a communications session at the end of the session or after [*Assignment: organization-defined time period*] of inactivity.

Supplemental Guidance: This control applies to both internal and external networks and local and remote connections. Terminating network connections associated with communications sessions include, for example, de-allocating associated TCP/IP address/port pairs at the operating-system level, or de-allocating networking assignments at the application level if multiple application sessions are using a single, operating system-level network connection. Time periods of inactivity may be established by organizations and include, for example, time periods by type of network access or for specific network accesses.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** SC-10	**HIGH** SC-10

SC-11 TRUSTED PATH

Control: The information system establishes a trusted communications path between the user and the following security functions of the system: [*Assignment: organization-defined security functions to include at a minimum, information system authentication and reauthentication*].

Supplemental Guidance: Trusted paths are mechanisms by which users (through input devices) can communicate directly with security functions of information systems with the requisite assurance to support information security policies. The mechanisms can only be activated by users or the

security functions of organizational information systems. User responses via trusted paths are protected from modifications by or disclosure to untrusted applications. Organizations employ trusted paths for high-assurance connections between security functions of information systems and users (e.g., during system logons).

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-12 CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT

Control: The organization establishes and manages cryptographic keys for required cryptography employed within the information system in accordance with [*Assignment: organization-defined requirements for key generation, distribution, storage, access, and destruction*].

Supplemental Guidance: Cryptographic key management and establishment can be performed using manual procedures or automated mechanisms with supporting manual procedures. Organizations define key management requirements in accordance with applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance, specifying appropriate options, levels, and parameters. Related controls: SC-13, SC-17.

Control Enhancements:

(1) *CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | AVAILABILITY*

The organization maintains availability of information in the event of the loss of cryptographic keys by users.

Supplemental Guidance: Escrowing of encryption keys is a common practice for ensuring availability in the event of loss of keys (e.g., due to forgotten passphrase).

(2) *CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | SYMMETRIC KEYS*

The organization produces, controls, and distributes symmetric cryptographic keys using [*Selection: NIST FIPS-compliant; NSA-approved*] key management technology and processes.

(3) *CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | ASYMMETRIC KEYS*

The organization produces, controls, and distributes asymmetric cryptographic keys using [*Selection: NSA-approved key management technology and processes; approved PKI Class 3 certificates or prepositioned keying material; approved PKI Class 3 or Class 4 certificates and hardware security tokens that protect the user's private key*].

(4) *CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | PKI CERTIFICATES*

[Withdrawn: Incorporated into SC-12].

(5) *CRYPTOGRAPHIC KEY ESTABLISHMENT AND MANAGEMENT | PKI CERTIFICATES / HARDWARE TOKENS*

[Withdrawn: Incorporated into SC-12].

References: NIST Special Publications 800-56, 800-57.

Priority and Baseline Allocation:

P1	**LOW** SC-12	**MOD** SC-12	**HIGH** SC-12 (1)

SC-13 CRYPTOGRAPHIC PROTECTION

Control: The information system implements required cryptographic protections using cryptographic modules that comply with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance.

Supplemental Guidance: This control does not impose any requirements on organizations to use cryptography. Rather, if cryptography is required based on the selection of other controls and subsequently implemented by organizational information systems, the cryptographic modules comply with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Generally applicable cryptographic standards include, for example, FIPS-validated cryptography to protect unclassified information and NSA-approved cryptography to protect classified information. Related controls: AC-2, AC-3, AC-7, AC-17, AC-18, AU-9, AU-10, CM-11, CP-9, IA-3, IA-7, MA-4, MP-2, MP-4, MP-5, SA-4, SC-8, SC-9, SC-12, SC-28, SI-7.

Control Enhancements:

(1) *CRYPTOGRAPHIC PROTECTION | FIPS-VALIDATED CRYPTOGRAPHY*

The information system implements, at a minimum, FIPS-validated cryptography to protect unclassified information.

(2) *CRYPTOGRAPHIC PROTECTION | NSA-APPROVED CRYPTOGRAPHY*

The information system implements NSA-approved cryptography to protect classified information.

(3) *CRYPTOGRAPHIC PROTECTION | INDIVIDUALS WITHOUT FORMAL ACCESS APPROVALS*

The information system implements, at a minimum, FIPS-validated cryptography to protect information when such information must be separated from individuals who have the necessary clearances yet lack the necessary formal access approvals.

(4) *CRYPTOGRAPHIC PROTECTION | DIGITAL SIGNATURES*

The information system implements [*Selection: FIPS-validated; NSA-approved*] cryptography to provide digital signatures.

Supplemental Guidance: Related control: SC-17.

References: FIPS Publication 140-2; Web: CSRC.NIST.GOV/CRYPTVAL, WWW.CNSS.GOV.

Priority and Baseline Allocation:

P1	**LOW** SC-13	**MOD** SC-13	**HIGH** SC-13

SC-14 PUBLIC ACCESS PROTECTIONS

Control: The information system protects the integrity and availability of publicly available information and applications.

Supplemental Guidance: This control addresses the protection needs for public information and applications with such protection likely being implemented as part of other security controls. Related controls: AC-3, SI-3, SI-4, SI-5, SI-7, SI-9, SI-10.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** SC-14	**MOD** SC-14	**HIGH** SC-14

SC-15 COLLABORATIVE COMPUTING DEVICES

Control: The information system:

a. Prohibits remote activation of collaborative computing devices with the following exceptions: [*Assignment: organization-defined exceptions where remote activation is to be allowed*]; and

b. Provides an explicit indication of use to users physically present at the devices.

Supplemental Guidance: Collaborative computing devices include, for example, networked white boards, cameras, and microphones. Explicit indication of use includes, for example, signals to users when collaborative computing devices are activated. Related control: AC-21.

Control Enhancements:

(1) *COLLABORATIVE COMPUTING DEVICES | PHYSICAL DISCONNECT*

The information system provides physical disconnect of collaborative computing devices in a manner that supports ease of use.

(2) *COLLABORATIVE COMPUTING DEVICES | BLOCKING INBOUND / OUTBOUND COMMUNICATIONS TRAFFIC*

[Withdrawn: Incorporated into SC-7].

(3) *COLLABORATIVE COMPUTING DEVICES | DISABLING / REMOVAL IN SECURE WORK AREAS*

The organization disables or removes collaborative computing devices from [*Assignment: organization-defined information systems or information system components*] in [*Assignment: organization-defined secure work areas*].

(4) *COLLABORATIVE COMPUTING DEVICES | EXPLICITLY INDICATE CURRENT PARTICIPANTS*

The information system provides an explicit indication of current participants in [*Assignment: organization-defined online meetings and teleconferences*].

References: None.

Priority and Baseline Allocation:

P1	**LOW** SC-15	**MOD** SC-15	**HIGH** SC-15

SC-16 TRANSMISSION OF SECURITY ATTRIBUTES

Control: The information system associates [*Assignment: organization-defined security attributes*] with information exchanged between information systems and between system components.

Supplemental Guidance: Security attributes can be explicitly or implicitly associated with the information contained in organizational information systems or system components. Related controls: AC-3, AC-4, AC-16.

Control Enhancements:

(1) *TRANSMISSION OF SECURITY ATTRIBUTES | INTEGRITY VALIDATION*

The information system validates the integrity of transmitted security attributes.

Supplemental Guidance: This control enhancement ensures that the verification of integrity of transmitted information includes security attributes. Related controls: AU-10, SC-8.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-17 PUBLIC KEY INFRASTRUCTURE CERTIFICATES

Control: The organization issues public key certificates under an [*Assignment: organization-defined certificate policy*] or obtains public key certificates from an approved service provider.

Supplemental Guidance: For user certificates, organizations obtain certificates from approved, shared service providers, as required by OMB policy. For organizations operating legacy public key infrastructures cross-certified with the Federal Bridge Certification Authority at medium assurance or higher, this Certification Authority suffices. This control addresses certificates with visibility external to organizational information systems and does not address certificates related to

the internal operations of systems, for example, application-specific time services. Related control: SC-12.

Control Enhancements: None.

References: OMB Memorandum 05-24; NIST Special Publications 800-32, 800-63.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-17	**HIGH** SC-17

SC-18 MOBILE CODE

Control: The organization:

a. Defines acceptable and unacceptable mobile code and mobile code technologies;

b. Establishes usage restrictions and implementation guidance for acceptable mobile code and mobile code technologies; and

c. Authorizes, monitors, and controls the use of mobile code within the information system.

Supplemental Guidance: Decisions regarding the employment of mobile code within organizational information systems are based on the potential for the code to cause damage to the systems if used maliciously. Mobile code technologies include, for example, Java, JavaScript, ActiveX, Postscript, PDF, Shockwave movies, Flash animations, and VBScript. Usage restrictions and implementation guidance apply to both the selection and use of mobile code installed on servers and mobile code downloaded and executed on individual workstations and devices (e.g., smart phones). Mobile code policy and procedures address preventing the development, acquisition, or introduction of unacceptable mobile code within organizational information systems. Related controls: AU-2, AU-12, CM-2, CM-6, SI-3.

Control Enhancements:

(1) *MOBILE CODE | IDENTIFY UNACCEPTABLE CODE / TAKE CORRECTIVE ACTIONS*

The information system identifies [*Assignment: organization-defined unacceptable mobile code*] and takes [*Assignment: organization-defined corrective actions*].

Supplemental Guidance: Corrective actions when unacceptable mobile code is detected include, for example, blocking, quarantine, or alerting administrators. Blocking includes, for example, preventing transmission of word processing files with embedded macros when such macros have been defined to be unacceptable mobile code.

(2) *MOBILE CODE | ACQUISITION / DEVELOPMENT / USE*

The organization ensures the acquisition, development, and use of mobile code to be deployed in the information system meets [*Assignment: organization-defined mobile code requirements*].

(3) *MOBILE CODE | PREVENT DOWNLOADING / EXECUTION*

The information system prevents the download and execution of [*Assignment: organization-defined unacceptable mobile code*].

(4) *MOBILE CODE | PREVENT AUTOMATIC EXECUTION*

The information system prevents the automatic execution of mobile code in [*Assignment: organization-defined software applications*] and enforces [*Assignment: organization-defined actions*] prior to executing the code.

Supplemental Guidance: Actions enforced before executing mobile code, include, for example, prompting users prior to opening electronic mail attachments. Preventing automatic execution of mobile code includes, for example, disabling auto execute features on information system components employing removable media such as Compact Disks (CDs), Digital Video Disks (DVDs), and Universal Serial Bus (USB) devices.

(5) *MOBILE CODE | ALLOW EXECUTION IN ONLY IN CONFINED ENVIRONMENTS*

The organization allows execution of permitted mobile code only in confined virtual machine environments.

References: NIST Special Publication 800-28; DoD Instruction 8552.01.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-18	**HIGH** SC-18

SC-19 VOICE OVER INTERNET PROTOCOL

Control: The organization:

a. Establishes usage restrictions and implementation guidance for Voice over Internet Protocol (VoIP) technologies based on the potential to cause damage to the information system if used maliciously; and

b. Authorizes, monitors, and controls the use of VoIP within the information system.

Supplemental Guidance: Related controls: CM-6, SC-7, SC-15.

Control Enhancements: None.

References: NIST Special Publication 800-58.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-19	**HIGH** SC-19

SC-20 SECURE NAME / ADDRESS RESOLUTION SERVICE (AUTHORITATIVE SOURCE)

Control: The information system:

a. Provides additional data origin and integrity artifacts along with the authoritative name resolution data the system returns in response to external name/address resolution queries; and

b. Provides the means to indicate the security status of child subspaces and (if the child supports secure resolution services) to enable verification of a chain of trust among parent and child domains, when operating as part of a distributed, hierarchical namespace.

Supplemental Guidance: This control enables external clients including, for example, remote Internet clients, to obtain origin authentication and integrity verification assurances for the host/service name to network address resolution information obtained through the service. Information systems that provide name and address resolution services include, for example, domain name system (DNS) servers. Additional artifacts include, for example, DNS Security (DNSSEC) digital signatures and cryptographic keys. DNS resource records are examples of authoritative data. The means to indicate the security status of child subspaces includes, for example, the use of delegation signer resource records in the DNS. The DNS security controls reflect (and are referenced from) OMB Memorandum 08-23. Information systems that use technologies other than the DNS to map between host/service names and network addresses provide other means to assure the authenticity and integrity of response data. Related controls: AU-10, SC-13, SC-17, SC-21, SC-22.

Control Enhancements:

(1) *SECURE NAME / ADDRESS RESOLUTION SERVICE (AUTHORITATIVE SOURCE) | CHILD SUBSPACES*

[Withdrawn: Incorporated into SC-20].

(2) *SECURE NAME / ADDRESS RESOLUTION SERVICE (AUTHORITATIVE SOURCE) | DATA ORIGIN / INTEGRITY*

The information system provides data origin and integrity protection artifacts for internal name/address resolution queries.

References: OMB Memorandum 08-23; NIST Special Publication 800-81.

Priority and Baseline Allocation:

P1	**LOW** SC-20	**MOD** SC-20	**HIGH** SC-20

SC-21 SECURE NAME / ADDRESS RESOLUTION SERVICE (RECURSIVE OR CACHING RESOLVER)

Control: The information system requests and performs data origin authentication and data integrity verification on the name/address resolution responses the system receives from authoritative sources.

Supplemental Guidance: Each client of name resolution services either performs this validation on its own, or has authenticated channels to trusted validation providers. Information systems that provide name and address resolution services for local clients include, for example, recursive resolving or caching domain name system (DNS) servers. DNS client resolvers either perform validation of DNSSEC signatures or clients use authenticated channels to recursive resolvers that perform such validations. Information systems that use technologies other than the DNS to map between host/service names and network addresses provide other means to enable clients to verify the authenticity and integrity of response data. Related controls: SC-20, SC-22.

Control Enhancements: None.

(1) *SECURE NAME / ADDRESS RESOLUTION SERVICE (RECURSIVE OR CACHING RESOLVER) | DATA ORIGIN / INTEGRITY*

[Withdrawn: Incorporated into SC-21].

References: NIST Special Publication 800-81.

Priority and Baseline Allocation:

P1	**LOW** SC-21	**MOD** SC-21	**HIGH** SC-21

SC-22 ARCHITECTURE AND PROVISIONING FOR NAME / ADDRESS RESOLUTION SERVICE

Control: The information systems that collectively provide name/address resolution service for an organization are fault-tolerant and implement internal/external role separation.

Supplemental Guidance: Information systems that provide name and address resolution services include, for example, domain name system (DNS) servers. To eliminate single points of failure and to enhance redundancy, organizations employ at least two authoritative domain name system servers, one configured as the primary server and the other configured as the secondary server. Additionally, organizations typically deploy the servers in two geographically-separated network subnetworks (i.e., not located in the same physical facility). For role separation, DNS servers with internal roles, only process name and address resolution requests from within organizations (i.e., from internal clients). DNS servers with external roles only process name and address resolution information requests from clients external to organizations (i.e., on external networks including the Internet). Organizations specify clients that can access authoritative DNS servers in particular roles (e.g., by address ranges, explicit lists). Related controls: SC-2, SC-20, SC-21, SC-24.

Control Enhancements: None.

References: NIST Special Publication 800-81.

Priority and Baseline Allocation:

P1	**LOW** SC-22	**MOD** SC-22	**HIGH** SC-22

SC-23 SESSION AUTHENTICITY

Control: The information system protects the authenticity of communications sessions.

Supplemental Guidance: This control addresses communications protection at the session, versus packet level (e.g., sessions in service-oriented architectures providing web-based services) and establishes grounds for confidence at both ends of communications sessions in ongoing identities of other parties and in the validity of information transmitted. Authenticity protection includes, for example, protecting against man-in-the-middle attacks/session hijacking and the insertion of false information into sessions. Related controls: SC-8, SC-9, SC-10, SC-11.

Control Enhancements:

(1) *SESSION AUTHENTICITY | INVALIDATE SESSION IDENTIFIERS AT LOGOUT*

The information system invalidates session identifiers upon user logout or other session termination.

(2) *SESSION AUTHENTICITY | USER-INITIATED LOGOUTS / MESSAGE DISPLAYS*

The information system:

(a) Provides a logout capability for user-initiated communications sessions whenever authentication is used to gain access to [*Assignment: organization-defined information resources*]; and

(b) Displays an explicit logout message to users indicating the reliable termination of authenticated communications sessions.

Supplemental Guidance: Information resources to which users gain access via authentication include, for example, password-protected websites and web-based services. Logout messages for web page access, for example, can be displayed after authenticated sessions have been terminated. However, for some types of interactive sessions, including, for example, file transfer protocol (FTP) sessions, information systems typically send logout messages as final messages prior to terminating sessions.

(3) *SESSION AUTHENTICITY | UNIQUE SESSION IDENTIFIERS*

The information system generates a unique session identifier for each session and recognizes only session identifiers that are system-generated.

(4) *SESSION AUTHENTICITY | UNIQUE SESSION IDENTIFIERS WITH RANDOMIZATION*

The information system generates unique session identifiers with [*Assignment: organization-defined randomness requirements*].

Supplemental Guidance: Employing the concept of randomness in the generation of unique session identifiers helps to protect against brute-force attacks to determine future session identifiers.

(5) *SESSION AUTHENTICITY | ALLOWED CERTIFICATE AUTHORITIES*

The information system only allows the installation of [*Assignment: organization-defined certificate authorities*] for verification of the establishment of protected sessions.

Supplemental Guidance: Reliance on certificate authorities (CA) for the establishment of secure sessions includes, for example, the use of Secure Socket Layer (SSL) and/or Transport Layer Security (TLS) certificates. These certificates, after verification by the respective certificate authorities, facilitate the establishment of protected sessions between web clients and web servers.

References: NIST Special Publications 800-52, 800-77, 800-95.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-23	**HIGH** SC-23

SC-24 FAIL IN KNOWN STATE

Control: The information system fails to a [*Assignment: organization-defined known-state*] for [*Assignment: organization-defined types of failures*] preserving [*Assignment: organization-defined system state information*] in failure.

Supplemental Guidance: Failure in a known state addresses security concerns in accordance with the mission/business needs of organizations. Failure in a known secure state helps prevents the loss of confidentiality, integrity, or availability of information in the event of failures of organizational information systems or system components. Failure in a known safe state helps prevent systems from failing to a state that may cause injury to individuals or destruction to property. Preserving information system state information facilitates system restart and return to the operational mode of organizations with less disruption of mission/business processes. Related controls: CP-2, CP-10, SC-7, SC-22.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** Not Selected	**HIGH** SC-24

SC-25 THIN NODES

Control: The organization employs processing components that have minimal functionality and information storage.

Supplemental Guidance: The deployment of information system components with reduced/minimal functionality (e.g., diskless nodes and thin client technologies) reduces the need to secure every user endpoint, and may reduce the exposure of information, information systems, and services to cyber attacks. Related control: SC-30.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-26 HONEYPOTS

Control: The information system includes components specifically designed to be the target of malicious attacks for the purpose of detecting, deflecting, and analyzing such attacks.

Supplemental Guidance: Related control: SI-3.

Control Enhancements: None.

(1) *HONEYPOTS | DETECTION OF MALICIOUS CODE*
[Withdrawn: Incorporated into SC-36].

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-27 OPERATING SYSTEM-INDEPENDENT APPLICATIONS

Control: The information system includes: [*Assignment: organization-defined operating system-independent applications*].

Supplemental Guidance: Operating system-independent applications are applications that can run on multiple operating systems. Such applications promote portability and reconstitution on different platform architectures, increasing the availability of critical functions within organizations while information systems with specific operating systems are under attack. Related control: SC-29.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-28 PROTECTION OF INFORMATION AT REST

Control: The information system protects the confidentiality and integrity of [*Assignment: organization-defined information at rest*].

Supplemental Guidance: This control addresses the confidentiality and integrity of information at rest and covers user information and system information. Information at rest refers to the state of information when it is located on storage devices as specific components of information systems. System-related information requiring protection includes, for example, configurations or rule sets for firewalls, gateways, intrusion detection/prevention systems, filtering routers, and authenticator content. Organizations may employ different mechanisms to achieve confidentiality and integrity protections. Organizations may also employ other security controls including for example, secure off-line storage in lieu of online storage when adequate protection of information at rest cannot otherwise be achieved. Related controls: AC-3, AC-6, CM-3, CM-5, CM-6, MP-4, MP-5, PE-3, SC-8, SC-9, SC-13, SI-3, SI-7.

Control Enhancements:

(1) *PROTECTION OF INFORMATION AT REST | CRYPTOGRAPHIC PROTECTION*

The organization employs cryptographic mechanisms implementing [*Selection: FIPS-validated cryptography; NSA-approved cryptography*] to prevent unauthorized disclosure and modification of [*Assignment: organization-defined information at rest*].

Supplemental Guidance: Related control: SC-13.

References: NIST Special Publications 800-56, 800-57, 800-111.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-28	**HIGH** SC-28

SC-29 HETEROGENEITY

Control: The organization employs a diverse set of information technologies for [*Assignment: organization-defined information system components*] in the implementation of the information system.

Supplemental Guidance: Increasing the diversity of information technologies within organizational information systems reduces the impact of potential exploitations of specific technologies and also defends against common mode failures, including those failures induced by supply chain attacks. An increase in diversity may add complexity and management overhead which could ultimately lead to mistakes and unauthorized configurations. Related controls: SA-12, SA-14, SC-27.

Control Enhancements:

(1) *HETEROGENEITY | VIRTUALIZATION TECHNIQUES*

The organization employs virtualization techniques to support the deployment of a diversity of operating systems and applications that are changed [*Assignment: organization-defined frequency*].

Supplemental Guidance: While frequent changes to operating systems and applications pose configuration management challenges, the changes can result in an increased work factor for adversaries in order to carry out successful cyber attacks. Changing virtual operating systems or applications, as opposed to changing actual operating systems/applications, provide virtual changes that impede attacker success while reducing configuration management efforts. In addition, virtualization techniques can assist organizations in isolating untrustworthy software and/or software of dubious provenance into confined execution environments.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-30 CONCEALMENT AND MISDIRECTION

Control: The organization employs [*Assignment: organization-defined concealment and misdirection techniques*] for [*Assignment: organization-defined information systems*] at [*Assignment: organization-defined time periods*] to confuse and mislead adversaries.

Supplemental Guidance: Concealment and misdirection techniques can significantly reduce the targeting capability of adversaries (i.e., window of opportunity and available attack surface) to initiate and complete cyber attacks. For example, virtualization techniques provide organizations with the ability to disguise information systems, potentially reducing the likelihood of successful attacks without the cost of having multiple platforms. Increased use of concealment/misdirection techniques including, for example, randomness, uncertainty, and virtualization, may sufficiently confuse and mislead adversaries and subsequently increase the risk of discovery and/or exposing tradecraft. Concealment/misdirection techniques may also provide organizations additional time to successfully perform core missions and business functions. Because of the time and effort required to support concealment/misdirection techniques, it is anticipated that such techniques would be used by organizations on a very limited basis. Related controls: SC-26, SC-29, SI-14.

Control Enhancements:

(1) *CONCEALMENT AND MISDIRECTION | VIRTUALIZATION TECHNIQUES*

[Withdrawn: Incorporated into SC-29].

(2) *CONCEALMENT AND MISDIRECTION | RANDOMNESS*

The organization employs [*Assignment: organization-defined techniques*] to introduce randomness into organizational operations and assets.

Supplemental Guidance: Randomness introduces increased levels of uncertainty for adversaries regarding the actions organizations take in defending against cyber attacks. Such actions may

impede the ability of adversaries to correctly target information resources of organizations supporting critical missions/business functions. Uncertainty may also cause adversaries to hesitate before initiating or continuing attacks. Misdirection techniques involving randomness include, for example, performing certain routine actions at different times of day, employing different information technologies (e.g., browsers, search engines), using different suppliers, and rotating roles and responsibilities of organizational personnel.

(3) *CONCEALMENT AND MISDIRECTION | CHANGE PROCESSING / STORAGE LOCATIONS*

The organization changes the location of [*Assignment: organization-defined processing and/or storage*] at [*Selection:* [*Assignment: organization-defined time intervals*]*; random time intervals*]].

Supplemental Guidance: Adversaries target critical organizational missions/business functions and the information resources supporting those missions and functions while at the same time, trying to minimize exposure of their existence and tradecraft. The static, homogeneous, and deterministic nature of organizational information systems targeted by adversaries, make such systems more susceptible to cyber attacks with less adversary cost and effort to be successful. Changing organizational processing and storage locations (sometimes referred to as moving target defense), addresses advanced persistent threats using techniques such as virtualization, distributed processing, and replication. This enables organizations to relocate the information resources (i.e., processing and/or storage) supporting critical missions and business functions. Changing locations of processing activities and/or storage sites introduces uncertainty into the targeting activities by adversaries. This uncertainty increases the work factor of adversaries making compromises and breaches to organizational information systems more difficult and time-consuming, and increasing the chances that adversaries may inadvertently disclose aspects of tradecraft while attempting locate critical organizational resources.

(4) *CONCEALMENT AND MISDIRECTION | MISLEADING INFORMATION*

The organization employs realistic, but misleading information in [*Assignment: organization-defined information system components*] with regard to its security state or posture.

Supplemental Guidance: This control enhancement misleads potential adversaries regarding the nature and extent of security safeguards deployed by organizations. As a result, adversaries may employ incorrect (and as a result ineffective) attack techniques. One way of misleading adversaries is for organizations to place misleading information regarding the specific security controls deployed in external information systems that are known to be accessed or targeted by adversaries. Another technique is the use of deception nets (e.g., honey nets, virtualized environments) that mimic actual aspects of organizational information systems but use, for example, out-of-date software configurations.

(5) *CONCEALMENT AND MISDIRECTION | CONCEALMENT OF SYSTEM COMPONENTS*

The organization employs [*Assignment: organization-defined techniques*] to hide or conceal [*Assignment: organization-defined information system components*].

Supplemental Guidance: By hiding, disguising, or otherwise concealing critical information system components, organizations may be able to decrease the probability that adversaries target and successfully compromise those assets. Potential means for organizations to hide and/or conceal information system components include, for example, configuration of routers or the use of honeynets or virtualization techniques.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-31 COVERT CHANNEL ANALYSIS

Control: The organization requires that information system developers identify exploitable covert [*Selection (one or more): storage; timing*] channels within the system and estimate the maximum bandwidth of those channels.

Supplemental Guidance: Information system developers are in the best position to identify potential areas within systems that might lead to covert channels. Covert channel analysis is a meaningful activity when there is the potential for unauthorized information flows across security domains, for example, in the case of information systems containing export-controlled information and having connections to external networks (i.e., networks not controlled by organizations). Covert channel analysis is also meaningful in the case of multilevel secure (MLS) information systems, multiple security level (MSL) systems, and cross-domain systems. Related controls: AC-4, PL-2.

Control Enhancements:

(1) *COVERT CHANNEL ANALYSIS | TESTING OF DEVELOPER-IDENTIFIED COVERT CHANNELS*

[Withdrawn: Incorporated into SC-31].

(2) *COVERT CHANNEL ANALYSIS | MAXIMUM BANDWIDTH*

The organization requires that information system developers reduce the maximum bandwidth for identified covert [*Selection (one or more); storage; timing*] channels to [*Assignment: organization-defined values*].

(3) *COVERT CHANNEL ANALYSIS | MEASURE BANDWIDTH IN OPERATIONAL ENVIRONMENTS*

The organization measures the bandwidth of [*Assignment: organization-defined subset of identified covert channels*] in the operational environment of the information system.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-32 INFORMATION SYSTEM PARTITIONING

Control: The organization partitions the information system into components residing in separate physical domains (or environments) based on [*Assignment: organization-defined circumstances for physical separation of components*].

Supplemental Guidance: Information system partitioning is a part of a defense-in-depth protection strategy. Organizations determine the degree of physical separation of system components from physically distinct components in separate racks in the same room, to components in separate rooms for the more critical components, to more significant geographical separation of the most critical components. Security categorization can guide the selection of appropriate candidates for domain partitioning. Managed interfaces restrict or prohibit network access and information flow among partitioned information system components. Related controls: AC-4, SA-8, SC-2, SC-3, SC-7.

Control Enhancements: None.

References: FIPS Publication 199.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SC-32	**HIGH** SC-32

SC-33 TRANSMISSION PREPARATION INTEGRITY

[Withdrawn: Incorporated into SC-8].

SC-34 NON-MODIFIABLE EXECUTABLE PROGRAMS

Control: The information system at [*Assignment: organization-defined information system components*]:

a. Loads and executes the operating environment from hardware-enforced, read-only media; and

b. Loads and executes [*Assignment: organization-defined applications*] from hardware-enforced, read-only media.

Supplemental Guidance: The term *operating environment* is defined as the specific code that hosts applications, for example, operating systems, executives, or monitors including virtual machine monitors (i.e., hypervisors). It can also include certain applications running directly on hardware platforms. Hardware-enforced, read-only media include, for example, Compact Disk-Recordable (CD-R)/Digital Video Disk-Recordable (DVD-R) disk drives and one-time programmable read only memory. The use of non-modifiable storage ensures the integrity of software from the point of creation of the read-only image. The use of reprogrammable read-only memory can be accepted as read-only media provided: (i) integrity can be adequately protected from point of initial writing to the insertion of the memory into the information system; and (ii) there are reliable hardware protections against reprogramming the memory while installed in organizational information systems. Related controls: AC-3, SI-7.

Control Enhancements:

(1) *NON-MODIFIABLE EXECUTABLE PROGRAMS | NO WRITABLE STORAGE*

The organization employs [*Assignment: organization-defined information system components*] with no writeable storage that is persistent across component restart or power on/off.

Supplemental Guidance: This control enhancement: (i) eliminates the possibility of malicious code insertion via persistent, writeable storage within the designated information system components; and (ii) applies to both fixed and removable storage, with the latter being addressed directly or as specific restrictions imposed through access controls for mobile devices. Related controls: AC-19, MP-7.

(2) *NON-MODIFIABLE EXECUTABLE PROGRAMS | INTEGRITY PROTECTION / READ-ONLY MEDIA*

The organization protects the integrity of the information when using read-only media.

Supplemental Guidance: This control enhancement protects the integrity of information to be placed onto read-only media and controls the media after information has been recorded onto the media. Security safeguards prevent the substitution of media into information systems or the reprogramming of programmable read-only media prior to installation into the systems. Security safeguards may include a combination of prevention and detection/response. Related controls: AC-3, AC-5, CM-3, CM-5, CM-9, MP-2, MP-4, MP-5, SA-12, SC-28, SI-3, and SI-7.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-35 TECHNICAL SURVEILLANCE COUNTERMEASURES SURVEY

Control: The organization employs a technical surveillance countermeasures survey at [*Assignment: organization-defined locations*] [*Selection (one or more):* [*Assignment: organization-defined frequency*]; [*Assignment: organization-defined events or indicators occur*]].

Supplemental Guidance: Technical surveillance countermeasures surveys are performed by qualified personnel to detect the presence of technical surveillance devices/hazards and to identify technical security weaknesses that could aid in the conduct of technical penetrations of surveyed facilities. Such surveys provide evaluations of the technical security postures of organizations and facilities

and typically include thorough visual, electronic, and physical examinations in and about surveyed facilities.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-36 HONEYCLIENTS

Control: The information system includes components that proactively seek to identify malicious websites and/or web-based malicious code.

Supplemental Guidance: Related control: SI-3.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-37 DISTRIBUTED PROCESSING AND STORAGE

Control: The organization distributes [*Assignment: organization-defined processing and storage*] across multiple physical locations.

Supplemental Guidance: Distributing processing and storage across multiple physical locations provides some degree of redundancy or overlap for organizations, and therefore, increases the work factor of adversaries to adversely impact organizational operations, assets, and individuals. This control does not assume a single primary processing or storage location, and thus allows for parallel processing and storage. Related controls: CP-6, CP-7.

Control Enhancements:

(1) *DISTRIBUTED PROCESSING AND STORAGE | DIVERSITY OF IMPLEMENTATION*

The organization employs diversity of implementation in the distribution of [*Assignment: organization-defined processing and storage components*].

Supplemental Guidance: Diversity in the implementation of distributed processing and storage components that compose organizational information systems reduces the likelihood that the means adversaries use to compromise one component will be equally effective against other components, thus further increasing the work factor to successfully complete planned cyber attacks.

(2) *DISTRIBUTED PROCESSING AND STORAGE | POLLING TECHNIQUES*

The organization employs polling techniques to identify potential faults, errors, or compromises to [*Assignment: organization-defined distributed processing and storage components*].

Supplemental Guidance: Distributed processing and/or storage may be employed to reduce opportunities for adversaries to successfully compromise the confidentiality, integrity, or availability of information and information systems. However, distribution of processing and/or storage components does not prevent adversaries from compromising one (or more) of the distributed components. Polling compares the processing results and/or storage content from the various distributed components and subsequently voting on the outcomes. Polling identifies potential faults, errors, or compromises in distributed processing and/or storage components.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-38 MALWARE ANALYSIS

Control: The organization:

a. Employs [*Assignment: organization-defined tools and techniques*] to analyze the behavior of malware; and

b. Incorporates the results from malware analysis into organizational incident response and flaw remediation processes.

Supplemental Guidance: The application of selected malware analysis tools and techniques provides organizations with a more in-depth understanding of adversary tradecraft (i.e., tactics, techniques, and procedures) and the functionality and purpose of specific instances of malware. Understanding malware facilitates more effective organizational responses to current threats and more effective responses to future threats. Organizations can conduct malware analyses either statically (without executing code) or dynamically (by monitoring the behavior of executing code).

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-39 OUT-OF-BAND CHANNELS

Control: The organization employs [*Assignment: organization-defined out-of-band channels*] for the physical delivery or electronic transmission of [*Assignment: organization-defined information, information system components, or devices*] to [*Assignment: organization-defined individuals or information systems*].

Supplemental Guidance: Out-of-band channels include, for example, local (non-network) accesses to information systems, network paths physically separate from network paths used for operational traffic, or non-electronic paths such as the US Postal Service. This is in contrast with using the same channels (i.e., in-band channels) that carry routine operational traffic. Out-of-band channels do not have the same vulnerability and exposure as in-band channels and hence the confidentiality, integrity, or availability compromises of in-band channels will not compromise the out-of-band channels. Organizations may employ out-of-band channels in the delivery or transmission of many organizational items including, for example, identifiers/authenticators, configuration management changes for hardware, firmware, or software, cryptographic key management information, security updates, maintenance information, and malicious code protection updates. Related controls: AC-2, CM-3, CM-5, CM-7, IA-4, IA-5, MA-4, SC-12, SI-3, SI-4, and SI-7.

Control Enhancements:

(1) *OUT-OF-BAND CHANNELS | ENSURE DELIVERY / TRANSMISSION*

The organization employs [*Assignment: organization-defined security safeguards*] to ensure that only [*Assignment: organization-defined individuals or information systems*] receive the [*Assignment: organization-defined information, information system components, or devices*].

Supplemental Guidance: Techniques and/or methods employed by organizations to ensure that only designated information systems or individuals receive particular information, system components, or devices include, for example, sending authenticators via courier service but

requiring recipients to show some form of government-issued photographic identification as a condition of receipt.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-40 OPERATIONS SECURITY

Control: The organization employs [*Assignment: organization-defined operations security safeguards*] to protect key organizational information throughout the system development life cycle.

Supplemental Guidance: Operations security (OPSEC) is a systematic process by which potential adversaries can be denied information about the capabilities and intentions of organizations by identifying, controlling, and protecting generally unclassified information that specifically relates to the planning and execution of sensitive organizational activities. The OPSEC process involves five steps: (i) identification of critical information (e.g., the security categorization process); (ii) analysis of threats; (iii) analysis of vulnerabilities; (iv) assessment of risks; and (v) the application of appropriate countermeasures. OPSEC safeguards are applied to both organizational information systems and the environments in which those systems operate. OPSEC safeguards help protect the confidentiality of key information including, for example, limiting the sharing of information with suppliers and potential suppliers of information system components, information technology products and services, and with other non-organizational elements and individuals. Information critical to mission/business success includes, for example, user identities, element uses, suppliers, supply chain processes, functional and security requirements, system design specifications, testing protocols, and security control implementation details. Related control: PM-14.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

SC-41 PROCESS ISOLATION

Control: The information system maintains a separate execution domain for each executing process.

Supplemental Guidance: Information systems can maintain separate execution domains for each executing process by assigning each process a separate address space. Each information system process has a distinct address space so that communication between processes is performed in a manner controlled through the security functions, and one process cannot modify the executing code of another process. Maintaining separate execution domains for executing processes can be achieved, for example, by implementing separate address spaces. This capability is available in most commercial operating systems that employ multi-state processor technologies. Related controls: AC-3, AC-4, AC-6, SA-4, SA-5, SA-8, SC-2, SC-3.

Control Enhancements:

(1) *PROCESS ISOLATION | HARDWARE SEPARATION*

The information system implements underlying hardware separation mechanisms to facilitate process separation.

Supplemental Guidance: Hardware memory management is an example of an underlying hardware separation mechanism.

(2) *PROCESS ISOLATION | THREAD ISOLATION*

The information system maintains a separate execution domain for each thread in [*Assignment: organization-defined multi-threaded processing*].

References: None.

Priority and Baseline Allocation:

P1	**LOW** SC-41	**MOD** SC-41	**HIGH** SC-41

SC-42 WIRELESS LINK PROTECTION

Control: The information system protects its external and internal wireless links [*Assignment: organization-defined wireless links*] from [*Assignment: organization-defined types of signal parameter attacks or references to sources for attacks*] that are based upon exploiting the signal parameters of these links.

Supplemental Guidance: This control applies to internal and external wireless communication links that may be visible to individuals who are not authorized information system users. There are various ways to exploit the signal parameters of wireless links to gain intelligence, deny service, or to spoof users of organizational information systems. This control reduces the impact of attacks that are unique to wireless systems. If organizations rely on commercial service providers for transmission services as commodity items rather than as fully dedicated services, it may not be possible to implement this control. Related control: SC-5.

Control Enhancements:

(1) *WIRELESS LINK PROTECTION | ELECTROMAGNETIC INTERFERENCE*

The information system employs [*Selection: FIPS-validated cryptography and key management system; NSA-approved cryptography and key management*] that achieves [*Assignment: organization-defined level of protection*] against the effects of intentional electromagnetic interference.

Supplemental Guidance: The control enhancement protects against intentional jamming that might deny or impair communications by ensuring that wireless, spread spectrum waveforms used to provide anti-jam protection are not predictable by unauthorized individuals. The control enhancement may also coincidentally help to mitigate the effects of unintentional jamming due to interference from legitimate transmitters sharing the same spectrum. Mission requirements, projected threats, concept of operations, and applicable legislation, directives, regulations, policies, standards, and guidelines determine levels of wireless link availability and performance/cryptography needed. Related controls: SC-12, SC-13.

(2) *WIRELESS LINK PROTECTION | REDUCE DETECTION POTENTIAL*

The information system employs [*Selection: FIPS-validated cryptography and key management system; NSA-approved cryptography and key management*] to reduce the detection potential of its wireless links to [*Assignment: organization-defined level of reduction*].

Supplemental Guidance: This control enhancement is needed for covert communications and protecting wireless transmitters from being geo-located by their transmissions. The control enhancement ensures that spread spectrum waveforms used to achieve low probability of detection are not predictable by unauthorized individuals. Mission requirements, projected threats, concept of operations, and applicable legislation, directives, regulations, policies, standards, and guidelines determine the levels to which wireless links should be undetectable. Related controls: SC-12, SC-13.

(3) *WIRELESS LINK PROTECTION | IMITATIVE OR MANIPULATIVE COMMUNICATIONS DECEPTION*

The information system employs [*Selection: FIPS-validated cryptography and key management system; NSA-approved cryptography and key management*] to identify and reject wireless transmissions that are deliberate attempts to achieve imitative or manipulative communications deception based on signal parameters.

Supplemental Guidance: This control enhancement ensures that the signal parameters of wireless transmissions are not predictable by unauthorized individuals which reduces the probability of imitative or manipulative communications deception based upon signal parameters alone. Related controls: SC-12, SC-13.

(4) *WIRELESS LINK PROTECTION | SIGNAL PARAMETER IDENTIFICATION*

The information system employs [*Selection: FIPS-validated cryptography and key management system; NSA-approved cryptography and key management*] to ensure that [*Assignment: organization-defined wireless transmitters*] cannot be identified by their signal parameters.

Supplemental Guidance: Radio fingerprinting techniques identify the unique signal parameters of transmitters to fingerprint such transmitters for purposes of tracking and mission/user identification. This control enhancement protects against the unique identification of wireless transmitters for purposes of intelligence exploitation by ensuring that anti-fingerprinting alterations to signal parameters are not predictable by unauthorized individuals. This control enhancement helps assure mission success when anonymity is required. Related controls: SC-12, SC-13.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

FAMILY: SYSTEM AND INFORMATION INTEGRITY

SI-1 SYSTEM AND INFORMATION INTEGRITY POLICY AND PROCEDURES

Control: The organization develops, disseminates, and reviews/updates [*Assignment: organization-defined frequency*]:

a. A formal, documented system and information integrity policy that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and

b. Formal, documented procedures to facilitate the implementation of the system and information integrity policy and associated system and information integrity controls.

Supplemental Guidance: This control addresses the establishment of policy and procedures for the effective implementation of selected security controls and control enhancements in the SI family. Policy and procedures reflect applicable federal laws, Executive Orders, directives, regulations, policies, standards, and guidance. Security program policies and procedures at the organization level may make the need for system-specific policies and procedures unnecessary. The policy can be included as part of the general information security policy for organizations. The procedures can be established for the security program in general and for particular information systems, if needed. The organizational risk management strategy is a key factor in establishing policy and procedures. Related control: PM-9.

Control Enhancements: None.

References: NIST Special Publications 800-12, 800-100.

Priority and Baseline Allocation:

P1	**LOW** SI-1	**MOD** SI-1	**HIGH** SI-1

SI-2 FLAW REMEDIATION

Control: The organization:

a. Identifies, reports, and corrects information system flaws;

b. Installs security-relevant software and firmware updates;

c. Tests software and firmware updates related to flaw remediation for effectiveness and potential side effects on organizational information systems before installation; and

d. Incorporates flaw remediation into the organizational configuration management process.

Supplemental Guidance: Organizations identify information systems affected by announced software flaws including potential vulnerabilities resulting from those flaws, and report this information to designated organizational personnel with information security responsibilities. Security-relevant software updates include, for example, patches, service packs, hot fixes, and anti-virus signatures. Organizations also address flaws discovered during security assessments, continuous monitoring, incident response activities, and system error handling. Organizations take advantage of available resources such as the Common Weakness Enumeration (CWE) or Common Vulnerabilities and Exposures (CVE) databases in remediating flaws discovered in organizational information systems. By incorporating flaw remediation into ongoing configuration management processes, required/anticipated remediation actions can be tracked and verified. Flaw remediation actions that can be tracked and verified include, for example, determining whether organizations follow US-CERT guidance and Information Assurance Vulnerability Alerts. Related controls: CA-2, CA-7, CM-3, CM-5, CM-8, MA-2, IR-4, RA-5, SA-10, SA-11, SI-11.

Control Enhancements:

(1) *FLAW REMEDIATION | CENTRAL MANAGEMENT AND AUTOMATIC SOFTWARE / FIRMWARE UPDATES*

The organization:

(a) Centrally manages the flaw remediation process; and

(b) Installs [*Assignment: organization-defined software and firmware updates*] automatically to [*Assignment: organization-defined information system components*].

Supplemental Guidance: Due to information system integrity and availability concerns, organizations give careful consideration to the methodology used to carry out automatic updates.

(2) *FLAW REMEDIATION | AUTOMATED FLAW REMEDIATION STATUS*

The organization employs automated mechanisms [*Assignment: organization-defined frequency*] to determine the state of information system components with regard to flaw remediation.

Supplemental Guidance: Related control: CM-6.

(3) *FLAW REMEDIATION | TIME TO REMEDIATE FLAWS / CORRECTIVE ACTIONS*

The organization:

(a) Measures the time between flaw identification and flaw remediation; and

(b) Takes corrective actions when the time exceeds [*Assignment: organization-defined benchmarks*].

(4) *FLAW REMEDIATION | AUTOMATED PATCH MANAGEMENT TOOLS*

[Withdrawn: Incorporated into SI-2].

References: NIST Special Publication 800-40.

Priority and Baseline Allocation:

P1	**LOW** SI-2	**MOD** SI-2 (2)	**HIGH** SI-2 (1) (2)

SI-3 MALICIOUS CODE PROTECTION

Control: The organization:

a. Employs malicious code protection mechanisms at information system entry and exit points and at workstations, servers, or mobile computing devices on the network to detect and eradicate malicious code:

- Transported by electronic mail, electronic mail attachments, web accesses, removable media, or other common means; or
- Inserted through the exploitation of information system vulnerabilities;

b. Updates malicious code protection mechanisms (including signature definitions) whenever new releases are available in accordance with organizational configuration management policy and procedures;

c. Configures malicious code protection mechanisms to:

- Perform periodic scans of the information system [*Assignment: organization-defined frequency*] and real-time scans of files from external sources at [*Selection (one or more); endpoint; network entry/exit points*] as the files are downloaded, opened, or executed in accordance with organizational security policy; and
- [*Selection (one or more): block malicious code; quarantine malicious code; send alert to administrator;* [*Assignment: organization-defined action*]] in response to malicious code detection; and

d. Addresses the receipt of false positives during malicious code detection and eradication and the resulting potential impact on the availability of the information system.

Supplemental Guidance: Information system entry and exit points include, for example, firewalls, electronic mail servers, web servers, proxy servers, and remote-access servers. Malicious code includes, for example, viruses, worms, Trojan horses, and spyware. Malicious code can also be encoded in various formats (e.g., UUENCODE, Unicode), contained within compressed files, or hidden in files using steganography. Removable media includes, for example, USB devices, diskettes, or compact disks. A variety of technologies and methods exist to limit or eliminate the effects of malicious code. Pervasive configuration management and comprehensive software integrity controls may be effective in preventing execution of unauthorized code. In addition to commercial off-the-shelf software, malicious code may also be present in custom-built software. This could include, for example, logic bombs, back doors, and other types of cyber attacks that could affect organizational missions/business functions. Traditional malicious code protection mechanisms cannot always detect such code. In these situations, organizations rely instead on other safeguards including, for example, secure coding practices, configuration management and control, trusted procurement processes, and monitoring practices to help ensure that software does not perform functions other than those functions intended. Organizations may determine that in response to malicious code detection, different actions may be warranted for different situations. Organizations can define, for example, actions in response to malicious code detection during periodic scans, actions in response to detection of malicious downloads, and actions in response to detection of maliciousness when attempting to open or execute files. Related controls: CM-3, MP-2, SA-4, SA-8, SA-12, SI-2, SI-4, SI-7.

Control Enhancements:

(1) *MALICIOUS CODE PROTECTION | CENTRAL MANAGEMENT*

The organization centrally manages malicious code protection mechanisms.

Supplemental Guidance: Related controls: AU-2, SI-8.

(2) *MALICIOUS CODE PROTECTION | AUTOMATIC UPDATES*

The information system automatically updates malicious code protection mechanisms (including signature definitions).

Supplemental Guidance: Related control: SI-8.

(3) *MALICIOUS CODE PROTECTION | NON-PRIVILEGED USERS*

The information system prevents non-privileged users from circumventing malicious code protection capabilities.

(4) *MALICIOUS CODE PROTECTION | UPDATES ONLY BY PRIVILEGED USERS*

The information system updates malicious code protection mechanisms only when directed by a privileged user.

(5) *MALICIOUS CODE PROTECTION | REMOVABLE MEDIA*

[Withdrawn: Incorporated into MP-7].

(6) *MALICIOUS CODE PROTECTION | TESTING / VERIFICATION*

The organization:

(a) Tests malicious code protection mechanisms [*Assignment: organization-defined frequency*] by introducing a known benign, non-spreading test case into the information system; and

(b) Verifies that both detection of the test case and associated incident reporting occur.

Supplemental Guidance: Related controls: CA-2, CA-7, RA-5.

(7) *MALICIOUS CODE PROTECTION | NON SIGNATURE-BASED DETECTION*

The information system employs non signature-based malicious code detection mechanisms.

Supplemental Guidance: Non signature-based detection mechanisms include, for example, the use of heuristics to provide safeguards against malware for which signatures do not yet exist or for which existing signatures may not be effective. This control enhancement does not preclude the use of signature-based detection mechanisms.

(8) *MALICIOUS CODE PROTECTION | DETECT UNAUTHORIZED COMMANDS*

The information system detects [*Assignment: organization-defined unauthorized operating system commands*] through the kernel application programming interface at [*Assignment: organization-defined information system hardware components*] and [*Selection (one or more): issues a warning; audits the command execution; prevents the execution of the command*].

Supplemental Guidance: Unauthorized operating system commands include, for example, commands for kernel functions from information system processes that are not trusted to initiate such commands, or commands for kernel functions that are suspicious even though commands of that type are reasonable for processes to initiate. Organizations define the malicious commands to be detected by a combination of command types, command classes, or specific instances of commands. Organizations define hardware components by specific component, component type, location in the network, or combination therein. Organizations may select different actions for different types/classes/specific instances of potentially malicious commands.

References: NIST Special Publication 800-83.

Priority and Baseline Allocation:

P1	**LOW** SI-3	**MOD** SI-3 (1) (2) (3)	**HIGH** SI-3 (1) (2) (3)

SI-4 INFORMATION SYSTEM MONITORING

Control: The organization:

a. Monitors the information system to detect attacks and indicators of potential attacks in accordance with [*Assignment: organization-defined monitoring objectives*];

b. Identifies unauthorized use of the information system;

c. Deploys monitoring devices: (i) strategically within the information system to collect organization-determined essential information; and (ii) at ad hoc locations within the system to track specific types of transactions of interest to the organization;

d. Heightens the level of information system monitoring activity whenever there is an indication of increased risk to organizational operations and assets, individuals, other organizations, or the Nation based on law enforcement information, intelligence information, or other credible sources of information; and

e. Obtains legal opinion with regard to information system monitoring activities in accordance with applicable federal laws, Executive Orders, directives, policies, or regulations.

Supplemental Guidance: Information system monitoring includes external and internal monitoring. External monitoring includes the observation of events occurring at the information system boundary (i.e., part of perimeter defense and boundary protection). Internal monitoring includes the observation of events occurring within the information system. Organizations can monitor information systems, for example, by observing audit activities in real time or by observing other system aspects such as access patterns, characteristics of access, and other actions. The monitoring objectives may guide determination of the events. Information system monitoring capability is achieved through a variety of tools and techniques (e.g., intrusion detection systems, intrusion prevention systems, malicious code protection software, audit record monitoring software, network monitoring software). Strategic locations for monitoring devices include, for example, selected perimeter locations and near server farms supporting critical applications, with such devices typically being employed at the managed interfaces associated with controls SC-7 and AC-17. Einstein network monitoring devices from the Department of Homeland Security can also be included as monitoring devices. The granularity of monitoring information collected is based on organizational monitoring objectives and the capability of information systems to support such objectives. Specific types of transactions of interest include, for example, Hyper Text Transfer Protocol (HTTP) traffic that bypasses HTTP proxies. Information system monitoring is an integral part of organizational continuous monitoring and incident response programs. Output from system monitoring serves as input to continuous monitoring and incident response programs. Related controls: AC-4, AC-8, AC-17, AU-2, AU-6, AU-7, AU-12, CA-7, IR-4, PE-3, RA-5, SC-7, SI-3, SI-7.

Control Enhancements:

(1) *INFORMATION SYSTEM MONITORING | SYSTEM-WIDE INTRUSION DETECTION SYSTEM*

The organization connects and configures individual intrusion detection tools into an information system-wide intrusion detection system using common protocols.

(2) *INFORMATION SYSTEM MONITORING | AUTOMATED TOOLS FOR REAL-TIME ANALYSIS*

The organization employs automated tools to support near real-time analysis of events.

(3) *INFORMATION SYSTEM MONITORING | AUTOMATED TOOL INTEGRATION*

The organization employs automated tools to integrate intrusion detection tools into access control and flow control mechanisms for rapid response to attacks by enabling reconfiguration of these mechanisms in support of attack isolation and elimination.

(4) *INFORMATION SYSTEM MONITORING | INBOUND AND OUTBOUND COMMUNICATIONS TRAFFIC*

The information system monitors inbound and outbound communications traffic for unusual or unauthorized activities or conditions.

Supplemental Guidance: Unusual/unauthorized activities or conditions related to information system inbound and outbound communications traffic include, for example, internal traffic that indicates the presence of malicious code within organizational information systems or propagating among system components, the unauthorized exporting of information, or signaling to external information systems. Evidence of malicious code is used to identify potentially compromised information systems or information system components.

(5) *INFORMATION SYSTEM MONITORING | NEAR REAL-TIME ALERTS*

The information system provides near real-time alerts when the following indications of compromise or potential compromise occur: [*Assignment: organization-defined compromise indicators*].

Supplemental Guidance: Alerts may be generated from a variety of sources, including, for example, audit records or inputs from malicious code protection mechanisms, intrusion detection or prevention mechanisms, or boundary protection devices such as firewalls, gateways, and routers. Related controls: AU-5, PE-6.

(6) *INFORMATION SYSTEM MONITORING | RESTRICT NON-PRIVILEGED USERS*

The information system prevents non-privileged users from circumventing intrusion detection and prevention capabilities.

(7) *INFORMATION SYSTEM MONITORING | AUTOMATED RESPONSE TO SUSPICIOUS EVENTS*

The information system notifies [*Assignment: organization-defined incident response personnel (identified by name and/or by role)*] of detected suspicious events and takes [*Assignment: organization-defined least-disruptive actions to terminate suspicious events*].

Supplemental Guidance: Least-disruptive actions may include, for example, initiating requests for human responses.

(8) *INFORMATION SYSTEM MONITORING | PROTECTION OF MONITORING INFORMATION*

The organization protects information obtained from intrusion-monitoring tools from unauthorized access, modification, and deletion.

Supplemental Guidance: Related controls: AC-3, AU-9.

(9) *INFORMATION SYSTEM MONITORING | TESTING OF MONITORING TOOLS*

The organization tests intrusion-monitoring tools [*Assignment: organization-defined time-period*].

Supplemental Guidance: The frequency of intrusion-monitoring tool testing depends on the types of tools used by organizations and methods of deployment. Related control: CP-9.

(10) *INFORMATION SYSTEM MONITORING | VISIBILITY OF ENCRYPTED COMMUNICATIONS*

The organization makes provisions so that [*Assignment: organization-defined encrypted communications traffic*] is visible to [*Assignment: organization-defined information system monitoring tools*].

Supplemental Guidance: Organizations balance the potentially conflicting needs for encrypting communications traffic and for having insight into such traffic from a monitoring perspective. For some organizations, the need to ensure the confidentiality of communications traffic is paramount; for others, mission-assurance is of greater concern. Organizations determine

whether the visibility requirement applies to internal encrypted traffic, encrypted traffic intended for external destinations, or a subset of the traffic types.

(11) *INFORMATION SYSTEM MONITORING | ANALYZE COMMUNICATIONS TRAFFIC ANOMALIES*

The organization analyzes outbound communications traffic at the external boundary of the information system and selected [*Assignment: organization-defined interior points within the system (e.g., subnetworks, subsystems)*] to discover anomalies.

Supplemental Guidance: Anomalies within organizational information systems include, for example, large file transfers, long-time persistent connections, unusual protocols and ports in use, and attempted communications with suspected malicious external addresses.

(12) *INFORMATION SYSTEM MONITORING | AUTOMATED ALERTS*

The organization employs automated mechanisms to alert security personnel of the following inappropriate or unusual activities with security implications: [*Assignment: organization-defined inappropriate or unusual activities that trigger alerts*].

(13) *INFORMATION SYSTEM MONITORING | ANALYZE TRAFFIC / EVENT PATTERNS*

The organization:

(a) Analyzes communications traffic/event patterns for the information system;

(b) Develops profiles representing common traffic patterns and/or events; and

(c) Uses the traffic/event profiles in tuning system-monitoring devices to reduce the number of false positives to [*Assignment: organization-defined measure of false positives*] and the number of false negatives to [*Assignment: organization-defined measure of false negatives*].

(14) *INFORMATION SYSTEM MONITORING | WIRELESS INTRUSION DETECTION*

The organization employs a wireless intrusion detection system to identify rogue wireless devices and to detect attack attempts and potential compromises/breaches to the information system.

Supplemental Guidance: Related controls: AC-18, IA-3.

(15) *INFORMATION SYSTEM MONITORING | WIRELESS TO WIRELINE COMMUNICATIONS*

The organization employs an intrusion detection system to monitor wireless communications traffic as the traffic passes from wireless to wireline networks.

Supplemental Guidance: Related control: AC-18.

(16) *INFORMATION SYSTEM MONITORING | CORRELATE MONITORING INFORMATION*

The organization correlates information from monitoring tools employed throughout the information system with other information to achieve organization-wide situational awareness.

(17) *INFORMATION SYSTEM MONITORING | INTEGRATED SITUATIONAL AWARENESS*

The organization correlates results from monitoring physical, cyber, and supply chain activities to achieve integrated situational awareness.

Supplemental Guidance: Integrated situational awareness from physical, cyber, and supply chain monitoring activities enhances the capability of organizations to more quickly detect sophisticated cyber attacks and investigate the methods and techniques employed to carry out such attacks. Related control: SA-12.

(18) *INFORMATION SYSTEM MONITORING | ANALYZE TRAFFIC / COVERT EXFILTRATION*

The organization analyzes outbound communications traffic at the external boundary of the information system (i.e., system perimeter) and at [*Assignment: organization-defined interior points within the system (e.g., subsystems, subnetworks)*] to detect covert exfiltration of information.

Supplemental Guidance: Covert means that can be used for the unauthorized exfiltration of organizational information include, for example, steganography.

(19) *INFORMATION SYSTEM MONITORING | INDIVIDUALS POSING GREATER RISK*

The organization implements [*Assignment: organization-defined additional monitoring*] of individuals who have been identified by [*Assignment: organization-defined sources*] as posing an increased level of risk.

Supplemental Guidance: Indications of increased risk from individuals can be obtained from a variety of sources including, for example, human resource records, intelligence agencies, law enforcement organizations, and/or other credible sources.

(20) *INFORMATION SYSTEM MONITORING | PRIVILEGED USER*

The organization implements [*Assignment: organization-defined additional monitoring*] of privileged users.

(21) *INFORMATION SYSTEM MONITORING | PROBATIONARY PERIODS*

The organization implements [*Assignment: organization-defined additional monitoring*] of individuals during [*Assignment: organization-defined probationary period*].

(22) *INFORMATION SYSTEM MONITORING | UNAUTHORIZED NETWORK SERVICES*

The information system detects network services that have not been authorized or approved by [*Assignment: organization-defined authorization or approval processes*] and [*Selection (one or more): audits; alerts* [*Assignment: organization-defined personnel and/or roles*]].

Supplemental Guidance: Unauthorized or unapproved network services include, for example, services in service-oriented architectures that lack organizational verification or validation and therefore, may be unreliable or malicious rogues for valid services.

(23) *INFORMATION SYSTEM MONITORING | HOST-BASED DEVICES*

The organization implements [*Assignment: organization-defined host-based monitoring mechanisms*] at [*Assignment: organization-defined information system components*].

Supplemental Guidance: Information system components where host-based monitoring can be implemented include, for example, servers, workstations, and mobile devices. Organizations consider employing host-based monitoring mechanisms from multiple information technology product developers.

References: NIST Special Publications 800-61, 800-83, 800-92, 800-94, 800-137.

Priority and Baseline Allocation:

P1	**LOW** SI-4	**MOD** SI-4 (2) (4) (5) (6)	**HIGH** SI-4 (2) (4) (5) (6)

SI-5 SECURITY ALERTS, ADVISORIES, AND DIRECTIVES

Control: The organization:

a. Receives information system security alerts, advisories, and directives from [*Assignment: organization-defined external organizations*] on an ongoing basis;

b. Generates internal security alerts, advisories, and directives as deemed necessary;

c. Disseminates security alerts, advisories, and directives to: [*Selection (one or more):* [*Assignment: organization-defined personnel (identified by name and/or by role)*]; [*Assignment: organization-defined elements within the organization*]; [*Assignment: organization-defined external organizations*]]; and

d. Implements security directives in accordance with established time frames, or notifies the issuing organization of the degree of noncompliance.

Supplemental Guidance: The United States Computer Emergency Readiness Team (US-CERT) generates security alerts and advisories to maintain situational awareness across the federal government. Security directives are issued by OMB or other designated organizations with the responsibility and authority to issue such directives. Compliance to security directives is essential due to the critical nature of many of these directives and the potential immediate adverse effects on organizational operations and assets, individuals, other organizations, and the Nation should the directives not be implemented in a timely manner. External organizations include, for example, external mission/business partners, supply chain partners, external service providers, and other peer/supporting organizations. Related control: SI-2.

Control Enhancements:

(1) *SECURITY ALERTS, ADVISORIES, AND DIRECTIVES | AUTOMATED ALERTS AND ADVISORIES*

The organization employs automated mechanisms to make security alert and advisory information available throughout the organization as needed.

References: NIST Special Publication 800-40.

Priority and Baseline Allocation:

P1	**LOW** SI-5	**MOD** SI-5	**HIGH** SI-5 (1)

SI-6 SECURITY FUNCTION VERIFICATION

Control: The information system:

a. Verifies the correct operation of [*Assignment: organization-defined security functions*];

b. Performs this verification [*Selection (one or more):* [*Assignment: organization-defined system transitional states*]*; upon command by user with appropriate privilege; periodically every* [*Assignment: organization-defined time-period*]];

c. Provides notification of failed automated security tests; and

d. [*Selection (one or more): notifies system administrator; shuts the system down; restarts the system;* [*Assignment: organization-defined alternative action(s)*]] when anomalies are discovered.

Supplemental Guidance: Transitional states for information systems include, for example, system startup, restart, shutdown, and abort. Notifications provided by information systems include, for example, electronic alerts to system administrators, messages to local computer consoles, and/or hardware indications such as lights. Related control: CM-6.

Control Enhancements:

(1) *SECURITY FUNCTION VERIFICATION | NOTIFICATION OF FAILED SECURITY TESTS*

[Withdrawn: Incorporated into SI-6].

(2) *SECURITY FUNCTION VERIFICATION | AUTOMATION SUPPORT FOR DISTRIBUTED TESTING*

The information system provides automation support for the management of distributed security testing.

Supplemental Guidance: Related control: SI-2.

(3) *SECURITY FUNCTION VERIFICATION | REPORT VERIFICATION RESULTS*

The organization reports the result of security function verification to [*Assignment: organization-defined personnel with information security responsibilities*].

Supplemental Guidance: Organizational personnel with information security responsibilities include, for example, senior information security officers, information system security managers, and information systems security officers. Related controls: SA-12, SI-4, SI-5.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** Not Selected	**HIGH** SI-6

SI-7 SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY

Control: The organization employs integrity verification tools to detect unauthorized changes to [*Assignment: organization-defined software, firmware, and information*].

Supplemental Guidance: Unauthorized changes to software, firmware, and information can occur due to errors or malicious activity (e.g., tampering). Software includes, for example, operating systems (with key internal components such as kernels, drivers), middleware, and applications. Firmware includes, for example, the Basic Input Output System (BIOS). Information includes metadata such as security attributes associated with information. State-of-the-practice integrity-checking mechanisms (e.g., parity checks, cyclical redundancy checks, cryptographic hashes) and associated tools can automatically monitor the integrity of information systems and hosted applications. Related controls: SA-12, SC-8, SC-13, SI-3.

Control Enhancements:

(1) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | INTEGRITY SCANS*

The organization assesses the integrity of [*Assignment: organization-defined software, firmware, and information*] by performing integrity scans of the information system [*Selection (one or more):* [*Assignment: organization-defined frequency*]; [*Assignment: organization-defined security-relevant events*]].

Supplemental Guidance: Security-relevant events triggering integrity scans may include, for example, transitional events such as system startup, restart, shutdown, and abort.

(2) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | AUTOMATED NOTIFICATIONS*

The organization employs automated tools that provide notification to [*Assignment: organization-defined personnel*] upon discovering discrepancies during integrity verification.

(3) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CENTRALLY-MANAGED INTEGRITY TOOLS*

The organization employs centrally managed integrity verification tools.

Supplemental Guidance: Related controls: AU-3, SI-2, SI-8.

(4) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | TAMPER-EVIDENT PACKAGING*

[Withdrawn: Incorporated into SA-12].

(5) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | AUTOMATED RESPONSE TO INTEGRITY VIOLATIONS*

The information system:

(a) Performs an integrity check of [*Assignment: organization-defined firmware, software, information*] at [*Selection (one or more): startup;* [*Assignment: organization-defined transitional states or events*]; [*Assignment: organization-defined frequency*]]; and

(b) Automatically [*Selection (one or more): notifies information system administrator; shuts the information system down; restarts the information system; implements* [*Assignment: organization-defined security safeguards*]] when integrity violations are discovered.

Supplemental Guidance: Organizations may define different integrity checking and anomaly responses: (i) by type of information (e.g., firmware, software, user data); (ii) by specific information (e.g., boot firmware, boot firmware for a specific types of machines); or (iii) a combination of both. Automatic implementation of specific safeguards within organizational information systems includes, for example, reversing the changes, halting the information system, or triggering audit alerts when unauthorized modifications to critical security files occur.

(6) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CRYPTOGRAPHIC PROTECTION*

The information system employs cryptographic mechanisms to detect unauthorized changes to software, firmware, and information.

Supplemental Guidance: Cryptographic mechanisms used for the protection of integrity include, for example, digital signatures and the computation and application of signed hashes using asymmetric cryptography, protecting the confidentiality of the key used to generate the hash, and using the public key to verify the hash information. Related control: SC-13.

(7) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | HARDWARE-BASED PROTECTION*

The organization:

(a) Employs hardware-based, write-protect for [*Assignment: organization-defined information system firmware components*]; and

(b) Implements specific procedures for [*Assignment: organization-defined authorized individuals*] to manually disable hardware write protect for firmware modifications and re-enable the write protect prior to returning to operational mode.

(8) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | INTEGRATION OF DETECTION AND RESPONSE*

The organization incorporates the detection of unauthorized [*Assignment: organization-defined security-relevant changes to the information system*] into the organizational incident response capability to ensure that such detected events are tracked, monitored, corrected, and available for historical purposes.

Supplemental Guidance: Security relevant changes include, for example, unauthorized changes to established configuration settings. Related controls: IR-4, IR-5, SI-4.

(9) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | AUDITING CAPABILITY FOR SIGNIFICANT EVENTS*

The information system, upon detection of a potential integrity violation, provides the capability to audit the event and initiates the following actions: [*Selection (one or more): generates an audit record; alerts current user; alerts* [*Assignment: organization-defined personnel*]; [*Assignment: organization-defined other actions*]].

Supplemental Guidance: Organizations select response actions based on types of software, specific software, or information for which there are potential integrity violations.

(10) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | VERIFY BOOT PROCESS*

The information system verifies the integrity of the boot process of [*Assignment: organization-defined devices*].

Supplemental Guidance: Ensuring the integrity of boot processes is critical to starting devices in known/trustworthy states. Integrity verification mechanisms provide organizational personnel with assurance that only trusted code is executed during boot processes.

(11) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | PROTECTION OF BOOT FIRMWARE*

The information system implements [*Assignment: organization-defined security safeguards*] to protect the integrity of boot firmware in [*Assignment: organization-defined devices*].

Supplemental Guidance: Unauthorized modifications to boot firmware may be indicative of a sophisticated, targeted cyber attack. These types of cyber attacks can result in a permanent denial of service (e.g., if the firmware is corrupted) or a persistent malware presence (e.g., if the malware is embedded within the firmware). Devices can protect the integrity of the boot firmware in organizational information systems: (i) by verifying the integrity and authenticity of all updates to the boot firmware prior to applying changes to the boot devices; and (ii) by preventing unauthorized processes from modifying the boot firmware.

(12) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CONFINED ENVIRONMENTS WITH LIMITED PRIVILEGES*

The organization requires that [*Assignment: organization-defined user-installed software*] execute in a confined physical or virtual machine environment with limited privileges.

Supplemental Guidance: Organizations identify software that may be of greater concern with regard to origin or potential for containing malicious code. For this type of software, user installations occur in confined environments of operation to limit or contain damage from malicious code that may be executed.

(13) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | INTEGRITY VERIFICATION*

The organization requires that the integrity of [*Assignment: organization-defined user-installed software*] be verified prior to execution.

Supplemental Guidance: Organizations verify the integrity of user-installed software prior to execution to reduce the likelihood of executing malicious code or code that contains errors from unauthorized modifications. Organizations consider the practicality of approaches to verifying software integrity, including, for example, availability of checksums of adequate trustworthiness from software developers or vendors.

(14) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | CODE EXECUTION IN PROTECTED ENVIRONMENTS*

The organization allows execution of binary or machine executable code obtained from sources with limited or no warranty and without the provision of source code only in confined physical or virtual machine environments.

(15) *SOFTWARE, FIRMWARE, AND INFORMATION INTEGRITY | BINARY OR MACHINE EXECUTABLE CODE*

The organization:

(a) Prohibits the use of binary or machine executable code from sources with limited or no warranty and without the provision of source code; and

(b) Provides exceptions to the source code requirement only for compelling mission/operational requirements and with the approval of the authorizing official.

Supplemental Guidance: Organizations assess software products without accompanying source code from sources with limited or no warranty for potential security impacts. The assessments address the fact that these types of software products may be very difficult to review, repair, or extend, given that organizations likely do not have access to the original source code and there may be no owners who could make such repairs on behalf of organizations. Related control: SA-5.

References: None.

References: NIST Special Publications 800-147, 800-155.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SI-7 (1) (8)	**HIGH** SI-7 (1) (2) (5) (8) (15)

SI-8 SPAM PROTECTION

Control: The organization:

a. Employs spam protection mechanisms at information system entry and exit points and at workstations, servers, or mobile computing devices on the network to detect and take action on unsolicited messages transported by electronic mail, electronic mail attachments, web accesses, or other common means; and

b. Updates spam protection mechanisms (including signature definitions) when new releases are available in accordance with organizational configuration management policy and procedures.

Supplemental Guidance: Information system entry and exit points include, for example, firewalls, electronic mail servers, web servers, proxy servers, and remote-access servers. Related controls: AT-2, AT-3, SC-5, SC-7, SI-3.

Control Enhancements:

(1) *SPAM PROTECTION | CENTRAL MANAGEMENT OF PROTECTION MECHANISMS*

The organization centrally manages spam protection mechanisms.

Supplemental Guidance: Related controls: AU-3, SI-2, SI-7.

(2) *SPAM PROTECTION | AUTOMATIC UPDATES*

The information system automatically updates spam protection mechanisms.

(3) *SPAM PROTECTION | CONTINUOUS LEARNING CAPABILITY*

The organization employs spam protection mechanisms with a learning capability to more effectively identify legitimate communications traffic.

Supplemental Guidance: Learning mechanisms include, for example, Bayesian filters that respond to user inputs identifying specific traffic as spam or legitimate by updating algorithm parameters and thereby more accurately separating types of traffic.

References: NIST Special Publication 800-45.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SI-8 (1) (2)	**HIGH** SI-8 (1) (2)

SI-9 INFORMATION INPUT RESTRICTIONS

Control: The organization restricts the authorization to input information to the information system to [*Assignment: organization-defined authorized personnel*].

Supplemental Guidance: Restrictions on organizational personnel authorized to input information to organizational information systems may extend beyond the typical access authorizations in place for those systems and include limitations based on specific operational/project responsibilities. Related controls: AC-2, AC-3, AC-5, AC-6.

Control Enhancements:

(1) *INFORMATION INPUT RESTRICTIONS | PROTECT REMOTE COMMANDS*

The information system implements [*Assignment: organization-defined security safeguards*] to authenticate [*Assignment: organization-defined remote commands*].

Supplemental Guidance: This control enhancement protects against unauthorized commands and replay of authorized commands. This capability is important for those remote information systems whose loss, malfunction, misdirection or exploitation would have immediate and/or serious consequences (e.g., injury or death, property damage, loss of high-valued assets or sensitive information, or failure of important missions/business functions). Authentication safeguards for remote commands help ensure that information systems accept and execute in the order intended, only authorized commands, and that unauthorized commands are rejected. Cryptographic mechanisms can be employed, for example, to authenticate remote commands. Related controls: SC-12, SC-13, and SC-23.

(2) *INFORMATION INPUT RESTRICTIONS | DETECT UNAUTHORIZED COMMANDS*

The information system detects [*Assignment: organization-defined unauthorized operating system commands*] through the kernel application programming interface at [*Assignment: organization-defined information system hardware components*] and [*Selection (one or more): warns; audits; prevents the execution of the command*].

Supplemental Guidance: Unauthorized operating system commands include, for example, commands for kernel functions from information system processes that are not trusted to initiate such commands, or commands for kernel functions that are suspicious even though commands of that type are reasonable for processes to initiate. Organizations define the malicious commands to be detected by a combination of command types, command classes, or specific instances of commands. Organizations define hardware components by specific component, component type, location in the network, or combination therein. Organizations may select different actions for different types/classes/specific instances of potentially malicious commands.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** SI-9	**HIGH** SI-9

SI-10 INFORMATION INPUT VALIDATION

Control: The information system checks the validity of [*Assignment: organization-defined information inputs*].

Supplemental Guidance: Checking the valid syntax and semantics of information system inputs (e.g., character set, length, numerical range, and acceptable values) verifies that inputs match specified definitions for format and content. Prescreening inputs prior to passing to interpreters prevent the content from being unintentionally interpreted as commands. Input validation helps ensure accurate and correct inputs and prevent attacks such as cross-site scripting and a variety of injection attacks.

Control Enhancements:

(1) *INFORMATION INPUT VALIDATION | MANUAL OVERRIDE CAPABILITY*

The information system:

(a) Provides a manual override capability for input validation of [*Assignment: organization-defined inputs*];

(b) Restricts the use of the manual override capability to only [*Assignment: organization-defined authorized individuals*]; and

(c) Audits the use of the manual override capability.

Supplemental Guidance: Related controls: CM-3, CM-5.

(2) *INFORMATION INPUT VALIDATION | REVIEW / RESOLUTION OF ERRORS*

The organization ensures that input validation errors are reviewed and resolved within [*Assignment: organization-defined time period*].

Supplemental Guidance: Resolution of input validation errors includes, for example, correcting systemic causes of errors and resubmitting transactions with corrected input.

(3) *INFORMATION INPUT VALIDATION | PREDICTABLE BEHAVIOR*

The information system behaves in a predictable and documented manner that reflects organizational and system objectives when invalid inputs are received.

Supplemental Guidance: A common vulnerability in organizational information systems is unpredictable behavior when invalid inputs are received. This control enhancement ensures that there is predictable behavior in the face of invalid inputs by specifying information system responses that facilitate transitioning the system to known states without adverse, unintended side effects.

(4) *INFORMATION INPUT VALIDATION | REVIEW / TIMING INTERACTIONS*

The organization accounts for timing interactions among information system components in determining appropriate responses for invalid inputs.

Supplemental Guidance: In addressing invalid information system inputs received across protocol interfaces, timing interfaces become relevant, where one protocol needs to consider the impact of the error response on other protocols within the protocol stack. For example, 802.11 standard wireless network protocols do not interact well with Transmission Control Protocols (TCP) when packets are dropped (which could be due to invalid packet input). TCP assumes packet losses are due to congestion, while packets lost over 802.11 links are typically dropped due to collisions or noise on the link. If TCP makes a congestion response, it takes precisely the wrong action in response to a collision event. Adversaries may be able to use apparently acceptable individual behaviors of the protocols in concert to achieve adverse effects through suitable construction of invalid input.

References: None.

Priority and Baseline Allocation:

P1	**LOW** Not Selected	**MOD** SI-10	**HIGH** SI-10

SI-11 ERROR HANDLING

Control: The information system:

a. Identifies potentially security-relevant error conditions;

b. Generates error messages that provide information necessary for corrective actions without revealing [*Assignment: organization-defined sensitive or potentially harmful information*] in error logs and administrative messages that could be exploited by adversaries; and

c. Reveals error messages only to authorized personnel.

Supplemental Guidance: Organizations carefully consider the structure/content of error messages. The extent to which information systems are able to identify and handle error conditions is guided by organizational policy and operational requirements. Sensitive information may include, for example, erroneous login attempts with passwords entered by mistake as the username, mission or business information that can be derived from (if not stated explicitly by) information recorded, and personal information such as account numbers, social security numbers, and credit card

numbers. In addition, error messages may provide a covert channel for transmitting information. Related controls: AU-3, SC-31.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P2	**LOW** Not Selected	**MOD** SI-11	**HIGH** SI-11

SI-12 INFORMATION OUTPUT HANDLING AND RETENTION

Control: The organization handles and retains both information within and output from the information system in accordance with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and operational requirements.

Supplemental Guidance: The output handling and retention requirements cover the full life cycle of information, in some cases extending beyond the disposal of information systems. The National Archives and Records Administration provides guidance on records retention. Related controls: AC-16, AU-5, AU-11, MP-2, MP-4.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P2	**LOW** SI-12	**MOD** SI-12	**HIGH** SI-12

SI-13 PREDICTABLE FAILURE PREVENTION

[Withdrawn: Incorporated into CP-11].

SI-14 NON-PERSISTENCE

Control: The organization implements non-persistent [*Assignment: organization-defined information system components and services*] that are initiated in a known state and terminated [*Selection (one or more): upon end of session of use; periodically at* [*Assignment: organization-defined frequency*]].

Supplemental Guidance: This control mitigates risk from advanced persistent threats by significantly reducing the targeting capability of adversaries (i.e., window of opportunity and available attack surface) to initiate and complete cyber attacks. By implementing the concept of non-persistence for selected information system components, organizations can provide a known state computing resource for a specific period of time that does not give adversaries sufficient time on target to exploit vulnerabilities in organizational information systems and the environments in which those systems operate. Since the advanced persistent threat is a high-end threat with regard to capability, intent, and targeting, organizations assume that over an extended period of time, a percentage of cyber attacks will be successful. Non-persistent information system components and services are activated as required using protected information and terminated periodically or upon the end of sessions. Non-persistence increases the work factor of adversaries in attempting to compromise or breach organizational information systems.

Non-persistent system components can be implemented for example, by periodically re-imaging components or by using a variety of common virtualization techniques. Non-persistent services can be implemented using virtualization techniques as part of virtual machines or as new instances of processes on physical machines (either persistent or non-persistent).The benefit of periodic refreshes of information system components/services is that it does not require organizations to first determine whether compromises of components or services have occurred (something that may often be difficult for organizations to determine). The refresh of selected information system components and services occurs with sufficient frequency to prevent the spread or intended impact of attacks, but not with such frequency that it makes the information system unstable. In some instances, refreshes of critical components and services may be done a periodically in order to hinder the ability of adversaries to exploit optimum windows of vulnerabilities. The software and data employed during refreshes is obtained from known trusted sources (e.g., software/data from write-once read only media or from selected off-line, secure storage facilities). Related controls: SC-30, SC-34.

Control Enhancements: None.

References: None.

Priority and Baseline Allocation:

P0	**LOW** Not Selected	**MOD** Not Selected	**HIGH** Not Selected

APPENDIX G

INFORMATION SECURITY PROGRAMS

ORGANIZATION-WIDE INFORMATION SECURITY PROGRAM MANAGEMENT CONTROLS

The Federal Information Security Management Act (FISMA) requires organizations to develop and implement an organization-wide information security program to address information security for the information and information systems that support the operations and assets of the organization, including those provided or managed by another organization, contractor, or other source. The information security program management (PM) controls described in this appendix complement the security controls in Appendix F and focus on the organization-wide information security requirements that are independent of any particular information system and are essential for managing information security programs. Tailoring guidance can be applied to the program management controls in a manner similar to how the guidance is applied to security controls in Appendix F. Organizations specify the individuals responsible for the development, implementation, assessment, authorization, and monitoring of the program management controls. Organizations document program management controls in the *information security program plan.* The organization-wide information security program plan supplements the individual security plans developed for each organizational information system. Together, the security plans for the individual information systems and the information security program cover the totality of security controls employed by the organization.

In addition to documenting the information security program management controls, the security program plan provides a vehicle for the organization, in a central repository, to document all security controls from Appendix F that have been designated as *common controls* (i.e., security controls inherited by organizational information systems). The information security program management controls and common controls contained in the information security program plan are implemented, assessed for effectiveness,[97] and authorized by a senior organizational official, with the same or similar authority and responsibility for managing risk as the authorization officials for information systems.[98] Plans of action and milestones are developed and maintained for the program management and common controls that are deemed through assessment to be less than effective. Information security program management and common controls are also subject to the same continuous monitoring requirements as security controls employed in individual organizational information systems.

Cautionary Note

Organizations are required to implement security program management controls to provide a foundation for the organizational information security program. The successful implementation of security controls for organizational information systems depends on the successful implementation of organization-wide program management controls. However, the manner in which organizations implement the program management controls depends on specific organizational characteristics including, for example, the size, complexity, and mission/business requirements of the respective organizations.

[97] Assessment procedures for program management controls and common controls can be found in NIST Special Publication 800-53A.

[98] Tailoring guidance can be applied to organizational program management controls in a manner similar to how the guidance is applied to security controls in Appendix F.

PM-1 INFORMATION SECURITY PROGRAM PLAN

Control: The organization:

a. Develops and disseminates an organization-wide information security program plan that:

- Provides an overview of the requirements for the security program and a description of the security program management controls and common controls in place or planned for meeting those requirements;
- Includes roles, responsibilities, management commitment, coordination among organizational entities, and compliance; and
- Is approved by a senior official with responsibility and accountability for the risk being incurred to organizational operations (including mission, functions, image, and reputation), organizational assets, individuals, other organizations, and the Nation;

b. Reviews the organization-wide information security program plan [*Assignment: organization-defined frequency*]; and

c. Revises the plan to address organizational changes and problems identified during plan implementation or security control assessments.

Supplemental Guidance: Information security program plans can be represented in single documents or compilations of documents at the discretion of organizations. The plans document the program management controls and organization-defined common controls. Information security program plans provide sufficient information about the program management controls/common controls (including specification of parameters for any *assignment* and *selection* statements either explicitly or by reference) to enable implementations that are unambiguously compliant with the intent of the plans and a determination of the risk to be incurred if the plans are implemented as intended.

The security plans for individual information systems and the organization-wide information security program plan together, provide complete coverage for all security controls employed within the organization. Common controls are documented in an appendix to the organization's information security program plan unless the controls are included in a separate security plan for an information system (e.g., security controls employed as part of an intrusion detection system providing organization-wide boundary protection inherited by one or more organizational information systems). The organization-wide information security program plan will indicate which separate security plans contain descriptions of common controls.

Organizations have the flexibility to describe common controls in a single document or in multiple documents. In the case of multiple documents, the documents describing common controls are included as attachments to the information security program plan. If the information security program plan contains multiple documents, the organization specifies in each document the organizational official or officials responsible for the development, implementation, assessment, authorization, and monitoring of the respective common controls. For example, the organization may require that the Facilities Management Office develop, implement, assess, authorize, and continuously monitor common physical and environmental protection controls from the PE family when such controls are not associated with a particular information system but instead, support multiple information systems. Related control: PM-8.

Control Enhancements: None.

References: None.

PM-2 SENIOR INFORMATION SECURITY OFFICER

Control: The organization appoints a senior information security officer with the mission and resources to coordinate, develop, implement, and maintain an organization-wide information security program.

Supplemental Guidance: The security officer described in this control is an organizational official. For a federal agency (as defined in applicable federal laws, Executive Orders, directives, policies, or regulations) this official is the Senior Agency Information Security Officer. Organizations may also refer to this organizational official as the Senior Information Security Officer or Chief Information Security Officer.

Control Enhancements: None.

References: None.

PM-3 INFORMATION SECURITY RESOURCES

Control: The organization:

a. Ensures that all capital planning and investment requests include the resources needed to implement the information security program and documents all exceptions to this requirement;

b. Employs a business case/Exhibit 300/Exhibit 53 to record the resources required; and

c. Ensures that information security resources are available for expenditure as planned.

Supplemental Guidance: Organizations consider establishing champions for information security efforts and as part of including the necessary resources, assign specialized expertise and resources as needed. Organizations may designate and empower an Investment Review Board (or similar group) to manage and provide oversight for the information security-related aspects of the capital planning and investment control process. Related controls: PM-4, SA-2.

Control Enhancements: None.

References: NIST Special Publication 800-65.

PM-4 PLAN OF ACTION AND MILESTONES PROCESS

Control: The organization:

a. Implements a process for ensuring that plans of action and milestones for the security program and associated organizational information systems:

   - Are developed and maintained; and
   - Document the remedial information security actions to adequately respond to risk to organizational operations and assets, individuals, other organizations, and the Nation;

b. Reviews plans of action and milestones for consistency with the organizational risk management strategy and organization-wide priorities for risk response actions.

Supplemental Guidance: The plan of action and milestones is a key document in the information security program and is subject to federal reporting requirements established by OMB. With the increasing emphasis on organization-wide risk management across all three tiers in the risk management hierarchy (i.e., organization, mission/business process, and information system), organizations view plans of action and milestones from an organizational perspective, prioritizing risk response actions and ensuring consistency with the goals and objectives of the organization. Plan of action and milestones updates are based on findings from security control assessments and continuous monitoring activities. OMB FISMA reporting guidance contains instructions regarding organizational plans of action and milestones. Related control: CA-5.

Control Enhancements: None.

References: OMB Memorandum 02-01; NIST Special Publication 800-37.

PM-5 INFORMATION SYSTEM INVENTORY

Control: The organization develops and maintains an inventory of its information systems.

Supplemental Guidance: This control addresses the inventory requirements in FISMA. OMB provides guidance on developing information systems inventories and associated reporting requirements.

Control Enhancements: None.

References: None.

PM-6 INFORMATION SECURITY MEASURES OF PERFORMANCE

Control: The organization develops, monitors, and reports on the results of information security measures of performance.

Supplemental Guidance: Measures of performance are outcome-based metrics used by an organization to measure the effectiveness or efficiency of the information security program and the security controls employed in support of the program.

Control Enhancements: None.

References: NIST Special Publication 800-55.

PM-7 ENTERPRISE ARCHITECTURE

Control: The organization develops an enterprise architecture with consideration for information security and the resulting risk to organizational operations, organizational assets, individuals, other organizations, and the Nation.

Supplemental Guidance: The enterprise architecture developed by the organization is aligned with the Federal Enterprise Architecture. The integration of information security requirements and associated security controls into the organization's enterprise architecture helps to ensure that security considerations are addressed by organizations early in the system development life cycle and are directly and explicitly related to the organization's mission/business processes. This also embeds into and links with the enterprise architecture, an integral information security architecture consistent with organizational risk management and information security strategies. For PM-7, the information security architecture is developed at a system-of-systems level (organization-wide), representing all of the organizational information systems. For PL-8, the security architecture is developed at a level representing an individual information system. Security requirements and security control integration are most effectively accomplished through the application of the Risk Management Framework and supporting security standards and guidelines. The Federal Segment Architecture Methodology provides guidance on integrating information security requirements and security controls into enterprise architectures. Related controls: PL-2, PL-8, PM-11, RA-2.

Control Enhancements: None.

References: NIST Special Publication 800-39; Web: WWW.FSAM.GOV.

PM-8 CRITICAL INFRASTRUCTURE PLAN

Control: The organization addresses information security issues in the development, documentation, and updating of a critical infrastructure and key resources protection plan.

Supplemental Guidance: The requirement and guidance for defining critical infrastructure and key resources and for preparing an associated critical infrastructure protection plan are found in applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Related controls: PM-1, PM-9, PM-11, RA-3.

Control Enhancements: None.

References: HSPD 7; National Infrastructure Protection Plan.

PM-9 RISK MANAGEMENT STRATEGY

Control: The organization:

a. Develops a comprehensive strategy to manage risk to organizational operations and assets, individuals, other organizations, and the Nation associated with the operation and use of information systems; and

b. Implements that strategy consistently across the organization.

Supplemental Guidance: An organization-wide risk management strategy includes, for example, an unambiguous expression of the risk tolerance for the organization, acceptable risk assessment methodologies, risk mitigation strategies, a process for consistently evaluating risk across the organization with respect to the organization's risk tolerance, and approaches for monitoring risk over time. The use of a risk executive function can facilitate consistent, organization-wide application of the risk management strategy. The organization-wide risk management strategy can be informed by risk-related inputs from other sources both internal and external to the organization to ensure the strategy is both broad-based and comprehensive. Related control: RA-3.

Control Enhancements: None.

References: NIST Special Publications 800-30, 800-39.

PM-10 SECURITY AUTHORIZATION PROCESS

Control: The organization:

a. Manages (i.e., documents, tracks, and reports) the security state of organizational information systems and the environments in which those systems operate through security authorization processes;

b. Designates individuals to fulfill specific roles and responsibilities within the organizational risk management process; and

c. Fully integrates the security authorization processes into an organization-wide risk management program.

Supplemental Guidance: Security authorization processes for information systems and environments of operation require the implementation of an organization-wide risk management process, a Risk Management Framework, and associated security standards and guidelines. Specific roles within the risk management process include an organizational risk executive (function) and designated authorizing officials for each organizational information system and common control provider. Security authorization processes are integrated with organizational continuous monitoring processes to facilitate ongoing understanding and acceptance of risk to organizational operations and assets, individuals, other organizations, and the Nation. Related control: CA-6.

Control Enhancements: None.

References: NIST Special Publications 800-37, 800-39.

PM-11 MISSION/BUSINESS PROCESS DEFINITION

Control: The organization:

a. Defines mission/business processes with consideration for information security and the resulting risk to organizational operations, organizational assets, individuals, other organizations, and the Nation; and

b. Determines information protection needs arising from the defined mission/business processes and revises the processes as necessary, until achievable protection needs are obtained.

Supplemental Guidance: Information protection needs are technology-independent, required capabilities to counter threats to organizations, individuals, or the Nation through the compromise of information (i.e., loss of confidentiality, integrity, or availability). Information protection needs are derived from the mission/business needs defined by the organization, the mission/business processes selected to meet the stated needs, and the organizational risk management strategy. Information protection needs determine the required security controls for the organization and the associated information systems supporting the mission/business processes. Inherent in defining an organization's information protection needs is an understanding of the level of adverse impact that could result if a compromise of information occurs. The security categorization process is used to make such potential impact determinations. Mission/business process definitions and associated information protection requirements are documented by the organization in accordance with organizational policy and procedure. Related controls: PM-7, PM-8, RA-2.

Control Enhancements: None.

References: FIPS Publication 199; NIST Special Publication 800-60.

PM-12 INSIDER THREAT PROGRAM

Control: The organization implements an insider threat program that includes a cross-discipline insider threat incident handling team.

Supplemental Guidance: Insider threat programs can leverage the existence of incident handling teams organizations may already have in place, such as computer security incident response teams. The cross-discipline insider threat incident handling team includes representation from major departments across the organization (e.g., human resources, legal, physical security, personnel security, information technology, and information system security). This cross-discipline team meets on a regular basis to discuss the current level of organizational preparedness in addressing insider threat. The insider threat program includes controls to detect malicious insider activity and the correlation of both technical and non-technical information. Human resources records are especially important in this effort, as there is compelling evidence to show that some types of insider crimes are often preceded by non-technical behaviors in the workplace (e.g., ongoing patterns of disgruntled behavior and conflicts with coworkers and other colleagues). These precursors can better inform and guide organizational officials in more focused, targeted monitoring efforts. The participation of a legal team is important to ensure that all monitoring activities are performed in accordance with appropriate legislation, directives, regulations, policies, standards, and guidelines. Insider threat programs have clearly defined policies and consistent enforcement to achieve maximum effectiveness. Related controls: AU-6, IR-4, SI-4.

Control Enhancements: None.

References: None.

PM-13 INFORMATION SECURITY WORKFORCE

Control: The organization establishes an information security workforce development and improvement program.

Supplemental Guidance: Information security workforce development and improvement programs include, for example, defining the appropriate knowledge and skill levels needed to perform information security duties and tasks, and standards for measuring and building individual qualifications for both incumbents and applicants for organizational information security-related positions. Such workforce programs can also include associated information security career paths to encourage: (i) information security professionals to advance in the field and fill positions with greater responsibility; and (ii) organizations to fill information security-related positions with

qualified personnel. Information security workforce development and improvement programs are complementary to organizational security awareness and training programs. Information security workforce development and improvement programs focus on developing and institutionalizing core information security capabilities of selected personnel needed to protect organizational operations, assets, and individuals. Related controls: AT-2, AT-3.

Control Enhancements: None.

References: None.

PM-14 OPERATIONS SECURITY PROGRAM

Control: The organization establishes and implements an Operations Security (OPSEC) program.

Supplemental Guidance: Operations security (OPSEC) is a systematic process by which potential adversaries can be denied information about capabilities and intentions by identifying, controlling, and protecting generally unclassified information related to the planning and execution of sensitive activities. The process involves five steps: identification of critical information, analysis of threats, analysis of vulnerabilities, assessment of risks, and application of appropriate countermeasures.

Control Enhancements: None.

References: None.

PM-15 TESTING, TRAINING, AND MONITORING

Control: The organization:

a. Implements a process for ensuring that organizational plans for conducting security testing, training, and monitoring activities associated with organizational information systems:
   - Are developed and maintained; and
   - Continue to be executed in a timely manner;
b. Reviews testing, training, and monitoring plans for consistency with the organizational risk management strategy and organization-wide priorities for risk response actions.

Supplemental Guidance: This control ensures that organizations provide oversight for the security testing, training, and monitoring activities conducted organization-wide and that those activities are coordinated. With the increasing importance of continuous monitoring programs, the selection and implementation of security across the three tiers of the risk management hierarchy, and the widespread use of common controls, organizations need to coordinate and consolidate the host of testing and monitoring activities that are routinely conducted as part of ongoing organizational assessments supporting a variety of security controls. Security training activities, while typically focused on individual information systems and specific roles, also necessitate coordination across all organizational elements. Testing, training, and monitoring plans and activities are informed by current threat and vulnerability assessments. Related controls: AT-3, CA-7, CP-4, IR-3, SI-4.

Control Enhancements: None.

References: NIST Special Publications 800-16, 800-37, 800-53A, 800-137.

APPENDIX H

INTERNATIONAL INFORMATION SECURITY STANDARDS

SECURITY CONTROL MAPPINGS FOR ISO/IEC 27001

The mapping tables in this appendix provide organizations with a *general* indication of security control coverage with respect to ISO/IEC 27001, *Information technology–Security techniques–Information security management systems–Requirements*.[99] This standard applies to all types of organizations and specifies requirements for establishing, implementing, operating, monitoring, reviewing, maintaining, and improving a documented information security management system (ISMS) within the context of business risks. While the risk management approach established by NIST originally focused on managing information security risk from the information system perspective, the approach has been expanded significantly with NIST Special Publication 800-39 to include risk management at the organizational level, mission/business process level, and information system level. Thus, the NIST security standards and guidelines developed in response to FISMA are consistent with ISO/IEC 27001 and provide additional implementation detail for the federal government and its contractors.

Table H-1 provides a forward mapping from the security controls in NIST Special Publication 800-53 to the controls in ISO/IEC 27001 (Annex A). The mappings are created by using the primary security topic identified in each of the Special Publication 800-53 security controls and associated control enhancements (if any) and searching for a similar security topic in ISO/IEC 27001 (Annex A). Security controls with similar functional meaning are included in the mapping table. For example, Special Publication 800-53 contingency planning and ISO/IEC 27001 (Annex A) business continuity were deemed to have similar, but not the same, functionality. In some cases, similar topics are addressed in the security control sets but provide a different context, perspective, or scope. For example, Special Publication 800-53 addresses information flow control broadly in terms of approved authorizations for controlling access between source and destination objects, whereas ISO/IEC 27001 (Annex A) addresses the information flow more narrowly as it applies to interconnected network domains. Table H-2 provides a reverse mapping from the security controls in ISO/IEC 27001 (Annex A) to the security controls in NIST Special Publication 800-53.[100]

[99] ISO/IEC 27001 was published in October 2005 by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

[100] The use of the term *XX-1 controls* in mapping Table H-2 refers to the set of security controls represented by the first control in each family in Appendix F, where *XX* is a placeholder for the two-letter family identifier.

TABLE H-1: MAPPING NIST SP 800-53 TO ISO/IEC 27001 (ANNEX A)

NIST SP 800-53 CONTROLS		ISO/IEC 27001 (Annex A) CONTROLS
AC-1	Access Control Policy and Procedures	A5.1.1, A5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A10.1.1, A.10.8.1, A.11.1.1, A.11.2.1, A11.2.2, A11.4.1, A.11.7.1, A.11.7.2, A.15.1.1, A.15.2.1
AC-2	Account Management	A.8.3.3, A.11.2.1, A.11.2.2, A.11.2.4, A 11.5.6, A15.2.1
AC-3	Access Enforcement	A.10.8.1 A.11.4.4, A.11.4.6, A.11.5.4, A.11.6.1, A.12.4.2
AC-4	Information Flow Enforcement	A.10.6.1, A.10.8.1, A.11.4.5, A.11.4.7, A.11.7.2, A.12.4.2, A.12.5.4
AC-5	Separation of Duties	A.6.1.3, A.8.1.1, A.10.1.3, A.11.1.1, A.11.4.1
AC-6	Least Privilege	A.6.1.3, A.8.1.1, A.11.1.1, A.11.2.2, A.11.4.1, A.11.4.4, A.11.4.6, A.11.5.4, A.11.6.1, A.12.4.3
AC-7	Unsuccessful Login Attempts	A.11.5.1
AC-8	System Use Notification	A.6.2.2, A.8.1.1, A.11.5.1, A.15.1.5
AC-9	Previous Logon (Access) Notification	A.11.5.1
AC-10	Concurrent Session Control	A.11.5.1
AC-11	Session Lock	A.11.3.2, A.11.3.3, A.11.5.5
AC-12	**Withdrawn**	---
AC-13	**Withdrawn**	---
AC-14	Permitted Actions without Identification or Authentication	A.11.6.1
AC-15	**Withdrawn**	---
AC-16	Security Attributes	A.7.2.2
AC-17	Remote Access	A.10.6.1, A.10.8.1, A.11.1.1, A.11.4.1, A.11.4.2, A.11.4.4, A.11.4.6, A.11.4.7, A.11.7.1, A.11.7.2
AC-18	Wireless Access	A.10.6.1, A.10.8.1, A.11.1.1, A.11.4.1, A.11.4.2, A.11.4.4, A.11.4.6, A.11.4.7, A.11.7.1, A.11.7.2
AC-19	Access Control for Mobile Devices	A.10.4.1, A.11.1.1, A.11.4.3, A.11.7.1
AC-20	Use of External Information Systems	A.7.1.3, A.8.1.1, A.8.1.3, A.10.6.1, A.10.8.1, A.11.4.1, A.11.4.2
AC-21	Collaboration and Information Sharing	A.11.2.1, A.11.2.2
AC-22	Publicly Accessible Content	None
AC-23	Data Mining Protection	None
AC-24	Access Control Decisions	None
AC-25	Reference Monitor Function	None
AT-1	Security Awareness and Training Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.15.1.1, A.15.2.1
AT-2	Security Awareness	A.6.2.2, A.8.1.1, A.8.2.2, A.9.1.5, A.10.4.1
AT-3	Security Training	A.8.1.1, A.8.2.2, A.9.1.5
AT-4	Security Training Records	None
AT-5	Contacts with Security Groups and Associations	A.6.1.7
AU-1	Audit and Accountability Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.10.10.2, A.15.1.1, A.15.2.1, A.15.3.1
AU-2	Auditable Events	A.10.10.1, A.10.10.4, A.10.10.5, A.15.3.1
AU-3	Content of Audit Records	A.10.10.1
AU-4	Audit Storage Capacity	A.10.10.1, A.10.3.1
AU-5	Response to Audit Processing Failures	A.10.3.1, A.10.10.1
AU-6	Audit Review, Analysis, and Reporting	A.10.10.2, A.10.10.5, A.13.1.1, A.15.1.5
AU-7	Audit Reduction and Report Generation	A.10.10.2
AU-8	Time Stamps	A.10.10.1, A.10.10.6
AU-9	Protection of Audit Information	A.10.10.3, A.13.2.3, A.15.1.3, A.15.3.2
AU-10	Non-repudiation	A.10.9.1, A.12.2.3
AU-11	Audit Record Retention	A.10.10.1, A.10.10.2, A.15.1.3
AU-12	Audit Generation	A.10.10.1, A.10.10.4, A.10.10.5
AU-13	Monitoring for Information Disclosure	None
AU-14	Session Audit	None
AU-15	Alternate Audit Capability	None
AU-16	Cross-Organizational Auditing	A.6.2.3

NIST SP 800-53 CONTROLS		ISO/IEC 27001 (Annex A) CONTROLS
CA-1	Security Assessment and Authorization Policies and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3 A.6.1.4, A.8.1.1, A.10.1.1, A.15.1.1, A.15.2.1
CA-2	Security Assessments	A.6.1.8, A.6.2.3, A.10.3.2, A.15.2.1, A.15.2.2
CA-3	Information System Connections	A.6.2.1, A.6.2.3, A.10.6.1, A.10.6.2, A.10.8.1, A.10.8.2, A.10.8.5, A.11.4.2
CA-4	**Withdrawn**	---
CA-5	Plan of Action and Milestones	None
CA-6	Security Authorization	A.6.1.4, A.10.3.2
CA-7	Continuous Monitoring	A.6.1.8, A.15.2.1, A.15.2.2
CM-1	Configuration Management Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.10.1.2, A.12.4.1, A.12.5.1, A.15.1.1, A.15.2.1
CM-2	Baseline Configuration	A.12.4.1, A.10.1.4
CM-3	Configuration Change Control	A.10.1.1, A.10.1.2, A.10.3.2, A.12.4.1, A.12.5.1, A.12.5.2, A.12.5.3
CM-4	Security Impact Analysis	A.10.1.2, A.10.3.2, A.12.4.1, A.12.5.2, A.12.5.3
CM-5	Access Restrictions for Change	A.10.1.2, A.11.1.1, A.11.6.1, A.12.4.1, A.12.4.3, A.12.5.3
CM-6	Configuration Settings	None
CM-7	Least Functionality	None
CM-8	Information System Component Inventory	A.7.1.1, A.7.1.2
CM-9	Configuration Management Plan	A.6.1.3. A.7.1.1, A.7.1.2, A.8.1.1, A.10.1.1, A.10.1.2, A.10.3.2, A.12.4.1, A.12.4.3, A.12.5.1, A.12.5.2, A.12.5.3
CM-10	Software Usage Restrictions	A.12.4.1, A.12.5.5, A.15.1.2
CM-11	User-Installed Software	A.12.4.1, A.12.5.5, A.15.1.5
CP-1	Contingency Planning Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.9.1.4, A.10.1.1, A.10.1.2, A.14.1.1, A.14.1.3, A.15.1.1, A.15.2.1
CP-2	Contingency Plan	A.6.1.2, A.9.1.4, A.10.3.1, A.14.1.1, A.14.1.2, A.14.1.3, A.14.1.4, A.14.1.5
CP-3	Contingency Training	A.8.2.2, A.9.1.4, A.14.1.3
CP-4	Contingency Plan Testing	A.6.1.2, A.9.1.4, A.14.1.1, A.14.1.3, A.14.1.4, A.14.1.5
CP-5	**Withdrawn**	---
CP-6	Alternate Storage Site	A.9.1.4, A.14.1.3
CP-7	Alternate Processing Site	A.9.1.4, A.14.1.3
CP-8	Telecommunications Services	A.9.1.4, A.10.6.1, A.14.1.3
CP-9	Information System Backup	A.9.1.4, A.10.5.1, A.14.1.3, A.15.1.3
CP-10	Information System Recovery and Reconstitution	A.9.1.4, A.14.1.3
CP-11	Predictable Failure Prevention	None
CP-12	Alternate Communications Protocols	None
CP-13	Safe Mode	None
IA-1	Identification and Authentication Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.11.2.1, A.15.1.1, A.15.2.1
IA-2	Identification and Authentication (Organizational Users)	A.11.3.2, A.11.5.1, A.11.5.2, A.11.5.3
IA-3	Device-to-Device Identification and Authentication	A.11.4.3
IA-4	Identifier Management	A.11.5.2
IA-5	Authenticator Management	A.11.2.1, A.11.2.3, A.11.3.1, A.11.5.2, A.11.5.3
IA-6	Authenticator Feedback	A.11.5.1
IA-7	Cryptographic Module Authentication	A.12.3.1, A.15.1.1, A.15.1.6, A.15.2.1
IA-8	Identification and Authentication (Non-Organizational Users)	A.10.9.1, A.11.4.2, A.11.5.1, A.11.5.2
IA-9	Service Identification and Authentication	None
IA-10	Alternative Authentication	None
IA-11	Adaptive Identification and Authentication	None
IA-12	Reauthentication	None
IR-1	Incident Response Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.13.1.1, A.13.2.1, A.15.1.1, A.15.2.1
IR-2	Incident Response Training	A.8.2.2
IR-3	Incident Response Testing	None
IR-4	Incident Handling	A.6.1.2, A.13.2.2, A.13.2.3

NIST SP 800-53 CONTROLS		ISO/IEC 27001 (Annex A) CONTROLS
IR-5	Incident Monitoring	None
IR-6	Incident Reporting	A.6.1.6, A.13.1.1
IR-7	Incident Response Assistance	None
IR-8	Incident Response Plan	None
IR-9	Information Spillage Response	A.12.5.4
MA-1	System Maintenance Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.9.2.4, A.10.1.1, A.15.1.1, A.15.2.1
MA-2	Controlled Maintenance	A.9.2.4
MA-3	Maintenance Tools	A.9.2.4, A.11.4.4
MA-4	Non-Local Maintenance	A.9.2.4, A.11.4.4
MA-5	Maintenance Personnel	A.9.2.4, A.12.4.3
MA-6	Timely Maintenance	A.9.2.4
MP-1	Media Protection Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.10.7.1, A.10.7.2, A.10.7.3, A.11.1.1, A.15.1.1, A.15.1.3, A.15.2.1
MP-2	Media Access	A.7.2.2, A.10.7.1, A.10.7.3
MP-3	Media Marking	A.7.2.2, A.10.7.1, A.10.7.3
MP-4	Media Storage	A.10.7.1, A.10.7.3, A.10.7.4, A.11.3.3, A.15.1.3
MP-5	Media Transport	A.9.2.5, A.9.2.7, A.10.7.1, A.10.7.3, A.10.8.3
MP-6	Media Sanitization	A.9.2.6, A.10.7.1, A.10.7.2, A.10.7.3
MP-7	Media Use	None
MP-8	Media Downgrading	None
PE-1	Physical and Environmental Protection Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.9.1.4, A.9.2.1, A.9.2.2, A.10.1.1, A.11.1.1, A.11.2.1, A.11.2.2, A.15.1.1, A.15.2.1
PE-2	Physical Access Authorizations	A.9.1.5, A.11.2.1, A.11.2.2, A.11.2.4
PE-3	Physical Access Control	A.9.1.1, A.9.1.2, A.9.1.3, A.9.1.5, A.9.1.6, A.11.3.2, A.11.4.4
PE-4	Access Control for Transmission Medium	A.9.1.3, A.9.1.5, A.9.2.3
PE-5	Access Control for Output Devices	A.9.1.2, A.9.1.3, A.10.6.1, A.11.3.2
PE-6	Monitoring Physical Access	A.9.1.2, A.9.1.5, A.10.10.2
PE-7	**Withdrawn**	---
PE-8	Visitor Access Records	A.9.1.5, A.10.10.2, A.15.2.1
PE-9	Power Equipment and Cabling	A.9.1.4, A.9.2.2, A.9.2.3
PE-10	Emergency Shutoff	A.9.1.4
PE-11	Emergency Power	A.9.1.4, A.9.2.2
PE-12	Emergency Lighting	A.9.2.2
PE-13	Fire Protection	A.9.1.4
PE-14	Temperature and Humidity Controls	A.9.2.2
PE-15	Water Damage Protection	A.9.1.4
PE-16	Delivery and Removal	A.9.1.6, A.9.2.7, A.10.7.1
PE-17	Alternate Work Site	A.9.2.5, A.11.7.2
PE-18	Location of Information System Components	A.9.2.1, A.11.3.2
PE-19	Information Leakage	A.12.5.4
PE-20	Port and I/O Device Access	A 10.4.1
PL-1	Security Planning Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.2, A.6.1.3, A.8.1.1, A.10.1.1, A.15.1.1, A.15.2.1
PL-2	System Security Plan	A.6.1.2, A.15.3.1
PL-3	**Withdrawn**	---
PL-4	Rules of Behavior	A.6.1.5, A.6.2.2, A.7.1.3. A.8.1.1, A.8.1.3, A.8.2.1, A.9.1.5, A.10.8.1, A.11.7.1, A.11.7.2, A.12.4.1, A.13.1.2, A.15.1.5
PL-5	**Withdrawn**	---
PL-6	**Withdrawn**	---
PL-7	Security Concept of Operations	A.12.1.1
PL-8	Security Architecture	A.12.1.1
PS-1	Personnel Security Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.15.1.1, A.15.2.1
PS-2	Position Categorization	A.8.1.1
PS-3	Personnel Screening	A.8.1.2
PS-4	Personnel Termination	A.8.3.1, A.8.3.2, A.8.3.3

NIST SP 800-53 CONTROLS		ISO/IEC 27001 (Annex A) CONTROLS
PS-5	Personnel Transfer	A.8.3.1, A.8.3.2, A.8.3.3
PS-6	Access Agreements	A.6.1.5, A.8.1.1, A.8.1.3, A.8.2.1, A.9.1.5, A.10.8.1, A.11.7.1, A.11.7.2, A.15.1.5
PS-7	Third-Party Personnel Security	A.6.2.3, A.8.1.1, A.8.2.1, A.8.1.3
PS-8	Personnel Sanctions	A.8.2.3, A.15.1.5
RA-1	Risk Assessment Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.14.1.2, A.15.1.1, A.15.2.1
RA-2	Security Categorization	A.7.2.1, A.14.1.2
RA-3	Risk Assessment	A.6.2.1, A.10.2.3, A.12.6.1, A.14.1.2
RA-4	**Withdrawn**	---
RA-5	Vulnerability Scanning	A.12.6.1, A.15.2.2
SA-1	System and Services Acquisition Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.6.2.1, A.8.1.1, A.10.1.1, A.12.1.1, A.12.5.5, A.15.1.1, A.15.2.1
SA-2	Allocation of Resources	A.6.1.2, A.10.3.1
SA-3	System Development Life Cycle	A.12.1.1
SA-4	Acquisition Process	A.12.1.1, A.12.5.5
SA-5	Information System Documentation	A.10.7.4, A.15.1.3
SA-6	**Withdrawn**	---
SA-7	**Withdrawn**	---
SA-8	Security Engineering Principles	A.10.4.1, A.10.4.2, A.11.4.5, A.12.5.5
SA-9	External Information System Services	A.6.1.5, A.6.2.1, A.6.2.3, A.8.1.1, A.8.2.1, A.10.2.1, A.10.2.2, A.10.2.3, A.10.6.2, A.10.8.2, A.12.5.5
SA-10	Developer Configuration Management	A.10.2.3, A.12.4.3, A.12.5.1, A.12.5.5
SA-11	Developer Security Testing	A.10.3.2, A.12.5.5
SA-12	Supply Chain Protections	A.12.5.5
SA-13	**Withdrawn**	---
SA-14	Critical Information System Components	None
SA-15	Development Process, Standards, and Tools	A.10.3.2, A.12.5.5
SA-16	Developer-Provided Training	None
SA-17	Developer Security Architecture and Design	A.10.3.2, A.12.5.5
SA-18	Tamper Resistance and Detection	None
SA-19	Anti-Counterfeit	None
SC-1	System and Communications Protection Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.15.1.1, A.15.2.1
SC-2	Application Partitioning	A.10.4.1, A.10.4.2
SC-3	Security Function Isolation	A.10.4.1, A.10.4.2, A.10.9.1, A.10.9.2
SC-4	Information In Shared Resources	None
SC-5	Denial of Service Protection	A.10.3.1
SC-6	Resource Availability	None
SC-7	Boundary Protection	A.6.2.1, A.10.4.1, A.10.4.2, A.10.6.1, A.10.8.1, A.10.9.1, A.10.9.2, A.10.10.2, A.11.4.5, A.11.4.6, A 11.6.2
SC-8	Transmission Integrity	A.10.4.2, A.10.6.1, A.10.6.2, A.10.9.1, A.10.9.2, A.12.2.3, A.12.3.1
SC-9	Transmission Confidentiality	A.10.6.1, A.10.6.2, A.10.9.1, A.10.9.2, A.12.3.1
SC-10	Network Disconnect	A.10.6.1, A.11.3.2, A.11.5.1, A.11.5.5
SC-11	Trusted Path	None
SC-12	Cryptographic Key Establishment and Management	A.12.3.2
SC-13	Cryptographic Protection	A.12.3.1, A.15.1.6
SC-14	Public Access Protections	A.10.4.1, A.10.4.2, A.10.9.1, A.10.9.2, A.10.9.3
SC-15	Collaborative Computing Devices	None
SC-16	Transmission of Security Attributes	A.7.2.2, A.10.8.1
SC-17	Public Key Infrastructure Certificates	A.12.3.2
SC-18	Mobile Code	A.10.4.2
SC-19	Voice Over Internet Protocol	A.10.6.1
SC-20	Secure Name/Address Resolution Service (Authoritative Source)	A.10.6.1

NIST SP 800-53 CONTROLS		ISO/IEC 27001 (Annex A) CONTROLS
SC-21	Secure Name/Address Resolution Service (Recursive or Caching Resolver)	A.10.6.1
SC-22	Architecture and Provisioning for Name/Address Resolution Service	A.10.6.1
SC-23	Session Authenticity	A.10.6.1, A.12.2.3
SC-24	Fail in Known State	None
SC-25	Thin Nodes	None
SC-26	Honeypots	None
SC-27	Operating System-Independent Applications	None
SC-28	Protection of Information at Rest	None
SC-29	Heterogeneity	None
SC-30	Concealment and Misdirection	None
SC-31	Covert Channel Analysis	None
SC-32	Information System Partitioning	None
SC-33	**Withdrawn**	---
SC-34	Non-Modifiable Executable Programs	None
SC-35	Technical Surveillance Countermeasures Survey	None
SC-36	Honeyclients	None
SC-37	Distributed Processing and Storage	None
SC-38	Malware Analysis	A.10.4.1
SC-39	Out-of-Band Channels	None
SC-40	Operations Security	None
SC-41	Process Isolation	None
SC-42	Wireless Link Protection	None
SI-1	System and Information Integrity Policy and Procedures	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3, A.8.1.1, A.10.1.1, A.15.1.1, A.15.2.1
SI-2	Flaw Remediation	A.10.10.5, A.12.5.2, A.12.6.1, A.13.1.2
SI-3	Malicious Code Protection	A.10.4.1
SI-4	Information System Monitoring	A.10.10.2, A.13.1.1, A.13.1.2
SI-5	Security Alerts, Advisories, and Directives	A.6.1.6, A 6.1.7, A.12.6.1, A.13.1.1, A.13.1.2
SI-6	Security Function Verification	None
SI-7	Software, Firmware, and Information Integrity	A.10.4.1, A.12.2.2, A.12.2.3, A.12.2.4
SI-8	Spam Protection	None
SI-9	Information Input Restrictions	A.10.8.1, A.11.1.1, A.11.2.2, A.12.2.2
SI-10	Information Input Validation	A.12.2.1, A.12.2.2
SI-11	Error Handling	None
SI-12	Information Output Handling and Retention	A.10.7.3, A.15.1.3, A.15.1.4, A.15.2.1
SI-13	**Withdrawn**	---
SI-14	Non-Persistence	None
PM-1	Information Security Program Plan	A.5.1.1, A.5.1.2, A.6.1.1, A.6.1.3 A.8.1.1, A.15.1.1, A.15.2.1
PM-2	Senior Information Security Officer	A.6.1.1, A.6.1.2, A.6.1.3
PM-3	Information Security Resources	A.6.1.1
PM-4	Plan of Action and Milestones Process	None
PM-5	Information System Inventory	A.7.1.1, A.7.1.2
PM-6	Information Security Measures of Performance	None
PM-7	Enterprise Architecture	None
PM-8	Critical Infrastructure Plan	None
PM-9	Risk Management Strategy	A.6.1.1, A.6.2.1, A.14.1.2
PM-10	Security Authorization Process	A.6.1.4
PM-11	Mission/Business Process Definition	None
PM-12	Insider Threat Program	None
PM-13	Information Security Workforce	A.8.2.1
PM-14	Operations Security Program	None
PM-15	Testing, Training, and Monitoring	A.8.2.1

TABLE H-2: MAPPING ISO/IEC 27001 (ANNEX A) TO NIST SP 800-53

ISO/IEC 27001 (Annex A) CONTROLS	NIST SP 800-53 CONTROLS
A.5 Security Policy	
A.5.1 Information security policy	
A.5.1.1 Information security policy document	XX-1 controls
A.5.1.2 Review of the information security policy	XX-1 controls
A.6 Organization of information security	
A.6.1 Internal	
A.6.1.1 Management commitment to information security	XX-1 controls, PM-2, PM-3, PM-9; SP 800-39, SP 800-37
A.6.1.2 Information security coordination	CP-2, CP-4, IR-4, PL-1, PL-2, PM-2, SA-2; SP 800-39, SP 800-37
A.6.1.3 Allocation of information security responsibilities	XX-1 controls, AC-5, AC-6, CM-9, PM-2; SP 800-39, SP 800-37
A.6.1.4 Authorization process for information processing facilities	CA-1, CA-6, PM-10; SP 800-37
A.6.1.5 Confidentiality agreements	PL-4, PS-6, SA-9
A.6.1.6 Contact with authorities	Multiple controls with contact reference (e.g., IR-6, SI-5); SP 800-39; SP 800-37
A.6.1.7 Contact with special interest groups	AT-5, SI-5
A.6.1.8 Independent review of information security	CA-2, CA-7; SP 800-39, SP 800-37
A.6.2 External Parties	
A.6.2.1 Identification of risks related to external parties	CA-3, PM-9, RA-3, SA-1, SA-9, SC-7
A.6.2.2 Addressing security when dealing with customers	AC-8 , AT-2, PL-4
A.6.2.3 Addressing security in third party agreements	AU-16, CA-2, CA-3, PS-7, SA-9
A.7 Asset Management	
A.7.1 Responsibility for assets	
A.7.1.1 Inventory of assets	CM-8, CM-9, PM-5
A.7.1.2 Ownership of assets	CM-8, CM-9, PM-5
A.7.1.3 Acceptable use of assets	AC-20, PL-4
A.7.2 Information Classification	
A.7.2.1 Classification Guidelines	RA-2
A.7.2.2 Information labeling and handling	AC-16, MP-2, MP-3, SC-16
A.8 Human Resources Security	
A.8.1 Prior to Employment	
A.8.1.1 Roles and Responsibilities	XX-1 controls, AC-5, AC-6, AC-8, AC-20, AT-2, AT-3, CM-9, PL-4, PS-2, PS-6, PS-7, SA-9
A.8.1.2 Screening	PS-3
A.8.1.3 Terms and conditions of employment	AC-20, PL-4, PS-6, PS-7
A.8.2 During employment	
A.8.2.1 Management responsibilities	PL-4, PM-13, PM-15, PS-6, PS-7, SA-9
A.8.2.2 Awareness, education, and training	AT-2, AT-3, IR-2
A.8.2.3 Disciplinary process	PS-8
A.8.3 Termination or change of employment	
A.8.3.1 Termination responsibilities	PS-4, PS-5
A.8.3.2 Return of assets	PS-4, PS-5
A.8.3.3 Removal of access rights	AC-2, PS-4, PS-5
A.9 Physical and environmental security	
A.9.1 Secure areas	
A.9.1.1 Physical security perimeter	PE-3
A.9.1.2 Physical entry controls	PE-3, PE-5, PE-6
A.9.1.3 Securing offices, rooms, facilities	PE-3, PE-4, PE-5
A.9.1.4 Protecting against external and environmental threats	CP Family; PE-1, PE-9, PE-10, PE-11, PE-13, PE-15
A.9.1.5 Working in secure areas	AT-2, AT-3 , PL-4, PS-6, PE-2, PE-3, PE-4, PE-6, PE-8
A.9.1.6 Public access, delivery and loading areas	PE-3 , PE-16
A.9.2 Equipment security	
A.9.2.1 Equipment siting and protection	PE-1, PE-18
A.9.2.2 Supporting utilities	PE-1, PE-9, PE-11, PE-12, PE-14
A.9.2.3 Cabling security	PE-4, PE-9

ISO/IEC 27001 (Annex A) CONTROLS	NIST SP 800-53 CONTROLS
A.9.2.4 Equipment maintenance	MA Family
A.9.2.5 Security of equipment off-premises	MP-5, PE-17
A.9.2.6 Secure disposal or reuse of equipment	MP-6
A.9.2.7 Removal of property	MP-5, PE-16
A.10 Communications and operations management	
A.10.1 Operational procedures and responsibilities	
A.10.1.1 Documented operating procedures	XX-1 controls, CM-9
A.10.1.2 Change management	CM-1, CM-3, CM-4, CM-5, CM-9
A.10.1.3 Segregation of duties	AC-5
A.10.1.4 Separation of development, test and operational facilities	CM-2
A.10.2 Third-party service delivery management	
A.10.2.1 Service delivery	SA-9
A.10.2.2 Monitoring and review of third-party services	SA-9
A.10.2.3 Managing changes to third-party services	RA-3, SA-9, SA-10
A.10.3 System planning and acceptance	
A.10.3.1 Capacity management	AU-4, AU-5, CP-2, SA-2, SC-5
A.10.3.2 System acceptance	CA-2, CA-6, CM-3, CM-4, CM-9, SA-11, SA-15, SA-17
A.10.4 Protection against malicious and mobile code	
A.10.4.1 Controls against malicious code	AC-19, AT-2, PE-20, SA-8, SC-2, SC-3, SC-7, SC-14, SC-38, SI-3, SI-7
A.10.4.2 Controls against mobile code	SA-8, SC-2, SC-3, SC-7, SC-14, SC-8, SC-18
A.10.5 Backup	
A.10.5.1 Information backup	CP-9
A.10.6 Network security management	
A.10.6.1 Network controls	AC-4, AC-17, AC-18, AC-20, CA-3, CP-8, PE-5, SC-7, SC-8, SC-9, SC-10, SC-19, SC-20, SC-21, SC-22, SC-23
A.10.6.2 Security of network services	CA-3, SA-9, SC-8, SC-9
A.10.7 Media handling	
A.10.7.1 Management of removable media	MP Family, PE-16
A.10.7.2 Disposal of media	MP-6
A.10.7.3 Information handling procedures	MP Family, SI-12
A.10.7.4 Security of system documentation	MP-4, SA-5
A.10.8 Exchange of information	
A.10.8.1 Information exchange policies and procedures	AC-1, AC-3, AC-4, AC-17, AC-18, AC-20, CA-3, PL-4, PS-6, SC-7, SC-16, SI-9
A.10.8.2 Exchange agreements	CA-3, SA-9
A.10.8.3 Physical media in transit	MP-5
A.10.8.4 Electronic messaging	Multiple controls; electronic messaging not addressed separately in SP 800-53
A.10.8.5 Business information systems	CA-1, CA-3
A.10.9 Electronic commerce services	
A.10.9.1 Electronic commerce	AU-10, IA-8, SC-7, SC-8, SC-9, SC-3, SC-14
A.10.9.2 Online transactions	SC-3, SC-7, SC-8, SC-9, SC-14
A.10.9.3 Publicly available information	SC-14
A.10.10 Monitoring	
A.10.10.1 Audit logging	AU-1, AU-2, AU-3, AU-4, AU-5, AU-8, AU-11, AU-12
A.10.10.2 Monitoring system use	AU-1, AU-6, AU-7, PE-6, PE-8, SC-7, SI-4
A.10.10.3 Protection of log information	AU-9
A.10.10.4 Administrator and operator logs	AU-2, AU-12
A.10.10.5 Fault logging	AU-2, AU-6, AU-12, SI-2
A.10.10.6 Clock synchronization	AU-8
A.11 Access Control	
A.11.1 Business requirement for access control	
A.11.1.1 Access control policy	AC-1, AC-5, AC-6, AC-17, AC-18, AC-19, CM-5, MP-1, SI-9
A.11.2 User access management	
A.11.2.1 User registration	AC-1, AC-2, AC-21, IA-5, PE-1, PE-2

ISO/IEC 27001 (Annex A) CONTROLS	NIST SP 800-53 CONTROLS
A.11.2.2 Privilege management	AC-1, AC-2, AC-6, AC-21, PE-1, PE-2, SI-9
A.11.2.3 User password management	IA-5
A.11.2.4 Review of user access rights	AC-2, PE-2
A 11.3 User responsibilities	
A.11.3.1 Password use	IA-2, IA-5
A.11.3.2 Unattended user equipment	AC-11, IA-2, PE-3, PE-5, PE-18, SC-10
A.11.3.3 Clear desk and clear screen policy	AC-11, MP-4
A.11.4 Network access control	
A.11.4.1 Policy on use of network services	AC-1, AC-5, AC-6, AC-17, AC-18, AC-20
A.11.4.2 User authentication for external connections	AC-17, AC-18, AC-20, CA-3, IA-2, IA-8
A.11.4.3 Equipment identification in networks	AC-19, IA-3
A.11.4.4 Remote diagnostic and configuration port protection	AC-3, AC-6, AC-17, AC-18, PE-3, MA-3, MA-4
A.11.4.5 Segregation in networks	AC-4, SA-8, SC-7
A.11.4.6 Network connection control	AC-3, AC-6, AC-17, AC-18, SC-7
A.11.4.7 Network routing control	AC-4, AC-17, AC-18
A 11.5 Operating system access control	
A.11.5.1 Secure log-on procedures	AC-7, AC-8, AC-9, AC-10, IA-2, IA-6, IA-8, SC-10
A.11.5.2 User identification and authentication	IA-2, IA-4, IA-5, IA-8
A.11.5.3 Password management system	IA-2, IA-5
A.11.5.4 Use of system utilities	AC-3, AC-6
A.11.5.5 Session time-out	AC-11, SC-10
A.11.5.6 Limitation of connection time	AC-2
A.11.6 Application and information access control	
A.11.6.1 Information access restriction	AC-3, AC-6, AC-14, CM-5
A.11.6.2 Sensitive system isolation	SC-7; SP 800-39
A.11.7 Mobile computing and teleworking	
A.11.7.1 Mobile computing and communications	AC-1, AC-17, AC-18, AC-19, PL-4, PS-6
A.11.7.2 Teleworking	AC-1, AC-4, AC-17, AC-18, PE-17, PL-4, PS-6
A.12 Information systems acquisition, development and maintenance	
A.12.1 Security requirements of information systems	
A.12.1.1 Security requirements analysis and specification	PL-7, PL-8, SA-1, SA-3, SA-4
A.12.2 Correct processing in applications	
A.12.2.1 Input data validation	SI-10
A.12.2.2 Control of internal processing	SI-7, SI-9, SI-10
A.12.2.3 Message integrity	AU-10, SC-8, SC-23, SI-7
A.12.2.4 Output data validation	SI-7
A.12.3 Cryptographic controls	
A.12.3.1 Policy on the use of cryptographic controls	Multiple controls address cryptography (e.g., IA-7, SC-8, SC-9, SC-12, SC-13)
A.12.3.2 Key management	SC-12, SC-17
A.12.4 Security of system files	
A.12.4.1 Control of operational software	CM-1, CM-2, CM-3, CM-4, CM-5, CM-9, CM-10, CM-11, PL-4
A.12.4.2 Protection of system test data	Multiple controls; protection of test data not addressed separately in SP 800-53 (e.g., AC-3, AC-4)
A.12.4.3 Access control to program source code	AC-3, AC-6, CM-5, CM-9, MA-5, SA-10
A.12.5 Security in development and support processes	
A.12.5.1 Change control procedures	CM-1, CM-3, CM-9, SA-10
A.12.5.2 Technical review of applications after operating system changes	CM-3, CM-4, CM-9, SI-2
A.12.5.3 Restrictions on changes to software packages	CM-3, CM-4, CM-5, CM-9
A.12.5.4 Information leakage	AC-4, IR-9, PE-19
A.12.5.5 Outsourced software development	CM-10, CM-11, SA-1, SA-4, SA-8, SA-9, SA-11, SA-12, SA-15, SA-17
A.12.6 Technical Vulnerability Management	
A.12.6.1 Control of technical vulnerabilities	RA-3, RA-5, SI-2, SI-5
A.13 Information security incident management	

ISO/IEC 27001 (Annex A) CONTROLS	NIST SP 800-53 CONTROLS
A.13.1 Reporting information security events and weaknesses	
A.13.1.1 Reporting information security events	AU-6, IR-1, IR-6, SI-4, SI-5
A.13.1.2 Reporting security weaknesses	PL-4, SI-2, SI-4, SI-5
A.13.2 Management of information security incidents and improvements	
A.13.2.1 Responsibilities and procedures	IR-1
A.13.2.2 Learning from information security incidents	IR-4
A.13.2.3 Collection of evidence	AU-7, AU-9, IR-4
A.14 Business continuity management	
A.14.1 Information security aspects of business continuity management	
A.14.1.1 Including information security in the business continuity management process	CP-1, CP-2, CP-4
A.14.1.2 Business continuity and risk assessment	CP-2, PM-9, RA Family
A.14.1.3 Developing and implementing continuity plans including information security	CP Family
A.14.1.4 Business continuity planning framework	CP-2, CP-4
A.14.1.5 Testing, maintaining and reassessing business continuity plans	CP-2, CP-4
A.15 Compliance	
A.15.1 Compliance with legal requirements	
A.15.1.1 Identification of applicable legislation	XX-1 controls, IA-7
A.15.1.2 Intellectual property rights (IPR)	CM-10
A.15.1.3 Protection of organizational records	AU-9, AU-11, CP-9, MP-1, MP-4, SA-5, SI-12
A.15.1.4 Data protection and privacy of personal information	Appendix J; SI-12
A.15.1.5 Prevention of misuse of information processing facilities	AC-8, AU-6, CM-11, PL-4, PS-6, PS-8
A.15.1.6 Regulation of cryptographic controls	IA-7, SC-13
A.15.2 Compliance with security policies and standards, and technical compliance	
A.15.2.1 Compliance with security policies and standards	XX-1 controls, AC-2, CA-2, CA-7, IA-7, PE-8, SI-12
A.15.2.2 Technical compliance checking	CA-2, CA-7, RA-5
A.15.3 Information systems audit considerations	
A.15.3.1 Information systems audit controls	AU-1, AU-2
A.15.3.2 Protection of information systems audit tools	AU-9

APPENDIX I

OVERLAY TEMPLATE

APPLYING TAILORING GUIDANCE FOR SPECIAL CONDITIONS OR COMMUNITY-WIDE USE[101]

Organizations may use the following template when developing tailored baselines using the concept of overlays.[102] The template is provided an as exemplar only—organizations may choose to use other formats or modify the format in this appendix based on organizational needs and the type of overlay being developed. The level of detail included in the overlay is at the discretion of the organization initiating the effort but should be of sufficient breadth and depth to provide an appropriate rationale and justification for the resulting tailored baseline developed and any risk-based decisions taken during the development process. The template consists of eight sections including:

- Characteristics and assumptions;
- Applicability;
- Implementation;
- Table of security controls;
- Supplemental guidance;
- Tailoring considerations;
- Duration; and
- Definitions.

Characteristics and Assumptions

Organizations describe the characteristics and assumptions that define the required use of the overlay. This includes a description of the environment in which the overlay will be used (e.g., inside a guarded building within the continental United States, while traveling for business to a foreign country that is known for attempting to gain access to sensitive or classified information, or in a mobile vehicle in close proximity to hostile entities). The characteristics and assumptions section may also include a description of the type of information that will be processed, stored, or transmitted (e.g., an information system that contains personally identifiable information (PII), sensitive financial information, or health records). Another characteristic of overlays describes the type of information system (e.g., standalone system, type of platform IT, industrial/process control system, or cross-domain system). An overlay may be required to protect organizations, mission/business processes, information systems, information, or individuals from a different set of threats and vulnerabilities than are typically addressed by the existing baselines with some level of tailoring as described in Chapter Three. If an overlay is designed to address such threats and vulnerabilities, they should be identified and documented in this section.

[101] Tailored baselines produced using the concept of *overlays* can be published independently in a variety of venues and publications including, for example, OMB policies, CNSS Instructions, NIST Special Publications, industry standards, and sector-specific guidance. As part of the overlay initiative at the federal level, the previous guidance in this appendix regarding industrial and process control system security will be transferred to NIST Special Publication 800-82.

[102] While organizations are encouraged to use the overlay concept to tailor security control baselines, generating widely divergent overlays on the same topic may prove to be counterproductive. The overlay concept is most effective when communities of interest work together to create consensus-based overlays that are not duplicative.

Example

Tactical overlays apply to organizational information systems that are being developed for use in or that will be deployed to tactical environments. Examples of tactical environments include, for example: mobile command centers such as command and control aircraft and large deck ships; mobile platforms such as tanks and fighter jets; and dismounted environments such as military personnel on foot in war zones. Some distinguishing characteristics of tactical environments include, for example: significant size, weight, and power constraints; network bandwidth and connectivity constraints; processing and storage limitations; high operational tempo; harsh environmental conditions; frequent personnel turnover; data with high refresh rates and low persistent value; and close physical proximity to adversaries and the associated non-cyber threats.

While many of the security controls from the initial baselines continue to apply in tactical environments, how the controls are implemented varies. Implementation varies because of differences in risk and in both technical and operational constraints. For example, because ships have little bandwidth it is not practical to automatically push all necessary security updates over the network. Instead, helicopters deliver CDs with the updates to the ships when necessary. Similarly, automatic updates in a tactical environment could be dangerous if the updates resulted in the system becoming inoperable or disruption of an ongoing mission, thereby compromising the success of the mission and the safety of the troops. In this case, updates are delayed until after active operational missions have been completed. Other security controls such as auditing must be carefully tailored to be sensitive to the limited storage and processing capacity of some tactical systems—resources that must be shared with critical mission functionality.

Applicability

Organizations provide a series of questions that are used to determine whether or not the overlay applies to a particular information system. The questions and possible answers are supported by the overlay characteristics and assumptions and lead organizations to a final decision on whether or not the overlay applies to a specific information system.

Example

The following questions are used to determine whether or not this overlay applies to a particular information system:

- Will the information system be deployed to a tactical environment (e.g., war zone, peacekeeping activity, disaster relief, humanitarian aid)?
- Will the size and weight of the information system have to be limited due to constraints of the operational environment (e.g., it must fit within a small area on a command and control aircraft, must be carried by a soldier)?
- Will the power supply for the information system be limited because it will not be possible to connect to a power grid (e.g., it will rely on a generator or batteries)?
- Will the network connectivity for the information system be limited and the bandwidth low due to constraints of the operational environment?
- Will the network connectivity be intermittent or unreliable?
- How persistent is the data (e.g., length of time data is relevant or requires protection)?
- Will the operational tempo be high (e.g., require 24-7 use of the information system)?
- Will the information system be required to operate in extreme environmental conditions (e.g., heat, salt, humidity, altitude, vibration)?

Implementation

Organizations describe which baseline is used as the foundation for the overlay (e.g., the low-impact, moderate-impact, or high-impact baselines from Appendix D or alternative baselines established for national security systems). Organizations also define any requirements related to implementation such as any additional overlays that are expected to be used in conjunction with this overlay and provide any guidance that should be considered when tailoring the resulting set of security controls developed from the selected baseline and applicable overlays. The security controls specified through the use of overlays can be implemented as a common, system-specific, or hybrid controls based on organization-specific guidance.

Table of Overlay Controls

Organizations list the set of security controls and control enhancements that apply to this overlay, indicating which controls/enhancements have been added to or removed from the initial baseline based on the tailoring guidance provided in Section 3.2 or any organization-specific guidance. It is possible to have an overlay without adding or removing security controls—that is, the overlay may only include new supplemental guidance, parameter values, or statutory/regulatory controls.

Supplemental Guidance

Organizations provide supplemental guidance for the security controls and control enhancements in the overlay. In some cases, the supplemental guidance for the selected controls/enhancements is modified to address the characteristics and assumptions of the overlays and the environments in which the overlays are intended to operate. Supplemental guidance can also provide information as to why a particular control/enhancement may not be applicable in some environments and offer suggestions for compensating controls, as appropriate. The use of particular overlays may limit implementation options for some security controls. Therefore, the supplemental guidance may include implementation guidance for those controls. The overlay supplemental guidance follows the format of security controls in Appendix F.

Example

The following examples illustrate additional supplemental guidance for industrial control systems.

AC-5 SEPARATION OF DUTIES

ICS Supplemental Guidance: In situations where the ICS cannot support the differentiation of roles, the organization employs appropriate compensating controls (e.g., providing increased personnel security and auditing). The organization carefully considers the appropriateness of a single individual performing multiple critical roles.

SC-13 CRYPTOGRAPHIC PROTECTION

ICS Supplemental Guidance: The use of cryptography is determined after careful consideration of the security needs and the potential ramifications on system performance. For example, the organization considers whether latency induced from the use of cryptography would adversely impact the operational performance of the ICS.

SC-10 NETWORK DISCONNECT

ICS Supplemental Guidance: In situations where the ICS cannot terminate a network connection at the end of a session or after an organization-defined time period of inactivity, or the ICS cannot terminate a network connection due to significant adverse impact on performance, safety, or reliability, the organization employs appropriate compensating controls (e.g., providing increased auditing measures or limiting remote access privileges to key personnel).

Statutory/Regulatory Controls

Organizations list security controls that are required on the basis of specific statutory/regulatory requirements (above and beyond FISMA), if applicable, including an identification of the specific statutory/regulatory requirements. If none of the security controls are statutory/regulatory, this is indicated in the overlay.

Tailoring Guidance

Organizations provide any tailoring guidance related to the use of the overlay. Tailoring guidance is contained in Section 3.2. If no additional tailoring guidance is needed, state that in this section. An information system owner may need to tailor the set of security controls established by simply combining the baseline and all appropriate overlays. In some cases, the use of multiple overlays may provide conflicting guidance. Authorizing officials have the authority to approve tailoring decisions and the resulting set of security controls in the tailored baseline. While information system owners, in conjunction with authorizing officials, determine the appropriate set of security controls for an information system, overlay developers may want to include information that will help guide those tailoring decisions. Organizations also establish any unique parameter values for the security control selections in the overlay.

Duration

Organizations define how long the overlay is to be in effect and any the events that trigger an update to the overlay other than changes to NIST Special Publication 800-53, CNSS Instruction 1253, or organization-specific security guidance. If there are no unique events that can trigger an update for this overlay, state that in this section.[103]

Definitions

Organizations provide any terms and associated definitions that are unique and relevant to this overlay. The terms and definitions are listed in alphabetical order. If there are no unique terms and definitions for this overlay, state that in this section.

[103] In addition to describing which version of NIST Special Publication 800-53 or CNSS Instruction 1253 is used to create overlays, organizations also consider updating overlays when modifications to baselines occur. Organizations should attempt to minimize the lag time in updating overlays with the latest baseline information provided by NIST or CNSS.

APPENDIX J

PRIVACY CONTROL CATALOG

PRIVACY CONTROLS, ENHANCEMENTS, AND SUPPLEMENTAL GUIDANCE

With increasing dependency on information systems, dramatic advances in information technologies, and significant growth in new applications of those technologies in such areas as cloud computing, Smart Grid, and mobile computing, information security and privacy are taking on new levels of importance in the public and private sectors. Privacy, with respect to personally identifiable information (PII),[104] is a core value that can be obtained only with appropriate legislation, policies, procedures, and associated controls to ensure compliance with requirements. Protecting the privacy of PII collected, used, maintained, shared, and disposed of by programs and information systems, is a fundamental responsibility of federal organizations. In today's digital world, effective privacy for individuals depends on the safeguards employed within the information systems that are processing, storing, and transmitting PII. Organizations cannot have effective privacy without a foundation of information security. However, privacy is more than security and includes, for example, the principles of transparency, notice, and choice.

This appendix provides a structured set of controls for protecting privacy.[105] It also serves as a roadmap for organizations to use in identifying and implementing privacy controls concerning the entire life cycle of PII, whether in paper or electronic form.[106] The controls focus on information privacy as a value distinct from, but highly interrelated with, information security. The privacy controls are based on the Fair Information Practice Principles (FIPPs)[107] embodied in the Privacy Act of 1974, Section 208 of the E-Government Act of 2002, and related Office of Management and Budget (OMB) guidance. The FIPPs are designed to build public trust in an organization's privacy practices and to help organizations avoid tangible costs and intangible damages stemming from privacy incidents.

[104] OMB Memorandum 07-16 defines PII as information which can be used to distinguish or trace an individual's identity such as their name, social security number, biometric records, etc., alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother's maiden name, etc. OMB Memorandum 10-22 reaffirmed this definition. NIST Special Publication 800-122 defines PII as any information about an individual that is maintained by an agency, including: (i) any information that can be used to distinguish or trace an individual's identity, such as name, social security number, date and place of birth, mother's maiden name, or biometric records; and (ii) any other information that is linked or linkable to an individual, such as medical, educational, financial, and employment information. Special Publication 800-122 differs from this appendix because it was focused on the security objective of confidentiality and not privacy in the broad sense. Definitions of PII established by organizations may vary based on the consideration of additional regulatory requirements. The privacy controls in this appendix apply regardless of the definition of PII by organizations.

[105] In 2010, the Federal CIO Council Privacy Committee issued a framework for designing and implementing a privacy program entitled *Best Practices: Elements of a Federal Privacy Program (Elements White Paper)*. The privacy controls in this appendix mirror a number of the elements included in the paper. Organizations can use the privacy controls and the guidance in the paper to develop an organization-wide privacy program or enhance an already existing program.

[106] Although NIST Special Publication 800-53 is primarily about protecting information, organizations may also engage in activities that do not involve the collection and use of PII, but may nevertheless raise privacy risks or concerns. The privacy controls are equally applicable to those activities and can be used to analyze the privacy risk and mitigate such risk when necessary.

[107] The FIPPs are widely accepted in the United States and internationally as a general framework for privacy and are reflected in other federal and international laws and policies. In a number of organizations, FIPPs serve as the basis for analyzing privacy risks and determining appropriate mitigation strategies. The Federal Enterprise Architecture Security and Privacy Profile (FEA-SPP) also provided information and materials in development of the privacy controls.

Privacy controls are the administrative, technical, and physical safeguards employed within organizations to protect and ensure the proper handling of PII. There are eight privacy control families with each family aligning with one of the FIPPs. The privacy control families can be implemented at the organization, department, agency, component, office, program, or information system level, under the leadership of the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO)[108] and in coordination with the Chief Information Security Officer, Chief Information Officer, program officials, and legal counsel. Table J-1 provides a summary of the privacy controls by family in the privacy control catalog.

TABLE J-1: SUMMARY OF PRIVACY CONTROLS BY FAMILY

ID	PRIVACY CONTROLS
AP	**Authority and Purpose**
AP-1	Authority to Collect
AP-2	Purpose Specification
AR	**Accountability, Audit, and Risk Management**
AR-1	Governance and Privacy Program
AR-2	Privacy Impact and Risk Assessment
AR-3	Privacy Requirements for Contractors and Service Providers
AR-4	Privacy Monitoring and Auditing
AR-5	Privacy Awareness and Training
AR-6	Privacy Reporting
AR-7	Privacy-Enhanced System Design and Development
AR-8	Accounting of Disclosures
DI	**Data Quality and Integrity**
DI-1	Data Quality
DI-2	Data Integrity and Data Integrity Board
DM	**Data Minimization and Retention**
DM-1	Minimization of Personally Identifiable Information
DM-2	Data Retention and Disposal
DM-3	Minimization of PII Used in Testing, Training, and Research
IP	**Individual Participation and Redress**
IP-1	Consent
IP-2	Individual Access
IP-3	Redress
IP-4	Complaint Management
SE	**Security**
SE-1	Inventory of Personally Identifiable Information
SE-2	Privacy Incident Response
TR	**Transparency**
TR-1	Privacy Notice
TR-2	System of Records Notices and Privacy Act Statements
TR-3	Dissemination of Privacy Program Information
UL	**Use Limitation**
UL-1	Internal Use
UL-2	Information Sharing with Third Parties

[108] All federal agencies and departments designate an SAOP/CPO as the senior organizational official with the overall organization-wide responsibility for information privacy issues. OMB Memorandum 05-08 provides guidance for the designation of SAOPs/CPOs. The term SAOP/CPO as used in this appendix means an organization's senior privacy leader, whose job title may vary from organization to organization.

There is a strong similarity in the structure of the privacy controls in this appendix and the security controls in Appendix F.[109] Moreover, the use of privacy plans in conjunction with security plans can provide an opportunity for organizations to select the appropriate set of security and privacy controls in accordance with organizational mission/business requirements and the environments in which the organizations operate. Incorporating the fundamental concepts associated with managing information security risk helps to ensure that the employment of privacy controls is carried out in a cost-effective and risk-based manner while simultaneously meeting compliance requirements. In addition to the basic privacy controls described in this appendix, NIST plans to develop assessment procedures to allow organizations to evaluate the effectiveness of the controls. Standardized privacy controls and assessment procedures will provide a more disciplined and structured approach for satisfying federal privacy requirements and demonstrating compliance with those requirements.

In summary, the Privacy Appendix achieves several important objectives. The appendix:

- Provides a structured set of privacy controls, based on international standards and best practices, that help organizations enforce requirements derived from federal privacy legislation, policies, regulations, directives, standards, and guidance;
- Establishes a linkage and relationship between privacy and security controls for purposes of enforcing respective privacy and security requirements that may overlap in concept and in implementation within federal information systems, programs, and organizations;
- Demonstrates the applicability of the NIST Risk Management Framework in the selection, implementation, assessment, and monitoring of privacy controls deployed in federal information systems, programs, and organizations; and
- Promotes closer cooperation between privacy and security officials within the federal government to help achieve the objectives of senior leaders/executives in enforcing the requirements in federal privacy legislation, policies, regulations, directives, standards, and guidance.

[109] While the security controls in Appendix F are allocated to the low, moderate, and high baselines in Appendix D, privacy controls are selected and implemented irrespective of the security control baselines—that is, the privacy controls are selected and implemented based on the privacy requirements of organizations and the need to protect the PII of individuals collected and maintained by systems and programs, in accordance with federal privacy legislation, policies, directives, regulations, guidelines, and best practices. However, it is understood that information systems rated moderate or high will trigger the need for several of the privacy controls outlined in this appendix as such systems may contain sensitive PII.

HOW TO USE THIS APPENDIX

The privacy controls outlined in this publication are primarily for use by an organization's Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) when working with program managers, information system developers, and information security personnel to determine how best to incorporate effective privacy protections and practices (i.e., privacy controls) within those programs and/or systems. These controls facilitate the organization's efforts to comply with privacy requirements affecting those programs and/or systems that collect, use, maintain, share, or dispose of personally identifiable information (PII).

Organizations can use the Risk Management Framework and its inherent flexibility, to assist in privacy control selection, implementation, assessment, and monitoring. Organizations analyze and apply each privacy control with respect to their distinct mission and operational needs based on their legal authorities and obligations. Implementation of the privacy controls may vary based upon this analysis (for example, organizations that are defined as *covered entities* pursuant to the Health Insurance Portability and Accountability Act [HIPAA] may have additional requirements that are not specifically enumerated in this publication). This enables organizations to determine the information practices that are compliant with law and policy and those that may need review. It also enables organizations to tailor the privacy controls to meet their defined and specific needs at the organization level, mission/business process level, and information system level. Organizations with national security or law enforcement authorities take those authorities as well as privacy interests into account in determining how to apply the privacy controls in their operational environments.

Control enhancements described in Appendix J reflect best practices which organizations should strive to achieve, but are not mandatory. Organizations should decide when to apply control enhancements to support their particular missions and business functions. Specific *overlays* for privacy, developed in accordance with the guidance in Section 3.2 and Appendix I, can also be considered to facilitate the tailoring of the security control baselines in Appendix D with the requisite privacy controls to ensure that both security and privacy requirements can be satisfied by organizations. Many of the security controls in Appendix F that are allocated to security control baselines provide the fundamental information protection for confidentiality (i.e., nondisclosure) within organizational information systems—protection that is essential for strong and effective privacy.

FAMILY: AUTHORITY AND PURPOSE

This family furthers compliance with the Privacy Act by ensuring that organizations: (i) identify the legal bases that authorize a particular PII collection or activity that impacts privacy; and (ii) specify in their notices, the purpose(s) for which PII is collected.

AP-1 AUTHORITY TO COLLECT

Control: The organization determines the legal authority that permits the collection, use, maintenance, and sharing of personally identifiable information (PII), either generally or in support of a specific program or information system need.

Supplemental Guidance: Before collecting PII in connection with an information system or program, the organization determines whether the contemplated collection of PII is legally authorized. Program officials consult with the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) and legal counsel regarding the authority of any program or activity to collect PII. The authority to collect PII is documented in the System of Records Notice (SORN) and/or Privacy Impact Assessment (PIA). Related controls: AR-2, DM-1, TR-1, TR-2.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (e)(3)(A); Section 208(c), E-Government Act of 2002 (P.L. 107-347).

AP-2 PURPOSE SPECIFICATION

Control: The organization describes the purpose(s) for which personally identifiable information (PII) is collected, used, maintained, and shared in its privacy notices.

Supplemental Guidance: Often, statutory language expressly authorizes specific collections and uses of PII. When statutory language is written broadly and thus subject to interpretation, organizations ensure, in consultation with the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) and legal counsel, that there is a close nexus between the general authorization and any specific collection of PII. Once the specific purposes have been identified, the purposes are clearly described in the related privacy compliance documentation, including but not limited to Privacy Impact Assessments (PIAs), System of Records Notices (SORNs), and Privacy Act Statements on forms organizations use to collect PII. Further, in order to avoid unauthorized collections or uses of PII, personnel who handle PII receive training on the organizational authorities for collecting PII and on the contents of the notice. Related controls: AR-4, AR-5, TR-1, UL-1, UL-2.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (e)(3)(A)-(B); Sections 208(b), (c), E-Government Act of 2002 (P.L. 107-347).

FAMILY: ACCOUNTABILITY, AUDIT, AND RISK MANAGEMENT

This family enhances public confidence through effective controls for governance, monitoring, risk management, and assessment to demonstrate that organizations are complying with applicable privacy protection requirements and minimizing overall privacy risk.

AR-1 GOVERNANCE AND PRIVACY PROGRAM

Control: The organization:

a. Appoints a Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) accountable for developing, implementing, and maintaining an organization-wide governance and privacy program to ensure compliance with all applicable laws and regulations regarding the collection, use, maintenance, sharing, and disposal of personally identifiable information (PII) by programs and information systems;

b. Monitors federal privacy laws and policy for changes that affect the privacy program;

c. Allocates [*Assignment: organization-defined allocation of budget and staffing resources*] to implement and operate the organization-wide privacy program;

d. Develops a strategic organizational privacy plan for implementing applicable privacy controls, policies, and procedures;

e. Develops, disseminates, and implements operational privacy policies and procedures that govern the appropriate privacy and security controls for programs, information systems, or technologies involving PII; and

f. Updates privacy plan, policies, and procedures [*Assignment: organization-defined frequency, at least biennially*].

Supplemental Guidance: The development and implementation of a comprehensive governance and privacy program demonstrates organizational accountability for and commitment to the protection of individual privacy. Accountability begins with the appointment of an SAOP/CPO with the authority, mission, resources, and responsibility to develop and implement a multifaceted privacy program. The SAOP/CPO, in consultation with legal counsel and information security officials: (i) ensures the development, implementation, and enforcement of privacy policies and procedures; (ii) defines roles and responsibilities for protecting PII; (iii) determines the level of information sensitivity with regard to PII holdings; (iv) identifies the laws, regulations, and internal policies that apply to the PII; (v) monitors privacy best practices; and (vi) monitors/audits compliance with identified privacy controls.

To further accountability, the SAOP/CPO develops privacy plans to document the privacy requirements of organizations and the privacy and security controls in place or planned for meeting those requirements. The plan serves as evidence of organizational privacy operations and supports resource requests by the SAOP/CPO. A single plan or multiple plans may be necessary depending upon the organizational structures, requirements, and resources, and the plan(s) may vary in comprehensiveness. For example, a one-page privacy plan may cover privacy policies, documentation, and controls already in place, such as Privacy Impact Assessments (PIAs) and System of Records Notices (SORNs). A comprehensive plan may include a baseline of privacy controls selected from this appendix and include: (i) processes for conducting privacy risk assessments; (ii) templates and guidance for completing PIAs and SORNs; (iii) privacy training and awareness requirements; (iv) requirements for contractors processing PII; (v) plans for eliminating unnecessary PII holdings; and (vi) a framework for measuring annual performance goals and objectives for implementing identified privacy controls.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a; E-Government Act of 2002 (P.L. 107-347); Federal Information Security Management Act of 2002 (FISMA), 44 U.S.C. § 3541; OMB Memoranda 03-22, 05-08, 07-16; OMB Circular A-130; Federal Enterprise Architecture Security and Privacy Profile.

AR-2 PRIVACY IMPACT AND RISK ASSESSMENT

Control: The organization:

a. Establishes a privacy risk assessment process that assesses privacy risk to individuals resulting from the collection, sharing, storing, transmitting, and use of personally identifiable information (PII);

b. Conducts a Privacy Impact Assessment (PIA) for information systems and programs in accordance with applicable law, OMB policy, and any existing organizational policies and procedures; and

c. Follows a documented, repeatable process for conducting, reviewing, and approving PIAs.

Supplemental Guidance: Organizational privacy risk assessment processes operate across the life cycles of all mission/business processes that collect, use, maintain, share, or dispose of PII. OMB Memorandum 03-22 provides guidance to organizations for implementing the privacy provisions of the E-Government Act of 2002, including guidance on when PIAs are required for information systems. Some organizations may be required by law or policy to extend the PIA requirement to other activities involving PII or otherwise impacting privacy, for example, programs, projects, or regulations. PIAs are conducted to identify privacy risks and identify methods to mitigate those risks. PIAs are also conducted to ensure that programs or information systems comply with legal, regulatory, and policy requirements. PIAs also serve as notice to the public of privacy practices. PIAs are performed before developing or procuring information systems, or initiating programs or projects, that collect, use, maintain, or share PII and are updated when changes create new privacy risks.

Control Enhancements: None.

References: Section 208, E-Government Act of 2002 (P.L. 107-347); Federal Information Security Management Act of 2002 (FISMA), 44 U.S.C. § 3541; OMB Memoranda 03-22, 05-08.

AR-3 PRIVACY REQUIREMENTS FOR CONTRACTORS AND SERVICE PROVIDERS

Control: The organization:

a. Establishes privacy roles and responsibilities for contractors and service providers; and

b. Includes privacy requirements in contracts and other acquisition-related documents.

Supplemental Guidance: Contractors and service providers include, but are not limited to, service bureaus, information providers, information processors, and other organizations providing information system development, information technology services, and other outsourced applications. Organizations consult with legal counsel, the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO), and contracting officers about applicable laws, directives, policies, or regulations that may impact implementation of this control. Related control: SA-4.

Control Enhancements: None.

References: OMB Circular A-130.

AR-4 PRIVACY MONITORING AND AUDITING

Control: The organization monitors and audits privacy controls and internal privacy policy [*Assignment: organization defined frequency*] to ensure effective implementation.

Supplemental Guidance: To promote accountability, organizations identify and address gaps in privacy compliance, management, operational, and technical controls by conducting regular assessments (e.g., internal risk assessments). These assessments can be self-assessments or third-party audits that result in reports on compliance gaps identified in programs, projects, and information systems. In addition to auditing for effective implementation of all privacy controls identified in this Appendix, organizations assess whether they: (i) implement a process to embed privacy considerations into the life cycle of programs, information systems, mission/business processes, and technology; (ii) monitor for changes to applicable privacy laws, regulations, and policies; (iii) track programs, information systems, and applications that collect and maintain personally identifiable information (PII) to ensure compliance; (iv) ensure access to PII is only on a *need-to-know* basis; and (v) ensure PII is being maintained and used only for the legally authorized purposes identified in the public notice(s).

Organizations also: (i) implement technology to audit for the security, appropriate use, and loss of PII; (ii) perform reviews to ensure physical security of documents containing PII; and (iii) assess contractor compliance with privacy requirements. The organization Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) coordinates monitoring and auditing efforts with information security officials and ensures that the results are provided to senior managers and oversight officials. Related controls: AR-6, AU-1, AU-2, AU-3, AU-6, AU-12, CA-7, TR-1, UL-2.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a; Section 208, E-Government Act of 2002 (P.L. 107-347); OMB Memoranda 03-22, 05-08, 07-16.

AR-5 PRIVACY AWARENESS AND TRAINING

Control: The organization:

a. Develops, implements, and updates a comprehensive training and awareness strategy aimed at ensuring that personnel understand privacy responsibilities and procedures;

b. Administers basic privacy training [*Assignment: organization-defined frequency, at least annually*] and targeted, role-based privacy training for personnel having responsibility for personally identifiable information (PII) or for activities that involve PII [*Assignment: organization-defined frequency, at least annually*]; and

c. Ensures that personnel certify (manually or electronically) acceptance of responsibilities for privacy requirements [*Assignment: organization-defined frequency, at least annually*].

Supplemental Guidance: Through implementation of a privacy training and awareness strategy, the organization promotes a culture of privacy. Privacy training and awareness programs typically focus on broad topics, such as responsibilities under the Privacy Act of 1974 and E-Government Act of 2002 and the consequences of failing to carry out those responsibilities, how to identify new privacy risks, how to mitigate privacy risks, and how and when to report privacy incidents. Privacy training may also target data collection and use requirements identified in public notices, such as Privacy Impact Assessments (PIAs) or System of Records Notices (SORNs) for a program or information system. Specific training methods may include: (i) mandatory annual privacy awareness training; (ii) targeted, role-based training; (iii) internal privacy program websites; (iv) manuals, guides, and handbooks; (v) slide presentations; (vi) events (e.g., privacy awareness week, privacy clean-up day); (vii) posters and brochures; and (viii) email messages to all employees and contractors. Organizations update training based on changing statutory, regulatory, mission, program, business process, and information system requirements, or on the results of compliance

monitoring and auditing. Where appropriate, organizations may provide privacy training as part of existing information security training. Related controls: AT-2, AT-3, TR-1.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a; Section 208, E-Government Act of 2002 (P.L. 107-347); OMB Memoranda 03-22, 07-16.

AR-6 PRIVACY REPORTING

Control: The organization develops, disseminates, and updates reports to the Office of Management and Budget (OMB) and Congress to demonstrate accountability with specific statutory and regulatory privacy program mandates, and to senior management and other personnel with responsibility for monitoring privacy program progress and compliance.

Supplemental Guidance: Through external and internal privacy reporting, organizations promote accountability and transparency in organizational privacy operations. Reporting also helps organizations determine progress in meeting privacy compliance requirements and privacy controls, compare performance across the federal government, identify vulnerabilities and gaps in policy and implementation, and identify success models. Types of privacy reports include: (i) annual Senior Agency Official for Privacy (SAOP) reports to OMB; (ii) reports to Congress required by the *Implementing Regulations of the 9/11 Commission Act*; or (iii) other public reports required by specific statutory mandates or internal policies of organizations. The organization Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) consults with legal counsel, where appropriate, to ensure that organizations meet all applicable privacy reporting requirements.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a; Section 208, E-Government Act of 2002 (P.L. 107-347); Federal Information Security Management Act of 2002 (FISMA), 44 U.S.C. § 3541; Section 803, 9/11 Commission Act, 42 U.S.C. § 2000ee-1; Section 804, 9/11 Commission Act, 42 U.S.C. § 2000ee-3; Section 522, Consolidated Appropriations Act of 2005 (P.L. 108-447); OMB Memoranda 03-22; OMB Circular A-130.

AR-7 PRIVACY-ENHANCED SYSTEM DESIGN AND DEVELOPMENT

Control: The organization designs information systems to enhance privacy by automating privacy controls.

Supplemental Guidance: To the extent feasible when designing organizational information systems, organizations employ technologies that automate privacy controls on the collection, use, and disclosure of personally identifiable information (PII). By building privacy controls into system design, organizations mitigate privacy risks to PII, thereby reducing the likelihood of information system breaches and other privacy-related incidents.[110] Organizations also conduct periodic reviews of systems' collection, use, and disclosure of PII to assess compliance with the Privacy Act and the organization's privacy policy. Regardless of whether automated privacy controls are employed, organizations regularly monitor information system use and sharing of PII to ensure that the use/sharing is consistent with the authorized purposes identified in the Privacy Act and/or in the public notice of organizations, or in a manner compatible with those purposes. Related controls: AC-6, AR-4, AR-5, DM-2, TR-1.

[110] The Information Privacy Commissioner of Ontario, Canada's Privacy by Design approach is consistent with this guidance (See www.privacybydesign.ca).

Control Enhancements: None.

References: Sections 208(b) and(c), E-Government Act of 2002 (P.L. 107-347); OMB Memorandum 03-22.

AR-8 ACCOUNTING OF DISCLOSURES

Control: The organization, consistent with, and subject to exceptions in, the Privacy Act:

a. Keeps an accurate accounting of disclosures of information held in each system of records under its control, including:

   - Date, nature, and purpose of each disclosure of a record; and
   - Name and address of the person or agency to which the disclosure was made;

b. Retains the accounting of disclosures for the life of the record or five years after the disclosure is made, whichever is longer; and

c. Makes the accounting of disclosures available to the person named in the record upon request.

Supplemental Guidance: The Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) periodically consults with managers of organization systems of record to ensure that the required accountings of disclosures of records are being properly maintained and provided to persons named in those records consistent with the dictates of the Privacy Act.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (c).

FAMILY: DATA QUALITY AND INTEGRITY

This family ensures compliance with Section 552a (e)(2) of the Privacy Act of 1974 and enhances public confidence that any PII collected and maintained by organizations is accurate, relevant, timely, and complete for the purpose for which it is to be used, as specified in public notices.

DI-1 DATA QUALITY

Control: The organization:

a. Confirms to the greatest extent practicable upon collection or creation of personally identifiable information (PII), the accuracy, relevance, timeliness, and completeness of that information;

b. Collects PII directly from the individual to the greatest extent practicable;

c. Checks for, and corrects as necessary, any inaccurate or outdated PII used by its programs or systems [*Assignment: organization-defined frequency*]; and

d. Issues guidelines ensuring and maximizing the quality, utility, objectivity, and integrity of disseminated information.

Supplemental Guidance: Organizations take reasonable steps to confirm the accuracy of PII. Such steps may include, for example, editing and validating addresses as they are collected or entered into information systems using automated address verification look-up application programming interfaces (APIs). The types of measures taken to protect data quality may be based on the nature and context of the PII, how it is to be used, and how it was obtained. Measures taken to validate the accuracy of PII that is used to make determinations about the rights, benefits, or privileges of individuals under federal programs may be more comprehensive than those used to validate less sensitive PII. Additional steps may be necessary to validate PII that is obtained from sources other than individuals or the authorized representatives of individuals.

When PII is of a sufficiently sensitive nature (e.g., when it is used for annual reconfirmation of a taxpayer's income for a recurring benefit), organizations incorporate mechanisms into information systems and develop corresponding procedures for how frequently, and by what method, the information is to be updated. Related controls: IP-3, SI-10.

Control Enhancements:

(1) *DATA QUALITY | VALIDATE PII*

The organization requests that the individual or individual's authorized representative validate PII during the collection process.

(2) *DATA QUALITY | RE-VALIDATE PII*

The organization requests that the individual or individual's authorized representative revalidate PII [*Assignment: organization-defined frequency*].

References: The Privacy Act of 1974, 5 U.S.C. § 552a (e)(5); Treasury and General Government Appropriations Act for Fiscal Year 2001 (P.L. 106-554), app C § 515, 114 Stat. 2763A-153-4; Paperwork Reduction Act, 44 U.S.C. § 3501; OMB Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies (October 2001); OMB Memorandum 07-16.

DI-2 DATA INTEGRITY AND DATA INTEGRITY BOARD

Control: The organization:

a. Documents processes to ensure the integrity of personally identifiable information (PII) through existing security controls; and

b. Establishes a Data Integrity Board when appropriate to oversee organizational Computer Matching Agreements[111] and to ensure that those agreements comply with the computer matching provisions of the Privacy Act.

Supplemental Guidance: Organizations conducting or participating in Computer Matching Agreements with other organizations regarding applicants for and recipients of financial assistance or payments under federal benefit programs, and applicants for and holders of positions as federal personnel, establish a Data Integrity Board to oversee and coordinate their implementation of such matching agreements. In many organizations, the Data Integrity Board is led by the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO). The Data Integrity Board ensures that controls are in place to maintain both the quality and the integrity of data shared under Computer Matching Agreements. Related controls: AC-1, AC-3, AC-4, AC-6, AC-17, AC-22, AU-2, AU-3, AU-6, AU-10, AU-11, DI-1, SC-8, SC-9, SC-14, SC-28, SI-9, UL-2.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (u); OMB Circular A-130, Appendix I.

[111] Organizations enter into Computer Matching Agreements in connection with computer matching programs to which they are a party. With certain exceptions, a computer matching program is any computerized comparison of two or more automated systems of records or a system of records with nonfederal records for the purpose of establishing or verifying the eligibility of, or continuing compliance with, statutory and regulatory requirements by, applicants for, recipients or beneficiaries of, participants in, or providers of services with respect to cash or in-kind assistance or payments under federal benefit programs. Reference the Computer Matching and Privacy Protection Act of 1988, 5 U.S.C. § 552a (a)(8)(A).

FAMILY: DATA MINIMIZATION AND RETENTION

This family helps organizations implement the data minimization and retention elements of the Privacy Act, which requires organizations to collect, use, and retain only PII that is relevant and necessary for the specified purpose for which it was originally collected. Organizations retain PII for only as long as necessary to fulfill the specified purpose(s) and in accordance with a National Archives and Records Administration (NARA)-approved record retention schedule.

DM-1 MINIMIZATION OF PERSONALLY IDENTIFIABLE INFORMATION

Control: The organization:

a. Identifies the minimum personally identifiable information (PII) elements (e.g., name, address, date of birth) that are relevant and necessary to accomplish the legally authorized purpose of collection;

b. Limits the collection and retention of PII to the minimum elements identified for the purposes described in the notice and for which the individual has provided consent; and

c. Conducts an initial evaluation of PII holdings and establishes and follows a schedule for regularly reviewing those holdings [*Assignment: organization-defined frequency, at least annually*] to ensure that only PII identified in the notice is collected and retained, and that the PII continues to be necessary to accomplish the legally authorized purpose.

Supplemental Guidance: The collection of PII is consistent with a purpose authorized by law or regulation. The minimum set of PII elements required to support a specific organization business process may be a subset of the PII the organization is authorized to collect. Program officials consult with the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) and legal counsel to identify the minimum PII elements required by the information system or activity to accomplish the legally authorized purpose.

Organizations can further reduce their privacy and security risks by also reducing their inventory of PII, where appropriate. OMB Memorandum 07-16 requires organizations to conduct both an initial review and subsequent reviews of their holdings of all PII and ensure, to the maximum extent practicable, that such holdings are accurate, relevant, timely, and complete. Organizations are also directed by OMB to reduce their holdings to the minimum necessary for the proper performance of a documented organizational business purpose. OMB Memorandum 07-16 requires organizations to develop and publicize, either through a notice in the Federal Register or on their websites, a schedule for periodic reviews of their holdings to supplement the initial review. Reductions in organizational holdings of PII are consistent with NARA retention schedules.

By performing periodic evaluations, organizations reduce risk, ensure that they are collecting only the data specified in the notice, and ensure that the data collected is still relevant and necessary for the purpose(s) specified in the notice. Related controls: AP-2, AR-4, IP-1, SE-1, SI-12, TR-1.

Control Enhancements:

(1) *MINIMIZATION OF PERSONALLY IDENTIFIABLE INFORMATION | LOCATE / REMOVE / REDACT / ANONYMIZE PII*

The organization, where feasible and within the limits of technology, locates and removes/redacts specified PII and/or uses anonymization and de-identification techniques to permit use of the retained information while reducing its sensitivity and reducing the risk resulting from disclosure.

Supplemental Guidance: NIST Special Publication 800-122 provides guidance on anonymization.

References: The Privacy Act of 1974, 5 U.S.C. §552a (e)(1), (e)(2); Section 208(b), E-Government Act of 2002 (P.L. 107-347); OMB Memoranda 03-22, 07-16.

DM-2 DATA RETENTION AND DISPOSAL

Control: The organization:

a. Retains personally identifiable information (PII) for [*Assignment: organization-defined time period*] to fulfill the purpose(s) identified in the notice or as required by law;

b. Disposes of, destroys, erases, and/or anonymizes the PII, regardless of the method of storage in accordance with a NARA-approved record retention schedule and in a manner that prevents loss, theft, misuse, or unauthorized access; and

c. Uses [*Assignment: organization-defined techniques or methods*] to ensure secure deletion or destruction of PII (including originals, copies, and archived records).

Supplemental Guidance: NARA provides retention schedules that govern the disposition of federal records containing PII. Program officials coordinate with records officers and with NARA to identify appropriate retention periods and disposal methods. NARA may require organizations to retain PII longer than is operationally needed. In those situations, organizations describe such requirements in the notice. Methods of storage include, for example, electronic, optical media, or paper.

Examples of ways organizations may reduce holdings include reducing the types of PII held (e.g., delete Social Security numbers if their use is no longer needed) or shortening the retention period for PII that is maintained if it is no longer necessary to keep PII for long periods of time (this effort is undertaken in consultation with an organization's records officer to receive NARA approval). In both examples, organizations provide notice (e.g., an updated System of Records Notice) to inform the public of any changes in holdings of PII.

Certain read-only archiving techniques, such as DVDs, CDs, microfilm, or microfiche may not permit the removal of individual records without the destruction of the entire database contained on such media. Related controls: AR-4, AU-11, DM-1, MP-6, SI-12, TR-1.

Control Enhancements:

(1) *DATA RETENTION AND DISPOSAL | SYSTEM CONFIGURATION*

The organization, where feasible, configures its information systems to record the date PII is collected, created, or updated and when PII is to be deleted or archived under an approved record retention schedule.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (e)(1); Section 208 (e), E-Government Act of 2002 (P.L. 107-347); 44 U.S.C. Chapters 29, 31, 33; OMB Memorandum 07-16; OMB Circular A-130; NIST Special Publication 800-88.

DM-3 MINIMIZATION OF PII USED IN TESTING, TRAINING, AND RESEARCH

Control: The organization:

a. Develops policies and procedures for the use of personally identifiable information (PII) for testing, training, and research; and

b. Implements controls to protect PII used for testing, training, and research.

Supplemental Guidance: Organizations often use PII for testing new applications or information systems prior to deployment. Organizations also use PII for research purposes, such as statistical analysis, and for training.

Control Enhancements:

(1) *MINIMIZATION OF PII USED IN TESTING, TRAINING, AND RESEARCH | RISK MINIMIZATION TECHNIQUES*

The organization, where feasible, uses techniques to minimize the risk to privacy of using PII for research, testing, or training.

Supplemental Guidance: Organizations can minimize risk to privacy of PII by using techniques such as de-identification.

References: NIST Special Publication 800-122.

FAMILY: INDIVIDUAL PARTICIPATION AND REDRESS

This family addresses the need to make individuals active participants in the decision-making process regarding the collection and use of their PII, as required by the Privacy Act. By providing individuals with access to PII and the ability to have their PII corrected or amended, as appropriate, the controls in this family enhance public confidence in organizational decisions made based on the PII.

IP-1 CONSENT

Control: The organization:

a. Provides means, where feasible and appropriate, for individuals to authorize the collection, use, maintaining, and sharing of personally identifiable information (PII) prior to its collection;

b. Provides appropriate means for individuals to understand the consequences of decisions to approve or decline the authorization of the collection, use, dissemination, and retention of PII;

c. Obtains consent, where feasible and appropriate, from individuals prior to any new uses or disclosure of previously collected PII; and

d. Ensures that individuals are aware of and, where feasible, consent to all uses of PII not initially described in the public notice that was in effect at the time the organization collected the PII.

Supplemental Guidance: Consent is fundamental to the participation of individuals in the decision-making process regarding the collection and use of their PII and the use of technologies that may increase risk to personal privacy. To obtain consent, organizations provide individuals appropriate notice of the purposes of the PII collection or technology use and a means for individuals to consent to the activity. Organizations tailor the public notice and consent mechanisms to meet operational needs. Organizations achieve awareness and consent, for example, through updated public notices.

Organizations may obtain consent through opt-in, opt-out, or implied consent. Opt-in consent is the preferred method, but it is not always feasible. Opt-in requires that individuals take affirmative action to *allow* organizations to collect or use PII. For example, opt-in consent may require an individual to sign a document providing consent. In contrast, opt-out requires individuals to take action to *prevent* the collection or use of such PII. For example, the Federal Trade Commission's Do-Not-Call Registry allows individuals to opt-out of receiving unsolicited telemarketing calls by requesting to be added to a list. Implied consent is the least preferred method and should be used in limited circumstances. Implied consent occurs where individuals' behavior or failure to object indicates agreement with the collection or use of PII (e.g., by entering and remaining in a building where notice has been posted that security cameras are in use, the individual implies consent to the video recording). Depending upon the nature of the program or information system, it may be appropriate to allow individuals to limit the types of PII they provide and subsequent uses of that PII. Organizational consent mechanisms include a discussion of the consequences to individuals for failure to provide PII. Consequences can vary from organization to organization. Related controls: AC-2, AP-1, TR-1.

Control Enhancements:

(1) *CONSENT | MECHANISMS SUPPORTING ITEMIZED OR TIERED CONSENT*

The organization implements mechanisms to support itemized or tiered consent for specific uses of data.

Supplemental Guidance: Organizations can provide, for example, individuals' itemized choices as to whether they wish to be contacted for any of a variety of purposes. In this situation, organizations construct consent mechanisms to ensure that the organizational operations comply with individual choices.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (b); Section 208(c), E-Government Act of 2002 (P.L. 107-347); OMB Memoranda 03-22, 10-22.

IP-2 INDIVIDUAL ACCESS

Control: The organization, consistent with, and subject to exceptions in, the Privacy Act:

a. Provides individuals the ability to have access to their personally identifiable information (PII) maintained in its system(s) of records in order to determine whether to have the PII corrected or amended, as appropriate;

b. Publishes rules and regulations governing how individuals may request access to records maintained in a Privacy Act system of records;

c. Publishes access procedures in System of Records Notices (SORNs); and

d. Adheres to Privacy Act requirements and OMB policies and guidance for the proper processing of Privacy Act requests.

Supplemental Guidance: Access affords individuals the ability to review PII about them held within organizational systems of records. Access includes timely, simplified, and inexpensive access to data. Organizational processes for allowing access to records may differ based on resources, legal requirements, or other factors. The organization Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) is responsible for the content of Privacy Act regulations and record request processing, in consultation with legal counsel. Related controls: IP-3, TR-1.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (d); OMB Circular A-130.

IP-3 REDRESS

Control: The organization:

a. Provides a process for individuals to have inaccurate personally identifiable information (PII) maintained by the organization corrected or amended, as appropriate; and

b. Establishes a process for disseminating corrections or amendments of the PII to other authorized users of the PII, such as external information sharing partners and, where feasible and appropriate, notifies affected individuals that their information has been corrected or amended.

Supplemental Guidance: Redress supports the ability of individuals to ensure the accuracy of PII held by organizations. Effective redress processes demonstrate organizational commitment to data quality especially in those business functions where inaccurate data may result in inappropriate decisions or denial of benefits and services to individuals. Organizations apply discretion in determining if records are to be corrected or amended, based on the scope of redress requests, the changes sought, and the impact of the changes. Individuals may appeal an adverse decision and have incorrect information amended, where appropriate.

To provide effective redress, organizations: (i) provide effective notice of the existence of a PII collection; (ii) provide plain language explanations of the processes and mechanisms for requesting access to records; (iii) establish criteria for submitting requests for correction or amendment; (iv) implement resources to analyze and adjudicate requests; (v) implement means of correcting or amending data collections; and (vi) review any decisions that may have been the result of inaccurate information.

Organizational redress processes provide responses to individuals of decisions to deny requests for correction or amendment, including the reasons for those decisions, a means to record individual objections to the organizational decisions, and a means of requesting organizational reviews of the initial determinations. Where PII is corrected or amended, organizations take steps to ensure that

all authorized recipients of that PII are informed of the corrected or amended information. In instances where redress involves information obtained from other organizations, redress processes include coordination with organizations that originally collected the information. Related controls: IP-2, TR-1, UL-2.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (d); OMB Circular A-130.

IP-4 COMPLAINT MANAGEMENT

Control: The organization implements a process for receiving and responding to complaints, concerns, or questions from individuals about the organizational privacy practices.

Supplemental Guidance: Complaints, concerns, and questions from individuals can serve as a valuable source of external input that ultimately improves operational models, uses of technology, data collection practices, and privacy and security safeguards. Organizations provide complaint mechanisms that are readily accessible by the public, include all information necessary for successfully filing complaints (including contact information for the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) or other official designated to receive complaints), and are easy to use. Organizational complaint management processes include tracking mechanisms to ensure that all complaints received are reviewed and appropriately addressed in a timely manner. Related controls: AR-6, IP-3.

Control Enhancements:

(1) *COMPLAINT MANAGEMENT | RESPONSE TIMES*

The organization responds to complaints, concerns, or questions from individuals within [*Assignment: organization-defined time period*].

References: OMB Circular A-130; OMB Memoranda 07-16, 08-09.

FAMILY: SECURITY

This family supplements the security controls in Appendix F to ensure administrative, technical, and physical safeguards are in place to protect PII collected or maintained by organizations against loss, unauthorized access, or disclosure, as required by the Privacy Act, and to ensure that organizational planning and responses to privacy incidents comply with OMB policies and guidance. The controls in this family are implemented in coordination with information security personnel and in accordance with the existing NIST Risk Management Framework.

SE-1 INVENTORY OF PERSONALLY IDENTIFIABLE INFORMATION

Control: The organization:

c. Establishes, maintains, and updates [*Assignment: organization-defined frequency*] an inventory that contains a listing of all programs and information systems identified as collecting, using, maintaining, or sharing personally identifiable information (PII); and

d. Provides each update of the PII inventory to the CIO or information security official [*Assignment: organization-defined frequency*] to support the establishment of information security requirements for all new or modified information systems containing PII.

Supplemental Guidance: The PII inventory enables organizations to implement effective administrative, technical, and physical security policies and procedures to protect PII consistent with Appendix F, and to mitigate risks of PII exposure. As one method of gathering information for its PII inventory, organizations may extract the following information elements from Privacy Impact Assessments (PIAs) of information systems containing PII: (i) the name and acronym for each system identified; (ii) the types of PII contained in that system; (iii) classification of level of sensitivity of all types of PII, as combined in that information system; and (iv) classification of level of potential risk of substantial harm, embarrassment, inconvenience, or unfairness to affected individuals, as well as the financial or reputational risks to organizations, if PII is exposed. Organizations take due care in updating the inventories by identifying linkable data that could create PII. Related controls: AR-1, AR-4, AR-5, AT-1, DM-1, PM-5, UL-3.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (e) (10); Section 208(b)(2), E-Government Act of 2002 (P.L. 107-347); OMB Memorandum 03-22; OMB Circular A-130, Appendix I; FIPS Publication 199; NIST Special Publications 800-37, 800-122.

SE-2 PRIVACY INCIDENT RESPONSE

Control: The organization:

a. Develops and implements a Privacy Incident Response Plan; and

b. Provides an organized and effective response to privacy incidents in accordance with the organizational Privacy Incident Response Plan.

Supplemental Guidance: In contrast to the Incident Response (IR) family in Appendix F, which concerns a broader range of incidents affecting information security, this control uses the term Privacy Incident to describe only those incidents that relate to personally identifiable information (PII). An organizational Privacy Incident Response Plan includes: (i) the establishment of a cross-functional Privacy Incident Response Team that reviews, approves, and participates in the execution of the Privacy Incident Response Plan; (ii) a process to determine whether notice to affected individuals is required and, where appropriate, to provide that notice; (iii) a privacy risk assessment process to determine the extent of harm, embarrassment, inconvenience, or unfairness to affected individuals and, where appropriate, to take steps to mitigate any such risks; and (iv) internal procedures to ensure prompt reporting by employees and contractors of any privacy

incident to information security officials and the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO), consistent with organizational incident management structures. Organizations may choose to integrate Privacy Incident Response Plans with Security Incident Response Plans, or keep the plans separate. Related controls: AR-1, AR-4, AR-5, AR-6, AU-1 through 14, IR-1 through IR-8, RA-1.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (e), (i)(1), and (m); Federal Information Security Management Act of 2002 (FISMA) 44 U.S.C. § 3541; OMB Memoranda 06-19, 07-16; NIST Special Publication 800-37.

FAMILY: TRANSPARENCY

This family implements Sections 552a (e)(3) and (e)(4) of the Privacy Act and Section 208 of the E-Government Act, which require public notice of an organization's information practices and the privacy impact of government programs and activities.

TR-1 PRIVACY NOTICE

Control: The organization:

a. Provides effective notice to the public and to individuals regarding: (i) its activities that impact privacy, including its collection, use, sharing, safeguarding, maintenance, and disposal of personally identifiable information (PII); (ii) authority for collecting PII; (iii) the choices, if any, individuals may have regarding how the organization uses PII and the consequences of exercising or not exercising those choices; and (iv) the ability to access and have PII amended or corrected if necessary;

b. Describes: (i) the PII the organization collects and the purpose(s) for which it collects that information; (ii) how the organization uses PII internally; (iii) whether the organization shares PII with external entities, the categories of those entities, and the purposes for such sharing; (iv) whether individuals have the ability to consent to specific uses or sharing of PII and how to exercise any such consent; (v) how individuals may obtain access to PII for the purpose of having it amended or corrected, where appropriate; and (vi) how the PII will be protected; and

c. Revises its public notices to reflect changes in practice or policy that affect PII or changes in its activities that impact privacy, before or as soon as practicable after the change.

Supplemental Guidance: Effective notice, by virtue of its clarity, readability, and comprehensiveness, enables individuals to understand how an organization uses PII generally and, where appropriate, to make an informed decision prior to providing PII to an organization. Effective notice also demonstrates the privacy considerations that the organization has addressed in implementing its information practices. The organization may provide general public notice through a variety of means, as required by law or policy, including System of Records Notices (SORNs), Privacy Impact Assessments (PIAs), in a website privacy policy, or in an Information Sharing Privacy Policy. As required by the Privacy Act, the organization also provides direct notice to individuals via Privacy Act Statements on the paper and electronic forms it uses to collect PII.

The organization Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) is responsible for the content of the organization's public notices, in consultation with legal counsel and relevant program managers. The public notice requirement in this control is satisfied by an organization's compliance with the public notice provisions of the Privacy Act, the E-Government Act's PIA requirement, with OMB guidance related to federal agency privacy notices, and, where applicable, with policy pertaining to participation in the Information Sharing Environment (ISE).[112] Related controls: AP-1, AP-2, AR-1, IP-1, IP-2, IP-3, UL-1, UL-2.

Control Enhancements:

(1) *PRIVACY NOTICE | REAL-TIME OR LAYERED NOTICE*

The organization provides real-time and/or layered notice when it collects PII.

Supplemental Guidance: Real-time notice is defined as notice at the point of collection. A layered notice approach involves providing individuals with a summary of key points in the organization's privacy policy. A second notice provides more detailed/specific information.

[112] The term *Information Sharing Environment* is an approach that facilitates the sharing of terrorism and homeland security information. The ISE was established by the Intelligence Reform and Terrorism Prevention Act of 2004, Public Law 108-458, 118 Stat. 3638. See the ISE website at: www.ise.gov.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (e)(3), (e)(4); Section 208(b), E-Government Act of 2002 (P.L. 107-347); OMB Memoranda 03-22, 07-16, 10-22, 10-23; ISE Privacy Guidelines.

TR-2 SYSTEM OF RECORDS NOTICES AND PRIVACY ACT STATEMENTS

Control: The organization, consistent with the Privacy Act:

a. Publishes in the Federal Register, System of Records Notices (SORNs) for information systems containing personally identifiable information (PII);

b. Keeps SORNs current; and

c. Includes Privacy Act Statements on its forms that collect PII, or on separate forms that can be retained by individuals, to provide additional formal notice to individuals from whom the information is being collected.

Supplemental Guidance: Organizations issue SORNs to provide the public notice regarding PII collected in a system of records, which the Privacy Act defines as "a group of any records under the control of any agency from which information is retrieved by the name of an individual or by some identifying number, symbol, or other identifier." SORNs explain how the information is used, retained, and may be corrected, and whether certain portions of the system are subject to Privacy Act exemptions for law enforcement or national security reasons. Privacy Act Statements provide notice of: (i) the authority of organizations to collect PII; (ii) whether providing PII is mandatory or optional; (iii) the principal purpose(s) for which the PII is to be used; (iv) the intended disclosures (routine uses) of the information; and (v) the consequences of not providing all or some portion of the information requested.

Control Enhancements:

(1) *SYSTEM OF RECORDS NOTICES AND PRIVACY ACT STATEMENTS | PUBLIC WEB SITE PUBLICATION*

The organization publishes SORNs on its public website.

References: The Privacy Act of 1974, 5 U.S.C. § e(3); OMB Circular A-130.

TR-3 DISSEMINATION OF PRIVACY PROGRAM INFORMATION

Control: The organization:

a. Ensures that the public has access to information about its privacy activities and is able to communicate with its Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO); and

b. Ensures that its privacy practices are publicly available through organizational websites or otherwise.

Supplemental Guidance: Organizations employ different mechanisms for informing the public about their privacy practices including, but not limited to, Privacy Impact Assessments (PIAs), System of Records Notices (SORNs), privacy reports, publicly available web pages, email distributions, blogs, and periodic publications (e.g., quarterly newsletters). Organizations also employ publicly facing email addresses and/or phone lines that enable the public to provide feedback and/or direct questions to privacy offices regarding privacy practices. Related control: AR-6.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a; Section 208, E-Government Act of 2002 (P.L. 107-347); OMB Memorandum 03-22.

FAMILY: USE LIMITATION

This family helps organizations comply with the Privacy Act, which prohibits the use of PII that is either not specified in notices, incompatible with the specified purposes, or not otherwise permitted by law. Implementation of the controls in this family will ensure that the scope of PII use is limited accordingly.

UL-1 INTERNAL USE

Control: The organization uses personally identifiable information (PII) internally only for the authorized purpose(s) identified in the Privacy Act and/or in public notices.

Supplemental Guidance: Organizations take steps to ensure that they use PII only for legally authorized purposes and in a manner compatible with uses identified in the Privacy Act and/or in public notices. These steps include monitoring and auditing organizational use of PII and training organizational personnel on the authorized uses of PII. With guidance from the Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) and where appropriate, legal counsel, organizations document processes and procedures for evaluating any proposed new uses of PII to assess whether they fall within the scope of the organizational authorities. Where appropriate, organizations obtain consent from individuals for the new use(s) of PII. Related controls: AP-2, AR-4, AR-5, IP-1, TR-1.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (a)(7), (b)(1).

UL-2 INFORMATION SHARING WITH THIRD PARTIES

Control: The organization:

a. Shares personally identifiable information (PII) externally, only for the authorized purposes identified in the Privacy Act and/or described in its notice(s) or in a manner compatible with those purposes;

b. Where appropriate, enters into Memoranda of Understanding, Memoranda of Agreement, Letters of Intent, Computer Matching Agreements, or similar agreements, with third parties that specifically describe the PII covered and specifically enumerate the purposes for which the PII may be used;

c. Monitors, audits, and trains its staff on the authorized uses and sharing of PII with third parties and on the consequences of unauthorized use or sharing of PII; and

d. Evaluates any proposed new instances of sharing PII with third parties to assess whether they are authorized and whether additional or new public notice is required.

Supplemental Guidance: The organization Senior Agency Official for Privacy (SAOP)/Chief Privacy Officer (CPO) and, where appropriate, legal counsel review and approve any proposed external sharing of PII, including with other public and private sector entities, for consistency with uses described in the existing organizational public notice(s). Where a new instance of external sharing of PII is authorized but not compatible with the purpose(s) specified in existing public notices, or as otherwise permitted by the Privacy Act, organizations review, update, and republish their Privacy Impact Assessments (PIAs), System of Records Notices (SORNs), website privacy policies, and other public notices, if any, to include specific descriptions of the new uses(s) and obtain consent where appropriate and feasible. Information-sharing agreements also include security protections consistent with the sensitivity of the information being shared. Related controls: AR-3, AR-4, AR-5, AP-2, DI-2, IP-1, TR-1.

Control Enhancements: None.

References: The Privacy Act of 1974, 5 U.S.C. § 552a (a)(7), (b), (c), (e)(3)(C), (o); ISE Privacy Guidelines.

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