Set Theory Relationship Mapping (STRM)

Reference Document : Secure Controls Framework (SCF) version 2024.4
Focal Document: Center for Internet Security (CIS) Critical Security Controls (CSC) v8.1
Focal Document URL: https://www.cisecurity.org/controls/v8-1
STRM URL: https://securecontrolsframework.com/content/strm/scf-strm-cis-csc-8-1.pdf

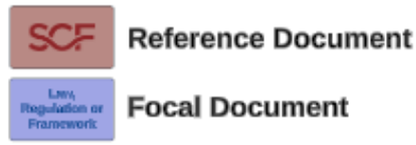
Set Theory Relationship Mapping (STRM) is well-suited for mapping between sets of elements that exist in two distinct concepts that are mostly the same as each other (e.g., cybersecurity & data privacy requirements). STRM also allows the strength of the mapping to be captured.

STRM relies on a justification for the relationship claim. There are three (3) options for the rationale, which is a high-level context within which the two concepts are related:

1. **Syntactic**: How similar is the wording that expresses the two concepts? This is a word-for-word analysis of the relationship, not an interpretation of the language.
2. **Semantic**: How similar are the meanings of the two concepts? This involves some interpretation of each concept's language.
3. **Functional**: How similar are the results of executing the two concepts? This involves understanding what will happen if the two concepts are implemented, performed, or otherwise executed.

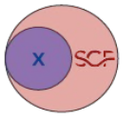
Based on NIST IR 8477, STRM supports five (5) five relationship types to describe the logical similarity between two distinct concepts:

1. **Subset Of**
2. **Intersects With**
3. **Equal**
4. **Superset Of**
5. **No Relationship**

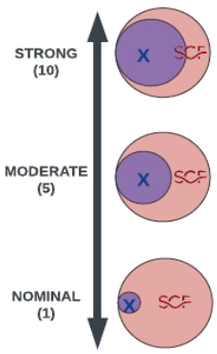


Relationship Type #1:
SUBSET OF

Focal Document Element is a subset of SCF control. In other words, SCF control contains everything that Focal Document Element does and more.

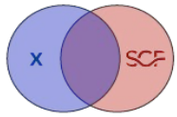


SUBSET OF
Relative Relationship Strength (control versus control)

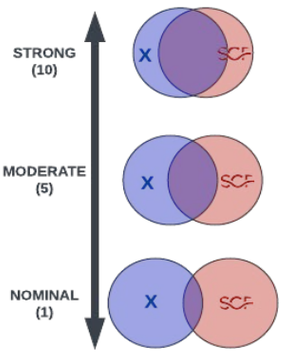


Relationship Type #2:
INTERSECTS WITH

SCF control has some overlap with Focal Document Element, but each includes content that the other does not.

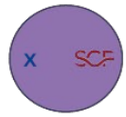


INTERSECTS WITH
Relative Relationship Strength (control versus control)

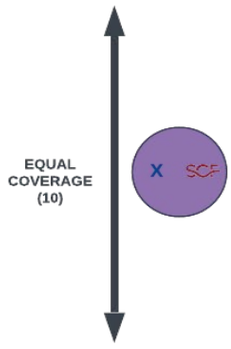


Relationship Type #3:
EQUAL

SCF control and Focal Document Element are the same, although not necessarily identical.

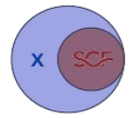


EQUAL
Relative Relationship Strength (control versus control)

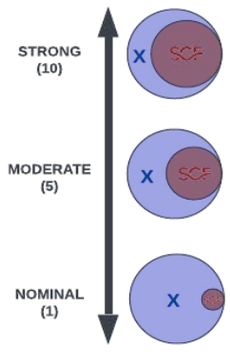


Relationship Type #4:
SUPERSET OF

Focal Document Element is a superset of SCF control. In other words, Focal Document Element contains everything that SCF control does and more.



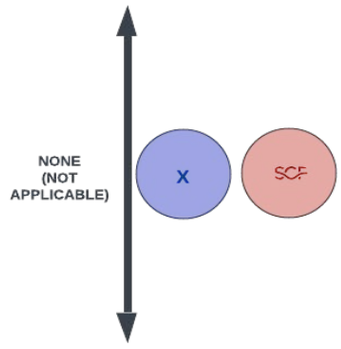
SUPERSET OF
Relative Relationship Strength (control versus control)



Relationship Type #5:
NO RELATIONSHIP

SCF control and Focal Document Element are unrelated; their content does not overlap.

NO RELATIONSHIP
Relative Relationship Strength (control versus control)



FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
1	Inventory and Control of Enterprise Assets	Actively manage (inventory, track, and correct) all enterprise assets (end-user devices, including portable and mobile; network devices; non-computing/Internet of Things (IoT) devices; and servers) connected to the infrastructure physically, virtually, remotely, and those within cloud environments, to accurately know the totality of assets that need to be monitored and protected within the enterprise. This will also support identifying unauthorized and unmanaged assets to remove or remediate.	Functional	Subset Of	Asset Governance	AST-01	Mechanisms exist to facilitate an IT Asset Management (ITAM) program to implement and manage asset management controls.	10	
			Functional	Equal	Asset Inventories	AST-02	Mechanisms exist to perform inventories of technology assets that: (1) Accurately reflects the current systems, applications and services in use; (2) Identifies authorized software products, including business justification details; (3) Is at the level of granularity deemed necessary for tracking and reporting; (4) Includes organization-defined information deemed necessary to achieve effective property accountability; and (5) Is available for review and audit by designated organizational personnel.	10	
1.1	Establish and Maintain Detailed Enterprise Asset Inventory	Establish and maintain an accurate, detailed, and up-to-date inventory of all enterprise assets with the potential to store or process data, to include: end-user devices (including portable and mobile), network devices, non-computing/IoT devices, and servers. Ensure the inventory records the network address (if static), hardware address, machine name, enterprise asset owner, department for each asset, and whether the asset has been approved to connect to the network. For mobile end-user devices, MDM type tools can support this process, where appropriate. This inventory includes assets connected to the infrastructure physically, virtually, remotely, and those within cloud environments. Additionally, it includes assets that are regularly connected to the enterprise's network infrastructure, even if they are not under control of the enterprise. Review and update the inventory of all enterprise assets bi-annually, or more frequently.	Functional	Equal	Asset Inventories	AST-02	Mechanisms exist to perform inventories of technology assets that: (1) Accurately reflects the current systems, applications and services in use; (2) Identifies authorized software products, including business justification details; (3) Is at the level of granularity deemed necessary for tracking and reporting; (4) Includes organization-defined information deemed necessary to achieve effective property accountability; and (5) Is available for review and audit by designated organizational personnel.	10	
1.2	Address Unauthorized Assets	Ensure that a process exists to address unauthorized assets on a weekly basis. The enterprise may choose to remove the asset from the network, deny the asset from connecting remotely to the network, or quarantine the asset.	Functional	Intersects With	Automated Unauthorized Component Detection	AST-02.2	Automated mechanisms exist to detect and alert upon the detection of unauthorized hardware, software and firmware components.	5	
			Functional	Intersects With	Host Containment	NET-08.3	Automated mechanisms exist to enforce host containment protections that revoke or quarantine a host's access to the network.	5	
1.3	Utilize an Active Discovery Tool	Utilize an active discovery tool to identify assets connected to the enterprise's network. Configure the active discovery tool to execute daily, or more frequently.	Functional	Intersects With	Automated Unauthorized Component Detection	AST-02.2	Automated mechanisms exist to detect and alert upon the detection of unauthorized hardware, software and firmware components.	5	
			Functional	Intersects With	Component Duplication Avoidance	AST-02.3	Mechanisms exist to establish and maintain an authoritative source and repository to provide a trusted source and accountability for approved and implemented system components that prevents assets from being duplicated in other asset inventories.	5	
1.4	Use Dynamic Host Configuration Protocol (DHCP) Logging to Update Enterprise Asset Inventory	Use DHCP logging on all DHCP servers or Internet Protocol (IP) address management tools to update the enterprise's asset inventory. Review and use logs to update the enterprise's asset inventory weekly, or more frequently.	Functional	Equal	Dynamic Host Configuration Protocol (DHCP) Server Logging	AST-02.6	Mechanisms exist to enable Dynamic Host Configuration Protocol (DHCP) server logging to improve asset inventories and assist in detecting unknown systems.	10	
1.5	Use a Passive Asset Discovery Tool	Use a passive discovery tool to identify assets connected to the enterprise's network. Review and use scans to update the enterprise's asset inventory at least weekly, or more frequently.	Functional	Intersects With	Automated Unauthorized Component Detection	AST-02.2	Automated mechanisms exist to detect and alert upon the detection of unauthorized hardware, software and firmware components.	5	
			Functional	Equal	Dynamic Host Configuration Protocol (DHCP) Server Logging	AST-02.6	Mechanisms exist to enable Dynamic Host Configuration Protocol (DHCP) server logging to improve asset inventories and assist in detecting unknown systems.	10	
2	Inventory and Control of Software Assets	Actively manage (inventory, track, and correct) all software (operating systems and applications) on the network so that only authorized software is installed and can execute, and that unauthorized and unmanaged software is found and prevented from installation or execution.	Functional	Subset Of	Asset Governance	AST-01	Mechanisms exist to facilitate an IT Asset Management (ITAM) program to implement and manage asset management controls.	10	
			Functional	Intersects With	Asset Inventories	AST-02	Mechanisms exist to perform inventories of technology assets that: (1) Accurately reflects the current systems, applications and services in use; (2) Identifies authorized software products, including business justification details; (3) Is at the level of granularity deemed necessary for tracking and reporting; (4) Includes organization-defined information deemed necessary to achieve effective property accountability; and (5) Is available for review and audit by designated organizational personnel.	5	
			Functional	Subset Of	Configuration Management Program	CFG-01	Mechanisms exist to facilitate the implementation of configuration management controls.	10	
2.1	Establish and Maintain a Software Inventory	Establish and maintain a detailed inventory of all licensed software installed on enterprise assets. The software inventory must document the title, publisher, initial install/use date, and business purpose for each entry; where appropriate, include the Uniform Resource Locator (URL), app store(s), version(s), deployment mechanism, and decommission date. Review and update the software inventory bi-annually, or more frequently.	Functional	Subset Of	Asset Governance	AST-01	Mechanisms exist to facilitate an IT Asset Management (ITAM) program to implement and manage asset management controls.	10	
			Functional	Intersects With	Asset Inventories	AST-02	Mechanisms exist to perform inventories of technology assets that: (1) Accurately reflects the current systems, applications and services in use; (2) Identifies authorized software products, including business justification details; (3) Is at the level of granularity deemed necessary for tracking and reporting; (4) Includes organization-defined information deemed necessary to achieve effective property accountability; and (5) Is available for review and audit by designated organizational personnel.	5	
			Functional	Intersects With	Configuration Management Database (CMDB)	AST-02.9	Mechanisms exist to implement and manage a Configuration Management Database (CMDB), or similar technology, to monitor and govern technology asset-specific information.	5	
2.2	Ensure Authorized Software is Currently Supported	Ensure that only currently supported software is designated as authorized in the software inventory for enterprise assets. If software is unsupported, yet necessary for the fulfillment of the enterprise's mission, document an exception detailing mitigating controls and residual risk acceptance. For any unsupported software without an exception documentation, designate as unauthorized. Review the software list to verify software support at least monthly, or more frequently.	Functional	Subset Of	Asset Governance	AST-01	Mechanisms exist to facilitate an IT Asset Management (ITAM) program to implement and manage asset management controls.	10	
			Functional	Intersects With	Asset Inventories	AST-02	Mechanisms exist to perform inventories of technology assets that: (1) Accurately reflects the current systems, applications and services in use; (2) Identifies authorized software products, including business justification details; (3) Is at the level of granularity deemed necessary for tracking and reporting; (4) Includes organization-defined information deemed necessary to achieve effective property accountability; and (5) Is available for review and audit by designated organizational personnel.	5	
			Functional	Intersects With	Software Licensing Restrictions	AST-02.7	Mechanisms exist to protect Intellectual Property (IP) rights with software licensing restrictions.	5	
			Functional	Intersects With	Compensating Countermeasures	RSK-06.2	Mechanisms exist to identify and implement compensating countermeasures to reduce risk and exposure to threats.	5	
			Functional	Intersects With	Unsupported Systems	TDA-17	Mechanisms exist to prevent unsupported systems by: (1) Replacing systems when support for the components is no longer available from the developer, vendor or manufacturer; and (2) Requiring justification and documented approval for the continued use of unsupported system components required to satisfy mission/business needs.	5	
2.3	Address Unauthorized Software	Ensure that unauthorized software is either removed from use on enterprise assets or receives a documented exception. Review monthly, or more frequently.	Functional	Intersects With	Automated Unauthorized Component Detection	AST-02.2	Automated mechanisms exist to detect and alert upon the detection of unauthorized hardware, software and firmware components.	5	
			Functional	Intersects With	Respond To Unauthorized Changes	CFG-02.8	Mechanisms exist to respond to unauthorized changes to configuration settings as security incidents.	5	
			Functional	Intersects With	Explicitly Allow / Deny Applications	CFG-03.3	Mechanisms exist to explicitly allow (allowlist / whitelist) and/or block (denylist / blacklist) applications that are authorized to execute on systems.	5	
			Functional	Intersects With	Unauthorized Installation Alerts	CFG-05.1	Mechanisms exist to configure systems to generate an alert when the unauthorized installation of software is detected.	5	
			Functional	Intersects With	Integrity Assurance & Enforcement (IAE)	CFG-06.1	Automated mechanisms exist to identify unauthorized deviations from an approved baseline and implement automated resiliency actions to remediate the unauthorized change.	5	
			Functional	Intersects With	Unauthorized Activities	MON-16.3	Mechanisms exist to monitor for unauthorized activities, accounts, connections, devices and software.	5	
			Functional	Intersects With	Software Installation Alerts	END-03.1	Mechanisms exist to generate an alert when new software is detected.	5	
			Functional	Intersects With	Endpoint Detection & Response (EDR)	END-06.2	Mechanisms exist to detect and respond to unauthorized configuration changes as cybersecurity incidents.	5	
			Functional	Intersects With	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	5	

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2.4	Utilize Automated Software Inventory Tools	Utilize software inventory tools, when possible, throughout the enterprise to automate the discovery and documentation of installed software.	Functional	Intersects With	Asset Inventories	AST-02	Mechanisms exist to perform inventories of technology assets that: (1) Accurately reflects the current systems, applications and services in use; (2) Identifies authorized software products, including business justification details; (3) Is at the level of granularity deemed necessary for tracking and reporting; (4) Includes organization-defined information deemed necessary to achieve effective property accountability; and (5) Is available for review and audit by designated organizational personnel.	5	
			Functional	Intersects With	Automated Unauthorized Component Detection	AST-02.2	Automated mechanisms exist to detect and alert upon the detection of unauthorized hardware, software and firmware components.	5	
			Functional	Intersects With	Configuration Management Database (CMDB)	AST-02.9	Mechanisms exist to implement and manage a Configuration Management Database (CMDB), or similar technology, to monitor and govern technology asset-specific information.	5	
			Functional	Intersects With	Integrity Assurance & Enforcement (IAE)	CFG-06.1	Automated mechanisms exist to identify unauthorized deviations from an approved baseline and implement automated resiliency actions to remediate the unauthorized change.	5	
			Functional	Intersects With	Endpoint Detection & Response (EDR)	END-06.2	Mechanisms exist to detect and respond to unauthorized configuration changes as cybersecurity incidents.	5	
2.5	Allowlist Authorized Software	Use technical controls, such as application allowlisting, to ensure that only authorized software can execute or be accessed. Reassess bi-annually, or more frequently.	Functional	Intersects With	Prevent Unauthorized Software Execution	CFG-03.2	Mechanisms exist to configure systems to prevent the execution of unauthorized software programs.	5	
			Functional	Intersects With	Explicitly Allow / Deny Applications	CFG-03.3	Mechanisms exist to explicitly allow (allowlist / whitelist) and/or block (denylist / blacklist) applications that are authorized to execute on systems.	5	
2.6	Allowlist Authorized Libraries	Use technical controls to ensure that only authorized software libraries, such as specific .dll, .ocx, and .so files, are allowed to load into a system process. Block unauthorized libraries from loading into a system process. Reassess bi-annually, or more frequently.	Functional	Equal	Explicitly Allow / Deny Applications	CFG-03.3	Mechanisms exist to explicitly allow (allowlist / whitelist) and/or block (denylist / blacklist) applications that are authorized to execute on systems.	10	
2.7	Allowlist Authorized Scripts	Use technical controls, such as digital signatures and version control, to ensure that only authorized scripts, such as specific .ps1, and .py files are allowed to execute. Block unauthorized scripts from executing. Reassess bi-annually, or more frequently.	Functional	Intersects With	Explicitly Allow / Deny Applications	CFG-03.3	Mechanisms exist to explicitly allow (allowlist / whitelist) and/or block (denylist / blacklist) applications that are authorized to execute on systems.	5	
			Functional	Intersects With	Privileged Account Management (PAM)	IAC-16	Mechanisms exist to restrict and control privileged access rights for users and services.	5	
			Functional	Intersects With	Maintenance Tools	MNT-04	Mechanisms exist to control and monitor the use of system maintenance tools.	5	
			Functional	Intersects With	Restrict Tool Usage	MNT-04.4	Automated mechanisms exist to restrict the use of maintenance tools to authorized maintenance personnel and/or roles.	5	
3	Data Protection	Develop processes and technical controls to identify, classify, securely handle, retain, and dispose of data.	Functional	Subset Of	Data Protection	DCH-01	Mechanisms exist to facilitate the implementation of data protection controls.	10	
3.1	Establish and Maintain a Data Management Process	Establish and maintain a documented data management process. In the process, address data sensitivity, data owner, handling of data, data retention limits, and disposal requirements, based on sensitivity and retention standards for the enterprise. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Subset Of	Data Protection	DCH-01	Mechanisms exist to facilitate the implementation of data protection controls.	10	
			Functional	Intersects With	Data Stewardship	DCH-01.1	Mechanisms exist to ensure data stewardship is assigned, documented and communicated.	5	
			Functional	Intersects With	Sensitive / Regulated Data Protection	DCH-01.2	Mechanisms exist to protect sensitive/regulated data wherever it is stored.	5	
			Functional	Intersects With	Defining Access Authorizations for Sensitive/Regulated Data	DCH-01.4	Mechanisms exist to explicitly define authorizations for specific individuals and/or roles for logical and /or physical access to sensitive/regulated data.	5	
			Functional	Intersects With	Data & Asset Classification	DCH-02	Mechanisms exist to ensure data and assets are categorized in accordance with applicable statutory, regulatory and contractual requirements.	5	
			Functional	Intersects With	Media Access	DCH-03	Mechanisms exist to control and restrict access to digital and non-digital media to authorized individuals.	5	
			Functional	Intersects With	Disclosure of Information	DCH-03.1	Mechanisms exist to restrict the disclosure of sensitive / regulated data to authorized parties with a need to know.	5	
			Functional	Intersects With	Physical Media Disposal	DCH-08	Mechanisms exist to securely dispose of media when it is no longer required, using formal procedures.	5	
			Functional	Intersects With	System Media Sanitization	DCH-09	Mechanisms exist to sanitize system media with the strength and integrity commensurate with the classification or sensitivity of the information prior to disposal, release out of organizational control or release for reuse.	5	
			Functional	Intersects With	Media & Data Retention	DCH-18	Mechanisms exist to retain media and data in accordance with applicable statutory, regulatory and contractual obligations.	5	
3.2	Establish and Maintain a Data Inventory	Establish and maintain a data inventory based on the enterprise's data management process. Inventory sensitive data, at a minimum. Review and update inventory annually, at a minimum, with a priority on sensitive data.	Functional	Intersects With	Sensitive Data Inventories	DCH-06.2	Mechanisms exist to maintain inventory logs of all sensitive media and conduct sensitive media inventories at least annually.	5	
			Functional	Intersects With	Periodic Scans for Sensitive Data	DCH-06.3	Mechanisms exist to periodically scan unstructured data sources for sensitive/regulated data or data requiring special protection measures by statutory, regulatory or contractual obligations.	5	
3.3	Configure Data Access Control Lists	Configure data access control lists based on a user's need to know. Apply data access control lists, also known as access permissions, to local and remote file systems, databases, and applications.	Functional	Subset Of	Data Protection	DCH-01	Mechanisms exist to facilitate the implementation of data protection controls.	10	
			Functional	Intersects With	Defining Access Authorizations for Sensitive/Regulated Data	DCH-01.4	Mechanisms exist to explicitly define authorizations for specific individuals and/or roles for logical and /or physical access to sensitive/regulated data.	5	
			Functional	Intersects With	Media Access	DCH-03	Mechanisms exist to control and restrict access to digital and non-digital media to authorized individuals.	5	
			Functional	Intersects With	Disclosure of Information	DCH-03.1	Mechanisms exist to restrict the disclosure of sensitive / regulated data to authorized parties with a need to know.	5	
			Functional	Intersects With	Limits of Authorized Use	DCH-13.1	Mechanisms exist to prohibit external parties, systems and services from storing, processing and transmitting data unless authorized individuals first: (1) Verifying the implementation of required security controls; or (2) Retaining a processing agreement with the entity hosting the external systems or service.	5	
			Functional	Intersects With	Information Sharing	DCH-14	Mechanisms exist to utilize a process to assist users in making information sharing decisions to ensure data is appropriately protected.	5	
			Functional	Intersects With	Transfer Authorizations	DCH-14.2	Mechanisms exist to verify that individuals or systems transferring data between interconnecting systems have the requisite authorizations (e.g., write permissions or privileges) prior to transferring said data.	5	
			Functional	Intersects With	Data Access Mapping	DCH-14.3	Mechanisms exist to leverage data-specific Access Control Lists (ACL) or Interconnection Security Agreements (ISAs) to generate a logical map of the parties with whom sensitive/regulated data is shared.	5	
			Functional	Intersects With	Role-Based Access Control (RBAC)	IAC-08	Mechanisms exist to enforce a Role-Based Access Control (RBAC) policy over users and resources that applies need-to-know and fine-grained access control for sensitive/regulated data access.	5	
			Functional	Intersects With	Data Flow Enforcement – Access Control Lists (ACLs)	NET-04	Mechanisms exist to implement and govern Access Control Lists (ACLs) to provide data flow enforcement that explicitly restrict network traffic to only what is authorized.	5	
3.4	Enforce Data Retention	Retain data according to the enterprise's documented data management process. Data retention must include both minimum and maximum timelines.	Functional	Equal	Media & Data Retention	DCH-18	Mechanisms exist to retain media and data in accordance with applicable statutory, regulatory and contractual obligations.	10	
3.5	Securely Dispose of Data	Securely dispose of data as outlined in the enterprise's documented data management process. Ensure the disposal process and method are commensurate with the data sensitivity.	Functional	Intersects With	Secure Disposal, Destruction or Re-Use of Equipment	AST-09	Mechanisms exist to securely dispose of, destroy or repurpose system components using organization-defined techniques and methods to prevent information being recovered from these components.	5	
			Functional	Intersects With	Physical Media Disposal	DCH-08	Mechanisms exist to securely dispose of media when it is no longer required, using formal procedures.	5	
			Functional	Intersects With	System Media Sanitization	DCH-09	Mechanisms exist to sanitize system media with the strength and integrity commensurate with the classification or sensitivity of the information prior to disposal, release out of organizational control or release for reuse.	5	
			Functional	Intersects With	Information Disposal	DCH-21	Mechanisms exist to securely dispose of, destroy or erase information.	5	
			Functional	Intersects With	Personal Data Retention & Disposal	PRI-05	Mechanisms exist to: (1) Retain Personal Data (PD), including metadata, for an organization-defined time period to fulfill the purpose(s) identified in the notice or as required by law; (2) Dispose of, destroys, erases, and/or anonymizes the PD, regardless of the method of storage; and (3) Use organization-defined techniques or methods to ensure secure deletion or destruction of PD (including originals, copies and archived records).	5	
3.6	Encrypt Data on End-User Devices	Encrypt data on end-user devices containing sensitive data. Example implementations can include: Windows BitLocker®, Apple FileVault®, Linux® dm-crypt.	Functional	Subset Of	Use of Cryptographic Controls	CRY-01	Mechanisms exist to facilitate the implementation of cryptographic protections controls using known public standards and trusted cryptographic technologies.	10	
			Functional	Intersects With	Encrypting Data At Rest	CRY-05	Cryptographic mechanisms exist to prevent unauthorized disclosure of data at rest.	5	

FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
3.7	Establish and Maintain a Data Classification Scheme	Establish and maintain an overall data classification scheme for the enterprise. Enterprises may use labels, such as “Sensitive,” “Confidential,” and “Public,” and classify their data according to those labels. Review and update the classification scheme annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Data & Asset Classification	DCH-02	Mechanisms exist to ensure data and assets are categorized in accordance with applicable statutory, regulatory and contractual requirements.	5	
			Functional	Intersects With	Highest Classification Level	DCH-02.1	Mechanisms exist to ensure that systems, applications and services are classified according to the highest level of data sensitivity that is stored, transmitted and/or processed.	5	
3.8	Document Data Flows	Document data flows. Data flow documentation includes service provider data flows and should be based on the enterprise’s data management process. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Network Diagrams & Data Flow Diagrams (DFDs)	AST-04	Mechanisms exist to maintain network architecture diagrams that: (1) Contain sufficient detail to assess the security of the network's architecture; (2) Reflect the current architecture of the network environment; and (3) Document all sensitive/regulated data flows.	5	
			Functional	Intersects With	Data Access Mapping	DCH-14.3	Mechanisms exist to leverage data-specific Access Control Lists (ACL) or Interconnection Security Agreements (ISAs) to generate a logical map of the parties with whom sensitive/regulated data is shared.	5	
3.9	Encrypt Data on Removable Media	Encrypt data on removable media.	Functional	Subset Of	Use of Cryptographic Controls	CRY-01	Mechanisms exist to facilitate the implementation of cryptographic protections controls using known public standards and trusted cryptographic technologies.	10	
			Functional	Intersects With	Encrypting Data At Rest	CRY-05	Cryptographic mechanisms exist to prevent unauthorized disclosure of data at rest.	5	
			Functional	Intersects With	Storage Media	CRY-05.1	Cryptographic mechanisms exist to protect the confidentiality and integrity of sensitive/regulated data residing on storage media.	5	
3.10	Encrypt Sensitive Data in Transit	Encrypt sensitive data in transit. Example implementations can include: Transport Layer Security (TLS) and Open Secure Shell (OpenSSH).	Functional	Subset Of	Use of Cryptographic Controls	CRY-01	Mechanisms exist to facilitate the implementation of cryptographic protections controls using known public standards and trusted cryptographic technologies.	10	
			Functional	Intersects With	Transmission Confidentiality	CRY-03	Cryptographic mechanisms exist to protect the confidentiality of data being transmitted.	5	
3.11	Encrypt Sensitive Data at Rest	Encrypt sensitive data at rest on servers, applications, and databases. Storage-layer encryption, also known as server-side encryption, meets the minimum requirement of this Safeguard. Additional encryption methods may include application-layer encryption, also known as client-side encryption, where access to the data storage device(s) does not permit access to the plain-text data.	Functional	Subset Of	Use of Cryptographic Controls	CRY-01	Mechanisms exist to facilitate the implementation of cryptographic protections controls using known public standards and trusted cryptographic technologies.	10	
			Functional	Intersects With	Encrypting Data At Rest	CRY-05	Cryptographic mechanisms exist to prevent unauthorized disclosure of data at rest.	5	
3.12	Segment Data Processing and Storage Based on Sensitivity	Segment data processing and storage based on the sensitivity of the data. Do not process sensitive data on enterprise assets intended for lower sensitivity data.	Functional	Intersects With	Highest Classification Level	DCH-02.1	Mechanisms exist to ensure that systems, applications and services are classified according to the highest level of data sensitivity that is stored, transmitted and/or processed.	5	
			Functional	Intersects With	System Partitioning	SEA-03.1	Mechanisms exist to partition systems so that partitions reside in separate physical domains or environments.	5	
3.13	Deploy a Data Loss Prevention Solution	Implement an automated tool, such as a host-based Data Loss Prevention (DLP) tool to identify all sensitive data stored, processed, or transmitted through enterprise assets, including those located onsite or at a remote service provider, and update the enterprise's data inventory.	Functional	Equal	Data Loss Prevention (DLP)	NET-17	Automated mechanisms exist to implement Data Loss Prevention (DLP) to protect sensitive information as it is stored, transmitted and processed.	10	
3.14	Log Sensitive Data Access	Log sensitive data access, including modification and disposal.	Functional	Intersects With	Privileged User Oversight	MON-01.15	Mechanisms exist to implement enhanced activity monitoring for privileged users.	5	
			Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Correlate Monitoring Information	MON-02.1	Automated mechanisms exist to correlate both technical and non-technical information from across the enterprise by a Security Incident Event Manager (SIEM) or similar automated tool, to enhance organization-wide situational awareness.	5	
			Functional	Intersects With	Integration of Scanning & Other Monitoring Information	MON-02.3	Automated mechanisms exist to integrate the analysis of audit records with analysis of vulnerability scanners, network performance, system monitoring and other sources to further enhance the ability to identify inappropriate or unusual activity.	5	
			Functional	Intersects With	Content of Event Logs	MON-03	Mechanisms exist to configure systems to produce event logs that contain sufficient information to, at a minimum: (1) Establish what type of event occurred; (2) When (date and time) the event occurred; (3) Where the event occurred; (4) The source of the event; (5) The outcome (success or failure) of the event; and (6) The identity of any user/subject associated with the event.	5	
			Functional	Intersects With	Sensitive Audit Information	MON-03.1	Mechanisms exist to protect sensitive/regulated data contained in log files.	5	
4	Secure Configuration of Enterprise Assets and Software	Establish and maintain the secure configuration of enterprise assets (end-user devices, including portable and mobile; network devices; non-computing/IoT devices; and servers) and software (operating systems and applications).	Functional	Subset Of	Configuration Management Program	CFG-01	Mechanisms exist to facilitate the implementation of configuration management controls.	10	
			Functional	Intersects With	Least Functionality	CFG-03	Mechanisms exist to configure systems to provide only essential capabilities by specifically prohibiting or restricting the use of ports, protocols, and/or services.	5	
4.1	Establish and Maintain a Secure Configuration Process	Establish and maintain a documented secure configuration process for enterprise assets (end-user devices, including portable and mobile, non-computing/IoT devices, and servers) and software (operating systems and applications). Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Subset Of	Configuration Management Program	CFG-01	Mechanisms exist to facilitate the implementation of configuration management controls.	10	
			Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Reviews & Updates	CFG-02.1	Mechanisms exist to review and update baseline configurations: (1) At least annually; (2) When required due to so; or (3) As part of system component installations and upgrades.	5	
4.2	Establish and Maintain a Secure Configuration Process for Network Infrastructure	Establish and maintain a documented secure configuration process for network devices. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Subset Of	Configuration Management Program	CFG-01	Mechanisms exist to facilitate the implementation of configuration management controls.	10	
			Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
4.3	Configure Automatic Session Locking on Enterprise Assets	Configure automatic session locking on enterprise assets after a defined period of inactivity. For general purpose operating systems, the period must not exceed 15 minutes. For mobile end-user devices, the period must not exceed 2 minutes.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Session Lock	IAC-24	Mechanisms exist to initiate a session lock after an organization-defined time period of inactivity, or upon receiving a request from a user and retain the session lock until the user reestablishes access using established identification and authentication methods.	5	
4.4	Implement and Manage a Firewall on Servers	Implement and manage a firewall on servers, where supported. Example implementations include a virtual firewall, operating system firewall, or a third-party firewall agent.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Software Firewall	END-05	Mechanisms exist to utilize host-based firewall software, or a similar technology, on all information systems, where technically feasible.	5	
			Functional	Intersects With	Web Application Firewall (WAF)	WEB-03	Mechanisms exist to deploy Web Application Firewalls (WAFs) to provide defense-in-depth protection for application-specific threats.	5	
4.5	Implement and Manage a Firewall on End-User Devices	Implement and manage a host-based firewall or port-filtering tool on end-user devices, with a default-deny rule that drops all traffic except those services and ports that are explicitly allowed.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Software Firewall	END-05	Mechanisms exist to utilize host-based firewall software, or a similar technology, on all information systems, where technically feasible.	5	
4.6	Securely Manage Enterprise Assets and Software	Securely manage enterprise assets and software. Example implementations include managing configuration through version-controlled Infrastructure-as-Code (IaC) and accessing administrative interfaces over secure network protocols, such as Secure Shell (SSH) and Hypertext Transfer Protocol Secure (HTTPS). Do not use insecure management protocols, such as Telnet (Teletype Network) and HTTP, unless operationally essential.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Least Functionality	CFG-03	Mechanisms exist to configure systems to provide only essential capabilities by specifically prohibiting or restricting the use of ports, protocols, and/or services.	5	
			Functional	Intersects With	Non-Console Administrative Access	CRY-06	Cryptographic mechanisms exist to protect the confidentiality and integrity of non-console administrative access.	5	
			Functional	Intersects With	Remote Maintenance	MNT-05	Mechanisms exist to authorize, monitor and control remote, non-local maintenance and diagnostic activities.	5	
			Functional	Intersects With	Data Flow Enforcement – Access Control Lists (ACLs)	NET-04	Mechanisms exist to implement and govern Access Control Lists (ACLs) to provide data flow enforcement that explicitly restrict network traffic to only what is authorized.	5	
			Functional	Intersects With	Insecure Ports, Protocols & Services	TDA-02.6	Mechanisms exist to mitigate the risk associated with the use of insecure ports, protocols and services necessary to operate technology solutions.	5	
4.7	Manage Default Accounts on Enterprise Assets and Software	Manage default accounts on enterprise assets and software, such as root, administrator, and other pre-configured vendor accounts. Example implementations can include: disabling default accounts or making them unusable.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Subset Of	Identity & Access Management (IAM)	IAC-01	Mechanisms exist to facilitate the implementation of identification and access management controls.	10	
			Functional	Intersects With	Default Authenticators	IAC-10.8	Mechanisms exist to ensure default authenticators are changed as part of account creation or system installation.	5	

FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
4.8	Uninstall or Disable Unnecessary Services on Enterprise Assets and Software	Uninstall or disable unnecessary services on enterprise assets and software, such as an unused file sharing service, web application module, or service function.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Least Functionality	CFG-03	Mechanisms exist to configure systems to provide only essential capabilities by specifically prohibiting or restricting the use of ports, protocols, and/or services.	5	
4.9	Configure Trusted DNS Servers on Enterprise Assets	Configure trusted DNS servers on network infrastructure. Example implementations include configuring network devices to use enterprise-controlled DNS servers and/or reputable externally accessible DNS servers.	Functional	Equal	Domain Name Service (DNS) Resolution	NET-10	Mechanisms exist to ensure Domain Name Service (DNS) resolution is designed, implemented and managed to protect the security of name / address resolution.	10	
4.10	Enforce Automatic Device Lockout on Portable End-User Devices	Enforce automatic device lockout following a predetermined threshold of local failed authentication attempts on portable end-user devices, where supported. For laptops, do not allow more than 20 failed authentication attempts; for tablets and smartphones, no more than 10 failed authentication attempts. Example implementations include Microsoft® InTune Device Lock and Apple® Configuration Profile maxFailedAttempts.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Account Lockout	IAC-22	Mechanisms exist to enforce a limit for consecutive invalid login attempts by a user during an organization-defined time period and automatically locks the account when the maximum number of unsuccessful attempts is exceeded.	5	
4.11	Enforce Remote Wipe Capability on Portable End-User Devices	Remotely wipe enterprise data from enterprise-owned portable end-user devices when deemed appropriate such as lost or stolen devices, or when an individual no longer supports the enterprise.	Functional	Intersects With	Bring Your Own Device (BYOD) Usage	AST-16	Mechanisms exist to implement and govern a Bring Your Own Device (BYOD) program to reduce risk associated with personally-owned devices in the workplace.	5	
			Functional	Subset Of	Centralized Management Of Mobile Devices	MDM-01	Mechanisms exist to implement and govern Mobile Device Management (MDM) controls.	10	
			Functional	Intersects With	Remote Purging	MDM-05	Mechanisms exist to remotely purge selected information from mobile devices.	5	
4.12	Separate Enterprise Workspaces on Mobile End-User Devices	Ensure separate enterprise workspaces are used on mobile end-user devices, where supported. Example implementations include using an Apple® Configuration Profile or Android™ Work Profile to separate enterprise applications and data from personal applications and data.	Functional	Equal	Separate Mobile Device Profiles	MDM-10	Mechanisms exist to enforce a separate device workspace on applicable mobile devices to separate work-related and personal-related applications and data.	10	
5	Account Management	Use processes and tools to assign and manage authorization to credentials for user accounts, including administrator accounts, as well as service accounts, to enterprise assets and software.	Functional	Subset Of	Identity & Access Management (IAM)	IAC-01	Mechanisms exist to facilitate the implementation of identification and access management controls.	10	
			Functional	Intersects With	Automated System Account Management (Directory Services)	IAC-15.1	Automated mechanisms exist to support the management of system accounts (e.g., directory services).	5	
5.1	Establish and Maintain an Inventory of Accounts	Establish and maintain an inventory of all accounts managed in the enterprise. The inventory mustmust at a minimum include user, administrator accounts, and service accounts. The inventory, at a minimum, should contain the person's name, username, start/stop dates, and department. Validate that all active accounts are authorized, on a recurring schedule at a minimum quarterly, or more frequently.	Functional	Intersects With	Privileged Account Management (PAM)	IAC-16	Mechanisms exist to restrict and control privileged access rights for users and services.	5	
			Functional	Intersects With	Privileged Account Inventories	IAC-16.1	Mechanisms exist to inventory all privileged accounts and validate that each person with elevated privileges is authorized by the appropriate level of organizational management.	5	
5.2	Use Unique Passwords	Use unique passwords for all enterprise assets. Best practice implementation includes, at a minimum, an 8-character password for accounts using Multi-Factor Authentication (MFA) and a 14-character password for accounts not using MFA.	Functional	Intersects With	Authenticator Management	IAC-10	Mechanisms exist to securely manage authenticators for users and devices.	5	
			Functional	Intersects With	Password-Based Authentication	IAC-10.1	Mechanisms exist to enforce complexity, length and lifespan considerations to ensure strong criteria for password-based authentication.	5	
5.3	Disable Dormant Accounts	Delete or disable any dormant accounts after a period of 45 days of inactivity, where supported.	Functional	Equal	Disable Inactive Accounts	IAC-15.3	Automated mechanisms exist to disable inactive accounts after an organization-defined time period.	10	
5.4	Restrict Administrator Privileges to Dedicated Administrator Accounts	Restrict administrator privileges to dedicated administrator accounts on enterprise assets. Conduct general computing activities, such as internet browsing, email, and productivity suite use, from the user's primary, non-privileged account.	Functional	Intersects With	Privileged Account Management (PAM)	IAC-16	Mechanisms exist to restrict and control privileged access rights for users and services.	5	
			Functional	Intersects With	Least Privilege	IAC-21	Mechanisms exist to utilize the concept of least privilege, allowing only authorized access to processes necessary to accomplish assigned tasks in accordance with organizational business functions.	5	
			Functional	Intersects With	Non-Privileged Access for Non-Security Functions	IAC-21.2	Mechanisms exist to prohibit privileged users from using privileged accounts, while performing non-security functions.	5	
5.5	Establish and Maintain an Inventory of Service Accounts	Establish and maintain an inventory of service accounts. The inventory, at a minimum, must contain department owner, review date, and purpose. Perform service account reviews to validate that all active accounts are authorized, on a recurring schedule at a minimum quarterly, or more frequently.	Functional	Intersects With	Identification & Authentication for Organizational Users	IAC-02	Mechanisms exist to uniquely identify and centrally Authenticate, Authorize and Audit (AAA) organizational users and processes acting on behalf of organizational users.	5	
			Functional	Intersects With	Identification & Authentication for Third Party Systems & Services	IAC-05	Mechanisms exist to identify and authenticate third-party systems and services.	5	
			Functional	Intersects With	Privileged Account Inventories	IAC-16.1	Mechanisms exist to inventory all privileged accounts and validate that each person with elevated privileges is authorized by the appropriate level of organizational management.	5	
5.6	Centralize Account Management	Centralize account management through a directory or identity service.	Functional	Subset Of	Identity & Access Management (IAM)	IAC-01	Mechanisms exist to facilitate the implementation of identification and access management controls.	10	
			Functional	Intersects With	Authenticate, Authorize and Audit (AAA)	IAC-01.2	Mechanisms exist to strictly govern the use of Authenticate, Authorize and Audit (AAA) solutions, both on-premises and those hosted by an External Service Provider (ESP).	5	
			Functional	Intersects With	Identification & Authentication for Organizational Users	IAC-02	Mechanisms exist to uniquely identify and centrally Authenticate, Authorize and Audit (AAA) organizational users and processes acting on behalf of organizational users.	5	
			Functional	Intersects With	Identifier Management (User Names)	IAC-09	Mechanisms exist to govern naming standards for usernames and systems.	5	
			Functional	Intersects With	Automated System Account Management (Directory Services)	IAC-15.1	Automated mechanisms exist to support the management of system accounts (e.g., directory services).	5	
6	Access Control Management	Use processes and tools to create, assign, manage, and revoke access credentials and privileges for user, administrator, and service accounts for enterprise assets and software.	Functional	Subset Of	Identity & Access Management (IAM)	IAC-01	Mechanisms exist to facilitate the implementation of identification and access management controls.	10	
			Functional	Intersects With	Role-Based Access Control (RBAC)	IAC-08	Mechanisms exist to enforce a Role-Based Access Control (RBAC) policy over users and resources that applies need-to-know and fine-grained access control for sensitive/regulated data access.	5	
			Functional	Intersects With	Automated System Account Management (Directory Services)	IAC-15.1	Automated mechanisms exist to support the management of system accounts (e.g., directory services).	5	
6.1	Establish an Access Granting Process	Establish and follow a documented process, preferably automated, for granting access to enterprise assets upon new hire or role change of a user.	Functional	Equal	User Provisioning & De-Provisioning	IAC-07	Mechanisms exist to utilize a formal user registration and de-registration process that governs the assignment of access rights.	10	
6.2	Establish an Access Revoking Process	Establish and follow a process, preferably automated, for revoking access to enterprise assets, through disabling accounts immediately upon termination, rights revocation, or role change of a user. Disabling accounts, instead of deleting accounts, may be necessary to preserve audit trails.	Functional	Equal	User Provisioning & De-Provisioning	IAC-07	Mechanisms exist to utilize a formal user registration and de-registration process that governs the assignment of access rights.	10	
6.3	Require MFA for Externally-Exposed Applications	Require all externally-exposed enterprise or third-party applications to enforce MFA, where supported. Enforcing MFA through a directory service or SSO provider is a satisfactory implementation of this Safeguard.	Functional	Equal	Multi-Factor Authentication (MFA)	IAC-06	Automated mechanisms exist to enforce Multi-Factor Authentication (MFA) for: (1) Remote network access; (2) Third-party systems, applications and/or services; and/ or (3) Non-console access to critical systems or systems that store, transmit and/or process sensitive/regulated data.	10	
6.4	Require MFA for Remote Network Access	Require MFA for remote network access.	Functional	Equal	Multi-Factor Authentication (MFA)	IAC-06	Automated mechanisms exist to enforce Multi-Factor Authentication (MFA) for: (1) Remote network access; (2) Third-party systems, applications and/or services; and/ or (3) Non-console access to critical systems or systems that store, transmit and/or process sensitive/regulated data.	10	
6.5	Require MFA for Administrative Access	Require MFA for all administrative access accounts, where supported, on all enterprise assets, whether managed on-site or through a service provider.	Functional	Equal	Network Access to Privileged Accounts	IAC-06.1	Mechanisms exist to utilize Multi-Factor Authentication (MFA) to authenticate network access for privileged accounts.	10	
6.6	Establish and Maintain an Inventory of Authentication and Authorization Systems	Establish and maintain an inventory of the enterprise's authentication and authorization systems, including those hosted on-site or at a remote service provider. Review and update the inventory, at a minimum, annually, or more frequently.	Functional	Intersects With	Asset Inventories	AST-02	Mechanisms exist to perform inventories of technology assets that: (1) Accurately reflects the current systems, applications and services in use; (2) Identifies authorized software products, including business justification details; (3) Is at the level of granularity deemed necessary for tracking and reporting; (4) Includes organization-defined information deemed necessary to achieve effective property accountability; and (5) Is available for review and audit by designated organizational personnel.	5	
			Functional	Subset Of	Identity & Access Management (IAM)	IAC-01	Mechanisms exist to facilitate the implementation of identification and access management controls.	10	
			Functional	Intersects With	Authenticate, Authorize and Audit (AAA)	IAC-01.2	Mechanisms exist to strictly govern the use of Authenticate, Authorize and Audit (AAA) solutions, both on-premises and those hosted by an External Service Provider (ESP).	5	
			Functional	Intersects With	Identification & Authentication for Organizational Users	IAC-02	Mechanisms exist to uniquely identify and centrally Authenticate, Authorize and Audit (AAA) organizational users and processes acting on behalf of organizational users.	5	

FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
6.7	Centralize Access Control	Centralize access control for all enterprise assets through a directory service or SSO provider, where supported.	Functional	Intersects With	Single Sign-On (SSO) Transparent Authentication	IAC-13.1	Mechanisms exist to provide a transparent authentication (e.g., Single Sign-On (SSO)) capability to the organization's systems and services.	5	
			Functional	Intersects With	Federated Credential Management	IAC-13.2	Mechanisms exist to federate credentials to allow cross-organization authentication of individuals and devices.	5	
6.8	Define and Maintain Role-Based Access Control	Define and maintain role-based access control, through determining and documenting the access rights necessary for each role within the enterprise to successfully carry out its assigned duties. Perform access control reviews of enterprise assets to validate that all privileges are authorized, on a recurring schedule at a minimum annually, or more frequently.	Functional	Equal	Role-Based Access Control (RBAC)	IAC-08	Mechanisms exist to enforce a Role-Based Access Control (RBAC) policy over users and resources that applies need-to-know and fine-grained access control for sensitive/regulated data access.	10	
7	Continuous Vulnerability Management	Develop a plan to continuously assess and track vulnerabilities on all enterprise assets within the enterprise’s infrastructure, in order to remediate, and minimize, the window of opportunity for attackers. Monitor public and private industry sources for new threat and vulnerability information.	Functional	Subset Of	Vulnerability & Patch Management Program (VPMP)	VPM-01	Mechanisms exist to facilitate the implementation and monitoring of vulnerability management controls.	10	
			Functional	Intersects With	Continuous Vulnerability Remediation Activities	VPM-04	Mechanisms exist to address new threats and vulnerabilities on an ongoing basis and ensure assets are protected against known attacks.	5	
7.1	Establish and Maintain a Vulnerability Management Process	Establish and maintain a documented vulnerability management process for enterprise assets. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Subset Of	Vulnerability & Patch Management Program (VPMP)	VPM-01	Mechanisms exist to facilitate the implementation and monitoring of vulnerability management controls.	10	
7.2	Establish and Maintain a Remediation Process	Establish and maintain a risk-based remediation strategy documented in a remediation process, with monthly, or more frequent, reviews.	Functional	Equal	Vulnerability Remediation Process	VPM-02	Mechanisms exist to ensure that vulnerabilities are properly identified, tracked and remediated.	10	
7.3	Perform Automated Operating System Patch Management	Perform operating system updates on enterprise assets through automated patch management on a monthly, or more frequent, basis.	Functional	Equal	Software & Firmware Patching	VPM-05	Mechanisms exist to conduct software patching for all deployed operating systems, applications and firmware.	10	
7.4	Perform Automated Application Patch Management	Perform application updates on enterprise assets through automated patch management on a monthly, or more frequent, basis.	Functional	Intersects With	Software & Firmware Patching	VPM-05	Mechanisms exist to conduct software patching for all deployed operating systems, applications and firmware.	5	
			Functional	Intersects With	Centralized Management of Flaw Remediation Processes	VPM-05.1	Mechanisms exist to centrally-manage the flaw remediation process.	5	
			Functional	Intersects With	Automated Remediation Status	VPM-05.2	Automated mechanisms exist to determine the state of system components with regard to flaw remediation.	5	
			Functional	Intersects With	Automated Software & Firmware Updates	VPM-05.4	Automated mechanisms exist to install the latest stable versions of security-relevant software and firmware updates.	5	
7.5	Perform Automated Vulnerability Scans of Internal Enterprise Assets	Perform automated vulnerability scans of internal enterprise assets on a quarterly, or more frequent, basis. Conduct both authenticated and unauthenticated scans.	Functional	Intersects With	Vulnerability Scanning	VPM-06	Mechanisms exist to detect vulnerabilities and configuration errors by routine vulnerability scanning of systems and applications.	5	
			Functional	Intersects With	Internal Vulnerability Assessment Scans	VPM-06.7	Mechanisms exist to perform quarterly internal vulnerability scans, which includes all segments of the organization's internal network, as well as rescans until passing results are obtained or all “high” vulnerabilities are resolved, as defined by the Common Vulnerability Scoring System (CVSS).	5	
7.6	Perform Automated Vulnerability Scans of Externally-Exposed Enterprise Assets	Perform automated vulnerability scans of externally-exposed enterprise assets. Perform scans on a monthly, or more frequent, basis.	Functional	Intersects With	Vulnerability Scanning	VPM-06	Mechanisms exist to detect vulnerabilities and configuration errors by routine vulnerability scanning of systems and applications.	5	
			Functional	Intersects With	External Vulnerability Assessment Scans	VPM-06.6	Mechanisms exist to perform quarterly external vulnerability scans (outside the organization's network looking inward) via a reputable vulnerability service provider, which include rescans until passing results are obtained or all “high” vulnerabilities are resolved, as defined by the Common Vulnerability Scoring System (CVSS).	5	
7.7	Remediate Detected Vulnerabilities	Remediate detected vulnerabilities in software through processes and tooling on a monthly, or more frequent, basis, based on the remediation process.	Functional	Intersects With	Vulnerability Remediation Process	VPM-02	Mechanisms exist to ensure that vulnerabilities are properly identified, tracked and remediated.	5	
			Functional	Intersects With	Continuous Vulnerability Remediation Activities	VPM-04	Mechanisms exist to address new threats and vulnerabilities on an ongoing basis and ensure assets are protected against known attacks.	5	
8	Audit Log Management	Collect, alert, review, and retain audit logs of events that could help detect, understand, or recover from an attack.	Functional	Subset Of	Continuous Monitoring	MON-01	Mechanisms exist to facilitate the implementation of enterprise-wide monitoring controls.	10	
8.1	Establish and Maintain an Audit Log Management Process	Establish and maintain a documented audit log management process that defines the enterprise’s logging requirements. At a minimum, address the collection, review, and retention of audit logs for enterprise assets. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Reviews & Updates	MON-01.8	Mechanisms exist to review event logs on an ongoing basis and escalate incidents in accordance with established timelines and procedures.	5	
			Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
8.2	Collect Audit Logs	Collect audit logs. Ensure that logging, per the enterprise’s audit log management process, has been enabled across enterprise assets.	Functional	Subset Of	Continuous Monitoring	MON-01	Mechanisms exist to facilitate the implementation of enterprise-wide monitoring controls.	10	
			Functional	Intersects With	System Generated Alerts	MON-01.4	Mechanisms exist to generate, monitor, correlate and respond to alerts from physical, cybersecurity, data privacy and supply chain activities to achieve integrated situational awareness.	5	
			Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	System-Wide / Time-Correlated Audit Trail	MON-02.7	Automated mechanisms exist to compile audit records into an organization-wide audit trail that is time-correlated.	5	
			Functional	Intersects With	Content of Event Logs	MON-03	Mechanisms exist to configure systems to produce event logs that contain sufficient information to, at a minimum: (1) Establish what type of event occurred; (2) When (date and time) the event occurred; (3) Where the event occurred; (4) The source of the event; (5) The outcome (success or failure) of the event; and (6) The identity of any user/subject associated with the event.	5	
8.3	Ensure Adequate Audit Log Storage	Ensure that logging destinations maintain adequate storage to comply with the enterprise’s audit log management process.	Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Event Log Storage Capacity	MON-04	Mechanisms exist to allocate and proactively manage sufficient event log storage capacity to reduce the likelihood of such capacity being exceeded.	5	
8.4	Standardize Time Synchronization	Standardize time synchronization. Configure at least two synchronized time sources across enterprise assets, where supported.	Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Synchronization With Authoritative Time Source	MON-07.1	Mechanisms exist to synchronize internal system clocks with an authoritative time source.	5	
8.5	Collect Detailed Audit Logs	Configure detailed audit logging for enterprise assets containing sensitive data. Include event source, date, username, timestamp, source addresses, destination addresses, and other useful elements that could assist in a forensic investigation.	Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Content of Event Logs	MON-03	Mechanisms exist to configure systems to produce event logs that contain sufficient information to, at a minimum: (1) Establish what type of event occurred; (2) When (date and time) the event occurred; (3) Where the event occurred; (4) The source of the event; (5) The outcome (success or failure) of the event; and (6) The identity of any user/subject associated with the event.	5	
8.6	Collect DNS Query Audit Logs	Collect DNS query audit logs on enterprise assets, where appropriate and supported.	Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Integration of Scanning & Other Monitoring Information	MON-02.3	Automated mechanisms exist to integrate the analysis of audit records with analysis of vulnerability scanners, network performance, system monitoring and other sources to further enhance the ability to identify inappropriate or unusual activity.	5	
8.7	Collect URL Request Audit Logs	Collect URL request audit logs on enterprise assets, where appropriate and supported.	Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Integration of Scanning & Other Monitoring Information	MON-02.3	Automated mechanisms exist to integrate the analysis of audit records with analysis of vulnerability scanners, network performance, system monitoring and other sources to further enhance the ability to identify inappropriate or unusual activity.	5	
8.8	Collect Command-Line Audit Logs	Collect command-line audit logs. Example implementations include collecting audit logs from PowerShell®, BASH™, and remote administrative terminals.	Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Privileged Functions Logging	MON-03.3	Mechanisms exist to log and review the actions of users and/or services with elevated privileges.	5	
8.9	Centralize Audit Logs	Centralize, to the extent possible, audit log collection and retention across enterprise assets in accordance with the documented audit log management process. Example implementations include leveraging a SIEM tool to centralize multiple log sources.	Functional	Equal	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	10	
8.10	Retain Audit Logs	Retain audit logs across enterprise assets for a minimum of 90 days.	Functional	Intersects With	Event Log Storage Capacity	MON-04	Mechanisms exist to allocate and proactively manage sufficient event log storage capacity to reduce the likelihood of such capacity being exceeded.	5	
			Functional	Intersects With	Event Log Retention	MON-10	Mechanisms exist to retain event logs for a time period consistent with records retention requirements to provide support for after-the-fact investigations of security incidents and to meet statutory, regulatory and contractual retention requirements.	5	

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8.11	Conduct Audit Log Reviews	Conduct reviews of audit logs to detect anomalies or abnormal events that could indicate a potential threat. Conduct reviews on a weekly, or more frequent, basis.	Functional	Equal	Central Review & Analysis	MON-02.2	Automated mechanisms exist to centrally collect, review and analyze audit records from multiple sources.	10	
8.12	Collect Service Provider Logs	Collect service provider logs, where supported. Example implementations include collecting authentication and authorization events, data creation and disposal events, and user management events.	Functional	Intersects With	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	5	
			Functional	Intersects With	Correlate Monitoring Information	MON-02.1	Automated mechanisms exist to correlate both technical and non-technical information from across the enterprise by a Security Incident Event Manager (SIEM) or similar automated tool, to enhance organization-wide situational awareness.	5	
			Functional	Intersects With	Integration of Scanning & Other Monitoring Information	MON-02.3	Automated mechanisms exist to integrate the analysis of audit records with analysis of vulnerability scanners, network performance, system monitoring and other sources to further enhance the ability to identify inappropriate or unusual activity.	5	
9	Email and Web Browser Protections	Improve protections and detections of threats from email and web vectors, as these are opportunities for attackers to manipulate human behavior through direct engagement.	Functional	Intersects With	Unsupported Internet Browsers & Email Clients	CFG-04.2	Mechanisms exist to allow only approved Internet browsers and email clients to run on systems.	5	
			Functional	Intersects With	Phishing & Spam Protection	END-08	Mechanisms exist to utilize anti-phishing and spam protection technologies to detect and take action on unsolicited messages transported by electronic mail.	5	
			Functional	Intersects With	Social Media & Social Networking Restrictions	HRS-05.2	Mechanisms exist to define rules of behavior that contain explicit restrictions on the use of social media and networking sites, posting information on commercial websites and sharing account information.	5	
			Functional	Intersects With	Detonation Chambers (Sandboxes)	IRO-15	Mechanisms exist to utilize a detonation chamber capability to detect and/or block potentially-malicious files and email attachments.	5	
			Functional	Intersects With	DNS & Content Filtering	NET-18	Mechanisms exist to force Internet-bound network traffic through a proxy device (e.g., Policy Enforcement Point (PEP)) for URL content filtering and DNS filtering to limit a user's ability to connect to dangerous or prohibited Internet sites.	5	
			Functional	Intersects With	Social Engineering & Mining	SAT-02.2	Mechanisms exist to include awareness training on recognizing and reporting potential and actual instances of social engineering and social mining.	5	
9.1	Ensure Use of Only Fully Supported Browsers and Email Clients	Ensure only fully supported browsers and email clients are allowed to execute in the enterprise, only using the latest version of browsers and email clients provided through the vendor.	Functional	Intersects With	Unsupported Internet Browsers & Email Clients	CFG-04.2	Mechanisms exist to allow only approved Internet browsers and email clients to run on systems.	5	
			Functional	Intersects With	Restrict Roles Permitted To Install Software	CFG-05.2	Mechanisms exist to configure systems to prevent the installation of software, unless the action is performed by a privileged user or service.	5	
9.2	Use DNS Filtering Services	Use DNS filtering services on all end-user devices, including remote and on-premises assets, to block access to known malicious domains.	Functional	Equal	DNS & Content Filtering	NET-18	Mechanisms exist to force Internet-bound network traffic through a proxy device (e.g., Policy Enforcement Point (PEP)) for URL content filtering and DNS filtering to limit a user's ability to connect to dangerous or prohibited Internet sites.	10	
9.3	Maintain and Enforce Network-Based URL Filters	Enforce and update network-based URL filters to limit an enterprise asset from connecting to potentially malicious or unapproved websites. Example implementations include category-based filtering, reputation-based filtering, or through the use of block lists. Enforce filters for all enterprise assets.	Functional	Equal	DNS & Content Filtering	NET-18	Mechanisms exist to force Internet-bound network traffic through a proxy device (e.g., Policy Enforcement Point (PEP)) for URL content filtering and DNS filtering to limit a user's ability to connect to dangerous or prohibited Internet sites.	10	
9.4	Restrict Unnecessary or Unauthorized Browser and Email Client Extensions	Restrict, either through uninstalling or disabling, any unauthorized or unnecessary browser or email client plugins, extensions, and add-on applications.	Functional	Intersects With	Unsupported Internet Browsers & Email Clients	CFG-04.2	Mechanisms exist to allow only approved Internet browsers and email clients to run on systems.	5	
			Functional	Intersects With	Restrict Roles Permitted To Install Software	CFG-05.2	Mechanisms exist to configure systems to prevent the installation of software, unless the action is performed by a privileged user or service.	5	
			Functional	Intersects With	Rules of Behavior	HRS-05.1	Mechanisms exist to define acceptable and unacceptable rules of behavior for the use of technologies, including consequences for unacceptable behavior.	5	
			Functional	Intersects With	Use of Critical Technologies	HRS-05.4	Mechanisms exist to govern usage policies for critical technologies.	5	
9.5	Implement DMARC	To lower the chance of spoofed or modified emails from valid domains, implement DMARC policy and verification, starting with implementing the Sender Policy Framework (SPF) and the DomainKeys Identified Mail (DKIM) standards.	Functional	Intersects With	Sender Policy Framework (SPF)	NET-10.3	Mechanisms exist to validate the legitimacy of email communications through configuring a Domain Naming Service (DNS) Sender Policy Framework (SPF) record to specify the IP addresses and/or hostnames that are authorized to send email from the specified domain.	5	
			Functional	Intersects With	Domain-Based Message Authentication Reporting and Conformance (DMARC)	NET-20.4	Mechanisms exist to implement domain signature verification protections that authenticate incoming email according to the Domain-based Message Authentication Reporting and Conformance (DMARC).	5	
9.6	Block Unnecessary File Types	Block unnecessary file types attempting to enter the enterprise's email gateway.	Functional	Intersects With	Phishing & Spam Protection	END-08	Mechanisms exist to utilize anti-phishing and spam protection technologies to detect and take action on unsolicited messages transported by electronic mail.	5	
			Functional	Intersects With	Detonation Chambers (Sandboxes)	IRO-15	Mechanisms exist to utilize a detonation chamber capability to detect and/or block potentially-malicious files and email attachments.	5	
			Functional	Intersects With	Boundary Protection	NET-03	Mechanisms exist to monitor and control communications at the external network boundary and at key internal boundaries within the network.	5	
			Functional	Intersects With	Network Intrusion Detection / Prevention Systems (NIDS / NIPS)	NET-08	Mechanisms exist to employ Network Intrusion Detection / Prevention Systems (NIDS/NIPS) to detect and/or prevent intrusions into the network.	5	
9.7	Deploy and Maintain Email Server Anti-Malware Protections	Deploy and maintain email server anti-malware protections, such as attachment scanning and/or sandboxing.	Functional	Intersects With	Phishing & Spam Protection	END-08	Mechanisms exist to utilize anti-phishing and spam protection technologies to detect and take action on unsolicited messages transported by electronic mail.	5	
			Functional	Intersects With	Detonation Chambers (Sandboxes)	IRO-15	Mechanisms exist to utilize a detonation chamber capability to detect and/or block potentially-malicious files and email attachments.	5	
10	Malware Defenses	Prevent or control the installation, spread, and execution of malicious applications, code, or scripts on enterprise assets.	Functional	Subset Of	Endpoint Security	END-01	Mechanisms exist to facilitate the implementation of endpoint security controls.	10	
			Functional	Intersects With	Endpoint Protection Measures	END-02	Mechanisms exist to protect the confidentiality, integrity, availability and safety of endpoint devices.	5	
			Functional	Intersects With	Malicious Code Protection (Anti-Malware)	END-04	Mechanisms exist to utilize antimalware technologies to detect and eradicate malicious code.	5	
10.1	Deploy and Maintain Anti-Malware Software	Deploy and maintain anti-malware software on all enterprise assets.	Functional	Equal	Malicious Code Protection (Anti-Malware)	END-04	Mechanisms exist to utilize antimalware technologies to detect and eradicate malicious code.	10	
10.2	Configure Automatic Anti-Malware Signature Updates	Configure automatic updates for anti-malware signature files on all enterprise assets.	Functional	Equal	Automatic Antimalware Signature Updates	END-04.1	Mechanisms exist to automatically update antimalware technologies, including signature definitions.	10	
10.3	Disable Autorun and Autoplay for Removable Media	Disable autorun and autoplay auto-execute functionality for removable media.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Endpoint Protection Measures	END-02	Mechanisms exist to protect the confidentiality, integrity, availability and safety of endpoint devices.	5	
10.4	Configure Automatic Anti-Malware Scanning of Removable Media	Configure anti-malware software to automatically scan removable media.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Endpoint Protection Measures	END-02	Mechanisms exist to protect the confidentiality, integrity, availability and safety of endpoint devices.	5	
			Functional	Intersects With	Malicious Code Protection (Anti-Malware)	END-04	Mechanisms exist to utilize antimalware technologies to detect and eradicate malicious code.	5	
			Functional	Intersects With	Always On Protection	END-04.7	Mechanisms exist to ensure that anti-malware technologies are continuously running in real-time and cannot be disabled or altered by non-privileged users, unless specifically authorized by management on a case-by-case basis for a limited time period.	5	
10.5	Enable Anti-Exploitation Features	Enable anti-exploitation features on enterprise assets and software, where possible, such as Microsoft® Data Execution Prevention (DEP), Windows® Defender Exploit Guard (WDEG), or Apple® System Integrity Protection (SIP) and Gatekeeper™.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	5	
			Functional	Intersects With	Endpoint Protection Measures	END-02	Mechanisms exist to protect the confidentiality, integrity, availability and safety of endpoint devices.	5	
10.6	Centrally Manage Anti-Malware Software	Centrally manage anti-malware software.	Functional	Equal	Centralized Management of Antimalware Technologies	END-04.3	Mechanisms exist to centrally-manage antimalware technologies.	10	
10.7	Use Behavior-Based Anti-Malware Software	Use behavior-based anti-malware software.	Functional	Equal	Heuristic / Nonsignature-Based Detection	END-04.4	Mechanisms exist to utilize heuristic / nonsignature-based antimalware detection capabilities.	10	
11	Data Recovery	Establish and maintain data recovery practices sufficient to restore in-scope enterprise assets to a pre-incident and trusted state.	Functional	Subset Of	Business Continuity Management System (BCMS)	BCD-01	Mechanisms exist to facilitate the implementation of contingency planning controls to help ensure resilient assets and services (e.g., Continuity of Operations Plan (COOP) or Business Continuity & Disaster Recovery (BC/DR) playbooks).	10	
			Functional	Subset Of	Data Protection	DCH-01	Mechanisms exist to facilitate the implementation of data protection controls.	10	
			Functional	Intersects With	Endpoint Protection Measures	END-02	Mechanisms exist to protect the confidentiality, integrity, availability and safety of endpoint devices.	5	
11.1	Establish and Maintain a Data Recovery Process	Establish and maintain a data recovery process. In the process, address the scope of data recovery activities, recovery prioritization, and the security of backup data. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Subset Of	Business Continuity Management System (BCMS)	BCD-01	Mechanisms exist to facilitate the implementation of contingency planning controls to help ensure resilient assets and services (e.g., Continuity of Operations Plan (COOP) or Business Continuity & Disaster Recovery (BC/DR) playbooks).	10	
11.2	Perform Automated Backups	Perform automated backups of in-scope enterprise assets. Run backups weekly, or more frequently, based on the sensitivity of the data.	Functional	Equal	Data Backups	BCD-11	Mechanisms exist to create recurring backups of data, software and/or system images, as well as verify the integrity of these backups, to ensure the availability of the data to satisfying Recovery Time Objectives (RTOs) and Recovery Point Objectives (RPOs).	10	

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11.3	Protect Recovery Data	Protect recovery data with equivalent controls to the original data. Reference encryption or data separation, based on requirements.	Functional	Intersects With	Testing for Reliability & Integrity	BCD-11.1	Mechanisms exist to routinely test backups that verify the reliability of the backup process, as well as the integrity and availability of the data.	5	
			Functional	Intersects With	Cryptographic Protection	BCD-11.4	Cryptographic mechanisms exist to prevent the unauthorized disclosure and/or modification of backup information.	5	
			Functional	Intersects With	Information System Recovery & Reconstitution	BCD-12	Mechanisms exist to ensure the secure recovery and reconstitution of systems to a known state after a disruption, compromise or failure.	5	
			Functional	Intersects With	Backup & Restoration Hardware Protection	BCD-13	Mechanisms exist to protect backup and restoration hardware and software.	5	
			Functional	Subset Of	Data Protection	DCH-01	Mechanisms exist to facilitate the implementation of data protection controls.	10	
11.4	Establish and Maintain an Isolated Instance of Recovery Data	Establish and maintain an isolated instance of recovery data. Example implementations include, version controlling backup destinations through offline, cloud, or off-site systems or services.	Functional	Equal	Isolated Recovery Environment	BCD-14	Mechanisms exist to utilize an isolated, non-production environment to perform data backup and recovery operations through offline, cloud or off-site capabilities.	10	
11.5	Test Data Recovery	Test backup recovery quarterly, or more frequently, for a sampling of in-scope enterprise assets.	Functional	Intersects With	Testing for Reliability & Integrity	BCD-11.1	Mechanisms exist to routinely test backups that verify the reliability of the backup process, as well as the integrity and availability of the data.	5	
			Functional	Intersects With	Test Restoration Using Sampling	BCD-11.5	Mechanisms exist to utilize sampling of available backups to test recovery capabilities as part of business continuity plan testing.	5	
12	Network Infrastructure Management	Establish, implement, and actively manage (track, report, correct) network devices, in order to prevent attackers from exploiting vulnerable network services and access points.	Functional	Subset Of	Network Security Controls (NSC)	NET-01	Mechanisms exist to develop, govern & update procedures to facilitate the implementation of Network Security Controls (NSC).	10	
12.1	Ensure Network Infrastructure is Up-to-Date	Ensure network infrastructure is kept up-to-date. Example implementations include running the latest stable release of software and/or using currently supported network-as-a-service (NaaS) offerings. Review software versions monthly, or more frequently, to verify software support.	Functional	Subset Of	Network Security Controls (NSC)	NET-01	Mechanisms exist to develop, govern & update procedures to facilitate the implementation of Network Security Controls (NSC).	10	
			Functional	Intersects With	Continuous Vulnerability Remediation Activities	VPM-04	Mechanisms exist to address new threats and vulnerabilities on an ongoing basis and ensure assets are protected against known attacks.	5	
			Functional	Intersects With	Stable Versions	VPM-04.1	Mechanisms exist to install the latest stable version of any software and/or security-related updates on all applicable systems.	5	
			Functional	Intersects With	Software & Firmware Patching	VPM-05	Mechanisms exist to conduct software patching for all deployed operating systems, applications and firmware.	5	
12.2	Establish and Maintain a Secure Network Architecture	Establish and maintain a secure network architecture. A secure network architecture must address segmentation, least privilege, and availability, at a minimum.	Functional	Subset Of	Network Security Controls (NSC)	NET-01	Mechanisms exist to develop, govern & update procedures to facilitate the implementation of Network Security Controls (NSC).	10	
			Functional	Intersects With	Layered Network Defenses	NET-02	Mechanisms exist to implement security functions as a layered structure that minimizes interactions between layers of the design and avoids any dependence by lower layers on the functionality or correctness of higher layers.	5	
			Functional	Subset Of	Secure Engineering Principles	SEA-01	Mechanisms exist to facilitate the implementation of industry-recognized cybersecurity & data privacy practices in the specification, design, development, implementation and modification of systems and services.	10	
			Functional	Intersects With	Alignment With Enterprise Architecture	SEA-02	Mechanisms exist to develop an enterprise architecture, aligned with industry-recognized leading practices, with consideration for cybersecurity & data privacy principles that addresses risk to organizational operations, assets, individuals, other organizations.	5	
12.3	Securely Manage Network Infrastructure	Securely manage network infrastructure. Example implementations include version-controlled Infrastructure-as-Code (IaC), and the use of secure network protocols, such as SSH and HTTPS.	Functional	Intersects With	Remote Maintenance Cryptographic Protection	MNT-05.3	Cryptographic mechanisms exist to protect the integrity and confidentiality of remote, non-local maintenance and diagnostic communications.	5	
			Functional	Subset Of	Network Security Controls (NSC)	NET-01	Mechanisms exist to develop, govern & update procedures to facilitate the implementation of Network Security Controls (NSC).	10	
			Functional	Intersects With	Non-Console Administrative Access	CRY-06	Cryptographic mechanisms exist to protect the confidentiality and integrity of non-console administrative access.	5	
12.4	Establish and Maintain Architecture Diagram(s)	Establish and maintain architecture diagram(s) and/or other network system documentation. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Equal	Network Diagrams & Data Flow Diagrams (DFDs)	AST-04	Mechanisms exist to maintain network architecture diagrams that: (1) Contain sufficient detail to assess the security of the network's architecture; (2) Reflect the current architecture of the network environment; and (3) Document all sensitive/regulated data flows.	10	
12.5	Centralize Network Authentication, Authorization, and Auditing (AAA)	Centralize network AAA.	Functional	Intersects With	Authenticate, Authorize and Audit (AAA)	IAC-01.2	Mechanisms exist to strictly govern the use of Authenticate, Authorize and Audit (AAA) solutions, both on-premises and those hosted by an External Service Provider (ESP).	5	
			Functional	Intersects With	Identification & Authentication for Organizational Users	IAC-02	Mechanisms exist to uniquely identify and centrally Authenticate, Authorize and Audit (AAA) organizational users and processes acting on behalf of organizational users.	5	
			Functional	Intersects With	Identification & Authentication for Non-Organizational Users	IAC-03	Mechanisms exist to uniquely identify and centrally Authenticate, Authorize and Audit (AAA) third-party users and processes that provide services to the organization.	5	
			Functional	Intersects With	Identification & Authentication for Devices	IAC-04	Mechanisms exist to uniquely identify and centrally Authenticate, Authorize and Audit (AAA) devices before establishing a connection using bidirectional authentication that is cryptographically- based and replay resistant.	5	
12.6	Use of Secure Network Management and Communication Protocols	Use secure network management and communication protocols (e.g., 802.1X, Wi-Fi Protected Access 2 (WPA2) Enterprise or greater).	Functional	Subset Of	Network Security Controls (NSC)	NET-01	Mechanisms exist to develop, govern & update procedures to facilitate the implementation of Network Security Controls (NSC).	10	
			Functional	Intersects With	Data Flow Enforcement – Access Control Lists (ACLs)	NET-04	Mechanisms exist to implement and govern Access Control Lists (ACLs) to provide data flow enforcement that explicitly restrict network traffic to only what is authorized.	5	
			Functional	Subset Of	Secure Engineering Principles	SEA-01	Mechanisms exist to facilitate the implementation of industry-recognized cybersecurity & data privacy practices in the specification, design, development, implementation and modification of systems and services.	10	
			Functional	Intersects With	Ports, Protocols & Services In Use	TDA-02.1	Mechanisms exist to require the developers of systems, system components or services to identify early in the Secure Development Life Cycle (SDLC), the functions, ports, protocols and services intended for use.	5	
			Functional	Intersects With	External Connectivity Requirements - Identification of Ports, Protocols & Services	TPM-04.2	Mechanisms exist to require External Service Providers (ESPs) to identify and document the business need for ports, protocols and other services it requires to operate its processes and technologies.	5	
12.7	Ensure Remote Devices Utilize a VPN and are Connecting to an Enterprise's AAA Infrastructure	Require users to authenticate to enterprise-managed VPN and authentication services prior to accessing enterprise resources on end-user devices.	Functional	Intersects With	Remote Access	NET-14	Mechanisms exist to define, control and review organization-approved, secure remote access methods.	5	
			Functional	Intersects With	Automated Monitoring & Control	NET-14.1	Automated mechanisms exist to monitor and control remote access sessions.	5	
			Functional	Intersects With	Protection of Confidentiality / Integrity Using Encryption	NET-14.2	Cryptographic mechanisms exist to protect the confidentiality and integrity of remote access sessions (e.g., VPN).	5	
			Functional	Intersects With	Managed Access Control Points	NET-14.3	Mechanisms exist to route all remote accesses through managed network access control points (e.g., VPN concentrator).	5	
12.8	Establish and Maintain Dedicated Computing Resources for All Administrative Work	Establish and maintain dedicated computing resources, either physically or logically separated, for all administrative tasks or tasks requiring administrative access. The computing resources should be segmented from the enterprise's primary network and not be allowed internet access.	Functional	Equal	Dedicated Administrative Machines	IAC-20.4	Mechanisms exist to restrict executing administrative tasks or tasks requiring elevated access to a dedicated machine.	10	
13	Network Monitoring and Defense	Operate processes and tooling to establish and maintain comprehensive network monitoring and defense against security threats across the enterprise's network infrastructure and user base.	Functional	Subset Of	Continuous Monitoring	MON-01	Mechanisms exist to facilitate the implementation of enterprise-wide monitoring controls.	10	
13.1	Centralize Security Event Alerting	Centralize security event alerting across enterprise assets for log correlation and analysis. Best practice implementation requires the use of a SIEM, which includes vendor-defined event correlation alerts. A log analytics platform configured with security-relevant correlation alerts also satisfies this Safeguard.	Functional	Equal	Centralized Collection of Security Event Logs	MON-02	Mechanisms exist to utilize a Security Incident Event Manager (SIEM), or similar automated tool, to support the centralized collection of security-related event logs.	10	
13.2	Deploy a Host-Based Intrusion Detection Solution	Deploy a host-based intrusion detection solution on enterprise assets, where appropriate and/or supported.	Functional	Equal	Host Intrusion Detection and Prevention Systems (HIDS / HIPS)	END-07	Mechanisms exist to utilize Host-based Intrusion Detection / Prevention Systems (HIDS / HIPS), or similar technologies, to monitor for and protect against anomalous host activity, including lateral movement across the network.	10	
13.3	Deploy a Network Intrusion Detection Solution	Deploy a network intrusion detection solution on enterprise assets, where appropriate. Example implementations include the use of a Network Intrusion Detection System (NIDS) or equivalent cloud service provider (CSP) service.	Functional	Equal	Network Intrusion Detection / Prevention Systems (NIDS / NIPS)	NET-08	Mechanisms exist to employ Network Intrusion Detection / Prevention Systems (NIDS/NIPS) to detect and/or prevent intrusions into the network.	10	
13.4	Perform Traffic Filtering Between Network Segments	Perform traffic filtering between network segments, where appropriate.	Functional	Intersects With	Data Flow Enforcement – Access Control Lists (ACLs)	NET-04	Mechanisms exist to implement and govern Access Control Lists (ACLs) to provide data flow enforcement that explicitly restrict network traffic to only what is authorized.	5	
			Functional	Intersects With	Deny Traffic by Default & Allow Traffic by Exception	NET-04.1	Mechanisms exist to configure firewall and router configurations to deny network traffic by default and allow network traffic by exception (e.g., deny all, permit by exception).	5	
13.5	Manage Access Control for Remote Assets	Manage access control for assets remotely connecting to enterprise resources. Determine amount of access to enterprise resources based on: up-to-date anti-malware software installed, configuration compliance with the enterprise's secure configuration process, and ensuring the operating system and applications are up-to-date.	Functional	Intersects With	Zero Trust Architecture (ZTA)	NET-01.1	Mechanisms exist to treat all users and devices as potential threats and prevent access to data and resources until the users can be properly authenticated and their access authorized.	3	
			Functional	Intersects With	Boundary Protection	NET-03	Mechanisms exist to monitor and control communications at the external network boundary and at key internal boundaries within the network.	5	
			Functional	Intersects With	Endpoint Security Validation	NET-14.7	Automated mechanisms exist to validate the security posture of the endpoint devices (e.g., software versions, patch levels, etc.) prior to allowing devices to connect to organizational technology assets.	8	

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13.6	Collect Network Traffic Flow Logs	Collect network traffic flow logs and/or network traffic to review and alert upon from network devices.	Functional	Subset Of	Continuous Monitoring	MON-01	Mechanisms exist to facilitate the implementation of enterprise-wide monitoring controls.	10	
			Functional	Intersects With	Alert Threshold Tuning	MON-01.13	Mechanisms exist to "tune" event monitoring technologies through analyzing communications traffic/event patterns and developing profiles representing common traffic patterns and/or events.	5	
			Functional	Intersects With	Correlate Monitoring Information	MON-02.1	Automated mechanisms exist to correlate both technical and non-technical information from across the enterprise by a Security Incident Event Manager (SIEM) or similar automated tool, to enhance organization-wide situational awareness.	5	
			Functional	Intersects With	Integration of Scanning & Other Monitoring Information	MON-02.3	Automated mechanisms exist to integrate the analysis of audit records with analysis of vulnerability scanners, network performance, system monitoring and other sources to further enhance the ability to identify inappropriate or unusual activity.	5	
13.7	Deploy a Host-Based Intrusion Prevention Solution	Deploy a host-based intrusion prevention solution on enterprise assets, where appropriate and/or supported. Example implementations include use of an Endpoint Detection and Response (EDR) client or host-based IPS agent.	Functional	Intersects With	Host Intrusion Detection and Prevention Systems (HIDS / HIPS)	END-07	Mechanisms exist to utilize Host-based Intrusion Detection / Prevention Systems (HIDS / HIPS), or similar technologies, to monitor for and protect against anomalous host activity, including lateral movement across the network.	5	
			Functional	Intersects With	Endpoint Detection & Response (EDR)	END-06.2	Mechanisms exist to detect and respond to unauthorized configuration changes as cybersecurity incidents.	5	
13.8	Deploy a Network Intrusion Prevention Solution	Deploy a network intrusion prevention solution, where appropriate. Example implementations include the use of a Network Intrusion Prevention System (NIPS) or equivalent CSP service.	Functional	Equal	Network Intrusion Detection / Prevention Systems (NIDS / NIPS)	NET-08	Mechanisms exist to employ Network Intrusion Detection / Prevention Systems (NIDS/NIPS) to detect and/or prevent intrusions into the network.	10	
13.9	Deploy Port-Level Access Control	Deploy port-level access control. Port-level access control utilizes 802.1x, or similar network access control protocols, such as certificates, and may incorporate user and/or device authentication.	Functional	Equal	Network Access Control (NAC)	AST-02.5	Automated mechanisms exist to employ Network Access Control (NAC), or a similar technology, which is capable of detecting unauthorized devices and disable network access to those unauthorized devices.	10	
13.10	Perform Application Layer Filtering	Perform application layer filtering. Example implementations include a filtering proxy, application layer firewall, or gateway.	Functional	Intersects With	DNS & Content Filtering	NET-18	Mechanisms exist to force Internet-bound network traffic through a proxy device (e.g., Policy Enforcement Point (PEP)) for URL content filtering and DNS filtering to limit a user's ability to connect to dangerous or prohibited Internet sites.	5	
			Functional	Intersects With	Route Internal Traffic to Proxy Servers	NET-18.1	Mechanisms exist to route internal communications traffic to external networks through organization-approved proxy servers at managed interfaces.	5	
			Functional	Intersects With	Web Application Firewall (WAF)	WEB-03	Mechanisms exist to deploy Web Application Firewalls (WAFs) to provide defense-in-depth protection for application-specific threats.	5	
13.11	Tune Security Event Alerting Thresholds	Tune security event alerting thresholds monthly, or more frequently.	Functional	Equal	Alert Threshold Tuning	MON-01.13	Mechanisms exist to "tune" event monitoring technologies through analyzing communications traffic/event patterns and developing profiles representing common traffic patterns and/or events.	10	
14	Security Awareness and Skills Training	Establish and maintain a security awareness program to influence behavior among the workforce to be security conscious and properly skilled to reduce cybersecurity risks to the enterprise.	Functional	Subset Of	Cybersecurity & Data Privacy-Minded Workforce	SAT-01	Mechanisms exist to facilitate the implementation of security workforce development and awareness controls.	10	
14.1	Establish and Maintain a Security Awareness Program	Establish and maintain a security awareness program. The purpose of a security awareness program is to educate the enterprise's workforce on how to interact with enterprise assets and data in a secure manner. Conduct training at hire and, at a minimum, annually. Review and update content annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Subset Of	Cybersecurity & Data Privacy-Minded Workforce	SAT-01	Mechanisms exist to facilitate the implementation of security workforce development and awareness controls.	10	
14.2	Train Workforce Members to Recognize Social Engineering Attacks	Train workforce members to recognize social engineering attacks, such as phishing, business email compromise (BEC), pretexting, and tailgating.	Functional	Equal	Social Engineering & Mining	SAT-02.2	Mechanisms exist to include awareness training on recognizing and reporting potential and actual instances of social engineering and social mining.	10	
14.3	Train Workforce Members on Authentication Best Practices	Train workforce members on authentication best practices. Example topics include MFA, password composition, and credential management.	Functional	Intersects With	Cybersecurity & Data Privacy Awareness Training	SAT-02	Mechanisms exist to provide all employees and contractors appropriate awareness education and training that is relevant for their job function.	5	
			Functional	Intersects With	Role-Based Cybersecurity & Data Privacy Training	SAT-03	Mechanisms exist to provide role-based cybersecurity & data privacy-related training: (1) Before authorizing access to the system or performing assigned duties; (2) When required by system changes; and (3) Annually thereafter.	5	
14.4	Train Workforce on Data Handling Best Practices	Train workforce members on how to identify and properly store, transfer, archive, and destroy sensitive data. This also includes training workforce members on clear screen and desk best practices, such as locking their screen when they step away from their enterprise asset, erasing physical and virtual whiteboards at the end of meetings, and storing data and assets securely.	Functional	Equal	Role-Based Cybersecurity & Data Privacy Training	SAT-03	Mechanisms exist to provide role-based cybersecurity & data privacy-related training: (1) Before authorizing access to the system or performing assigned duties; (2) When required by system changes; and (3) Annually thereafter.	10	
14.5	Train Workforce Members on Causes of Unintentional Data Exposure	Train workforce members to be aware of causes for unintentional data exposure. Example topics include mis-delivery of sensitive data, losing a portable end-user device, or publishing data to unintended audiences.	Functional	Equal	Sensitive Information Storage, Handling & Processing	SAT-03.3	Mechanisms exist to ensure that every user accessing a system processing, storing or transmitting sensitive information is formally trained in data handling requirements.	10	
14.6	Train Workforce Members on Recognizing and Reporting Security Incidents	Train workforce members to be able to recognize a potential incident and be able to report such an incident.	Functional	Equal	Suspicious Communications & Anomalous System Behavior	SAT-03.2	Mechanisms exist to provide training to personnel on organization-defined indicators of malware to recognize suspicious communications and anomalous behavior.	10	
14.7	Train Workforce on How to Identify and Report if Their Enterprise Assets are Missing Security Updates	Train workforce to understand how to verify and report out-of-date software patches or any failures in automated processes and tools. Part of this training should include notifying IT personnel of any failures in automated processes and tools.	Functional	Intersects With	Cybersecurity & Data Privacy Awareness Training	SAT-02	Mechanisms exist to provide all employees and contractors appropriate awareness education and training that is relevant for their job function.	5	
			Functional	Intersects With	Role-Based Cybersecurity & Data Privacy Training	SAT-03	Mechanisms exist to provide role-based cybersecurity & data privacy-related training: (1) Before authorizing access to the system or performing assigned duties; (2) When required by system changes; and (3) Annually thereafter.	5	
14.8	Train Workforce on the Dangers of Connecting to and Transmitting Enterprise Data Over Insecure Networks	Train workforce members on the dangers of connecting to, and transmitting data over, insecure networks for enterprise activities. If the enterprise has remote workers, training must include guidance to ensure that all users securely configure their home network infrastructure.	Functional	Intersects With	Cybersecurity & Data Privacy Awareness Training	SAT-02	Mechanisms exist to provide all employees and contractors appropriate awareness education and training that is relevant for their job function.	5	
			Functional	Intersects With	Role-Based Cybersecurity & Data Privacy Training	SAT-03	Mechanisms exist to provide role-based cybersecurity & data privacy-related training: (1) Before authorizing access to the system or performing assigned duties; (2) When required by system changes; and (3) Annually thereafter.	5	
14.9	Conduct Role-Specific Security Awareness and Skills Training	Conduct role-specific security awareness and skills training. Example implementations include secure system administration courses for IT professionals, OWASP® Top 10 vulnerability awareness and prevention training for web application developers, and advanced social engineering awareness training for high-profile roles.	Functional	Intersects With	Role-Based Cybersecurity & Data Privacy Training	SAT-03	Mechanisms exist to provide role-based cybersecurity & data privacy-related training: (1) Before authorizing access to the system or performing assigned duties; (2) When required by system changes; and (3) Annually thereafter.	5	
			Functional	Intersects With	Practical Exercises	SAT-03.1	Mechanisms exist to include practical exercises in cybersecurity & data privacy training that reinforce training objectives.	5	
			Functional	Intersects With	Continuing Professional Education (CPE) - Cybersecurity & Data Privacy Personnel	SAT-03.7	Mechanisms exist to ensure cybersecurity & data privacy personnel receive Continuing Professional Education (CPE) training to maintain currency and proficiency with industry-recognized secure practices that are pertinent to their assigned roles and responsibilities.	5	
15	Service Provider Management	Develop a process to evaluate service providers who hold sensitive data, or are responsible for an enterprise's critical IT platforms or processes, to ensure these providers are protecting those platforms and data appropriately.	Functional	Subset Of	Third-Party Management	TPM-01	Mechanisms exist to facilitate the implementation of third-party management controls.	10	
			Functional	Intersects With	Responsible, Accountable, Supportive, Consulted & Informed (RASCI) Matrix	TPM-05.4	Mechanisms exist to document and maintain a Responsible, Accountable, Supportive, Consulted & Informed (RASCI) matrix, or similar documentation, to delineate assignment for cybersecurity & data privacy controls between internal stakeholders and External Service Providers (ESPs).	5	
			Functional	Intersects With	Third-Party Scope Review	TPM-05.5	Mechanisms exist to perform recurring validation of the Responsible, Accountable, Supportive, Consulted & Informed (RASCI) matrix, or similar documentation, to ensure cybersecurity & data privacy control assignments accurately reflect current business practices, compliance obligations, technologies and stakeholders.	5	
			Functional	Intersects With	Review of Third-Party Services	TPM-08	Mechanisms exist to monitor, regularly review and audit External Service Providers (ESPs) for compliance with established contractual requirements for cybersecurity & data privacy controls.	5	
15.1	Establish and Maintain an Inventory of Service Providers	Establish and maintain an inventory of service providers. The inventory is to list all known service providers, include classification(s), and designate an enterprise contact for each service provider. Review and update the inventory annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Equal	Third-Party Inventories	TPM-01.1	Mechanisms exist to maintain a current, accurate and complete list of External Service Providers (ESPs) that can potentially impact the Confidentiality, Integrity, Availability and/or Safety (CIAS) of the organization's systems, applications, services and data.	10	
15.2	Establish and Maintain a Service Provider Management Policy	Establish and maintain a service provider management policy. Ensure the policy addresses the classification, inventory, assessment, monitoring, and decommissioning of service providers. Review and update the policy annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Equal	Supply Chain Risk Management (SCRM) Plan	RSK-09	Mechanisms exist to develop a plan for Supply Chain Risk Management (SCRM) associated with the development, acquisition, maintenance and disposal of systems, system components and services, including documenting selected mitigating actions and monitoring performance against those plans.	10	
			Functional	Subset Of	Third-Party Management	TPM-01	Mechanisms exist to facilitate the implementation of third-party management controls.	10	

FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
15.3	Classify Service Providers	Classify service providers. Classification consideration may include one or more characteristics, such as data sensitivity, data volume, availability requirements, applicable regulations, inherent risk, and mitigated risk. Update and review classifications annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Equal	Third-Party Criticality Assessments	TPM-02	Mechanisms exist to identify, prioritize and assess suppliers and partners of critical systems, components and services using a supply chain risk assessment process relative to their importance in supporting the delivery of high-value services.	10	
15.4	Ensure Service Provider Contracts Include Security Requirements	Ensure service provider contracts include security requirements. Example requirements may include minimum security program requirements, security incident and/or data breach notification and response, data encryption requirements, and data disposal commitments. These security requirements must be consistent with the enterprise's service provider management policy. Review service provider contracts annually to ensure contracts are not missing security requirements.	Functional	Intersects With	Adequate Security for Sensitive / Regulated Data In Support of Contracts	IAO-03.2	Mechanisms exist to protect sensitive / regulated data that is collected, developed, received, transmitted, used or stored in support of the performance of a contract.	5	
			Functional	Intersects With	Data Privacy Requirements for Contractors & Service Providers	PRI-07.1	Mechanisms exist to include data privacy requirements in contracts and other acquisition-related documents that establish data privacy roles and responsibilities for contractors and service providers.	5	
			Functional	Intersects With	Limit Potential Harm	TPM-03.2	Mechanisms exist to utilize security safeguards to limit harm from potential adversaries who identify and target the organization's supply chain.	5	
			Functional	Intersects With	Third-Party Services	TPM-04	Mechanisms exist to mitigate the risks associated with third-party access to the organization's systems and data.	5	
			Functional	Intersects With	Third-Party Contract Requirements	TPM-05	Mechanisms exist to require contractual requirements for cybersecurity & data privacy requirements with third-parties, reflecting the organization's needs to protect its systems, processes and data.	5	
15.5	Assess Service Providers	Assess service providers consistent with the enterprise's service provider management policy. Assessment scope may vary based on classification(s), and may include review of standardized assessment reports, such as Service Organization Control 2 (SOC 2) and Payment Card Industry (PCI) Attestation of Compliance (AoC), customized questionnaires, or other appropriately rigorous processes. Reassess service providers annually, at a minimum, or with new and renewed contracts.	Functional	Intersects With	Supply Chain Risk Assessment	RSK-09.1	Mechanisms exist to periodically assess supply chain risks associated with systems, system components and services.	5	
			Functional	Intersects With	Third-Party Services	TPM-04	Mechanisms exist to mitigate the risks associated with third-party access to the organization's systems and data.	5	
			Functional	Intersects With	Third-Party Risk Assessments & Approvals	TPM-04.1	Mechanisms exist to conduct a risk assessment prior to the acquisition or outsourcing of technology-related services.	5	
15.6	Monitor Service Providers	Monitor service providers consistent with the enterprise's service provider management policy. Monitoring may include periodic reassessment of service provider compliance, monitoring service provider release notes, and dark web monitoring.	Functional	Equal	Review of Third-Party Services	TPM-08	Mechanisms exist to monitor, regularly review and audit External Service Providers (ESPs) for compliance with established contractual requirements for cybersecurity & data privacy controls.	10	
15.7	Securely Decommission Service Providers	Securely decommission service providers. Example considerations include user and service account deactivation, termination of data flows, and secure disposal of enterprise data within service provider systems.	Functional	Intersects With	Cybersecurity & Data Privacy Requirements Definition	PRM-05	Mechanisms exist to identify critical system components and functions by performing a criticality analysis for critical systems, system components or services at pre-defined decision points in the Secure Development Life Cycle (SDLC).	5	
			Functional	Intersects With	Business Process Definition	PRM-06	Mechanisms exist to define business processes with consideration for cybersecurity & data privacy that determines: (1) The resulting risk to organizational operations, assets, individuals and other organizations; and (2) Information protection needs arising from the defined business processes and revises the processes as necessary, until an achievable set of protection needs is obtained.	5	
			Functional	Intersects With	Secure Development Life Cycle (SDLC) Management	PRM-07	Mechanisms exist to ensure changes to systems within the Secure Development Life Cycle (SDLC) are controlled through formal change control procedures.	5	
			Functional	Subset Of	Technology Development & Acquisition	TDA-01	Mechanisms exist to facilitate the implementation of tailored development and acquisition strategies, contract tools and procurement methods to meet unique business needs.	10	
			Functional	Intersects With	Product Management	TDA-01.1	Mechanisms exist to design and implement product management processes to update products, including systems, software and services, to improve functionality and correct security deficiencies.	5	
			Functional	Intersects With	Managing Changes To Third-Party Services	TPM-10	Mechanisms exist to control changes to services by suppliers, taking into account the criticality of business information, systems and processes that are in scope by the third-party.	5	
16	Application Software Security	Manage the security life cycle of in-house developed, hosted, or acquired software to prevent, detect, and remediate security weaknesses before they can impact the enterprise.	Functional	Subset Of	Technology Development & Acquisition	TDA-01	Mechanisms exist to facilitate the implementation of tailored development and acquisition strategies, contract tools and procurement methods to meet unique business needs.	10	
			Functional	Intersects With	Secure Coding	TDA-06	Mechanisms exist to develop applications based on secure coding principles.	5	
			Functional	Subset Of	Secure Engineering Principles	SEA-01	Mechanisms exist to facilitate the implementation of industry-recognized cybersecurity & data privacy practices in the specification, design, development, implementation and modification of systems and services.	10	
			Functional	Intersects With	Web Security Standard	WEB-07	Mechanisms exist to ensure the Open Web Application Security Project (OWASP) Application Security Verification Standard is incorporated into the organization's Secure Systems Development Lifecycle (SSDLC) process.	5	
			Functional	Intersects With	Web Application Framework	WEB-08	Mechanisms exist to ensure a robust Web Application Framework is used to aid in the development of secure web applications, including web services, web resources and web APIs.	5	
16.1	Establish and Maintain a Secure Application Development Process	Establish and maintain a secure application development process. In the process, address such items as: secure application design standards, secure coding practices, developer training, vulnerability management, security of third-party code, and application security testing procedures. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Development Methods, Techniques & Processes	TDA-02.3	Mechanisms exist to require software developers to ensure that their software development processes employ industry-recognized secure practices for secure programming, engineering methods, quality control processes and validation techniques to minimize flawed and/or malformed software.	5	
			Functional	Intersects With	Developer Architecture & Design	TDA-05	Mechanisms exist to require the developers of systems, system components or services to produce a design specification and security architecture that: (1) Is consistent with and supportive of the organization's security architecture which is established within and is an integrated part of the organization's enterprise architecture; (2) Accurately and completely describes the required security functionality and the allocation of security controls among physical and logical components; and (3) Expresses how individual security functions, mechanisms and services work together to provide required security capabilities and a unified approach to protection.	5	
			Functional	Intersects With	Secure Coding	TDA-06	Mechanisms exist to develop applications based on secure coding principles.	5	
			Functional	Intersects With	Software Assurance Maturity Model (SAMM)	TDA-06.3	Mechanisms exist to utilize a Software Assurance Maturity Model (SAMM) to govern a secure development lifecycle for the development of systems, applications and services.	5	
			Functional	Intersects With	Secure Settings By Default	TDA-09.6	Mechanisms exist to implement secure configuration settings by default to reduce the likelihood of software being deployed with weak security settings that would put the asset at a greater risk of compromise.	5	
			Functional	Intersects With	Developer-Provided Training	TDA-16	Mechanisms exist to require the developers of systems, system components or services to provide training on the correct use and operation of the system, system component or service.	5	
			Functional	Intersects With	Web Security Standard	WEB-07	Mechanisms exist to ensure the Open Web Application Security Project (OWASP) Application Security Verification Standard is incorporated into the organization's Secure Systems Development Lifecycle (SSDLC) process.	5	
			Functional	Intersects With	Web Application Framework	WEB-08	Mechanisms exist to ensure a robust Web Application Framework is used to aid in the development of secure web applications, including web services, web resources and web APIs.	5	
16.2	Establish and Maintain a Process to Accept and Address Software Vulnerabilities	Establish and maintain a process to accept and address reports of software vulnerabilities, including providing a means for external entities to report. The process is to include such items as: a vulnerability handling policy that identifies reporting process, responsible party for handling vulnerability reports, and a process for intake, assignment, remediation, and remediation testing. As part of the process, use a vulnerability tracking system that includes severity ratings, and metrics for measuring timing for identification, analysis, and remediation of vulnerabilities. Review and update documentation annually, or when significant enterprise changes occur that could impact this Safeguard. Third-party application developers need to consider this an externally-facing policy that helps to set expectations for outside stakeholders.	Functional	Intersects With	Software Bill of Materials (SBOM)	TDA-04.2	Mechanisms exist to generate, or obtain, a Software Bill of Materials (SBOM) for systems, applications and services that lists software packages in use, including versions and applicable licenses.	5	
			Functional	Intersects With	Threat Modeling	TDA-06.2	Mechanisms exist to perform threat modelling and other secure design techniques, to ensure that threats to software and solutions are identified and accounted for.	5	
			Functional	Intersects With	Software Design Review	TDA-06.5	Mechanisms exist to have an independent review of the software design to confirm that all cybersecurity & data privacy requirements are met and that any identified risks are satisfactorily addressed.	5	
			Functional	Intersects With	Cybersecurity & Data Privacy Testing Throughout Development	TDA-09	Mechanisms exist to require system developers/integrators consult with cybersecurity & data privacy personnel to: (1) Create and implement a Security Test and Evaluation (ST&E), or similar plan; (2) Implement a verifiable flaw remediation process to correct weaknesses and deficiencies identified during the security testing and evaluation process; and (3) Document the results of the security testing/evaluation and flaw remediation processes.	5	
			Functional	Intersects With	Continuous Monitoring Plan	TDA-09.1	Mechanisms exist to require the developers of systems, system components or services to produce a plan for the continuous monitoring of cybersecurity & data privacy control effectiveness.	5	

FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
			Functional	Intersects With	Developer Threat Analysis & Flaw Remediation	TDA-15	Mechanisms exist to require system developers and integrators to create a Security Test and Evaluation (ST&E) plan and implement the plan under the witness of an independent party.	5	
			Functional	Intersects With	Vulnerability Disclosure Program (VDP)	THR-06	Mechanisms exist to establish a Vulnerability Disclosure Program (VDP) to assist with the secure development and maintenance of products and services that receives unsolicited input from the public about vulnerabilities in organizational systems, services and processes.	5	
16.3	Perform Root Cause Analysis on Security Vulnerabilities	Perform root cause analysis on security vulnerabilities. When reviewing vulnerabilities, root cause analysis is the task of evaluating underlying issues that create vulnerabilities in code, and allows development teams to move beyond just fixing individual vulnerabilities as they arise.	Functional	Intersects With	Root Cause Analysis (RCA) & Lessons Learned	IRO-13	Mechanisms exist to incorporate lessons learned from analyzing and resolving cybersecurity & data privacy incidents to reduce the likelihood or impact of future incidents.	5	
			Functional	Intersects With	Cybersecurity & Data Privacy Testing Throughout Development	TDA-09	Mechanisms exist to require system developers/integrators consult with cybersecurity & data privacy personnel to: (1) Create and implement a Security Test and Evaluation (ST&E), or similar plan; (2) Implement a verifiable flaw remediation process to correct weaknesses and deficiencies identified during the security testing and evaluation process; and (3) Document the results of the security testing/evaluation and flaw remediation processes.	5	
16.4	Establish and Manage an Inventory of Third-Party Software Components	Establish and manage an updated inventory of third-party components used in development, often referred to as a "bill of materials," as well as components slated for future use. This inventory is to include any risks that each third-party component could pose. Evaluate the list at least monthly to identify any changes or updates to these components, and validate that the component is still supported.	Functional	Intersects With	Minimum Viable Product (MVP) Security Requirements	TDA-02	Mechanisms exist to ensure risk-based technical and functional specifications are established to define a Minimum Viable Product (MVP).	5	
			Functional	Intersects With	Ports, Protocols & Services In Use	TDA-02.1	Mechanisms exist to require the developers of systems, system components or services to identify early in the Secure Development Life Cycle (SDLC), the functions, ports, protocols and services intended for use.	5	
			Functional	Intersects With	Identification & Justification of Ports, Protocols & Services	TDA-02.5	Mechanisms exist to require process owners to identify, document and justify the business need for the ports, protocols and other services necessary to operate their technology solutions.	5	
			Functional	Intersects With	Software Bill of Materials (SBOM)	TDA-04.2	Mechanisms exist to generate, or obtain, a Software Bill of Materials (SBOM) for systems, applications and services that lists software packages in use, including versions and applicable licenses.	5	
16.5	Use Up-to-Date and Trusted Third-Party Software Components	Use up-to-date and trusted third-party software components. When possible, choose established and proven frameworks and libraries that provide adequate security. Acquire these components from trusted sources or evaluate the software for vulnerabilities before use.	Functional	Intersects With	Provenance	AST-03.2	Mechanisms exist to track the origin, development, ownership, location and changes to systems, system components and associated data.	3	
			Functional	Intersects With	Secure Coding	TDA-06	Mechanisms exist to develop applications based on secure coding principles.	5	
			Functional	Intersects With	Software Assurance Maturity Model (SAMM)	TDA-06.3	Mechanisms exist to utilize a Software Assurance Maturity Model (SAMM) to govern a secure development lifecycle for the development of systems, applications and services.	5	
			Functional	Intersects With	Product Tampering and Counterfeiting (PTC)	TDA-11	Mechanisms exist to maintain awareness of component authenticity by developing and implementing Product Tampering and Counterfeiting (PTC) practices that include the means to detect and prevent counterfeit components.	5	
			Functional	Intersects With	Software / Firmware Integrity Verification	TDA-14.1	Mechanisms exist to require developer of systems, system components or services to enable integrity verification of software and firmware components.	5	
16.6	Establish and Maintain a Severity Rating System and Process for Application Vulnerabilities	Establish and maintain a severity rating system and process for application vulnerabilities that facilitates prioritizing the order in which discovered vulnerabilities are fixed. This process includes setting a minimum level of security acceptability for releasing code or applications. Severity ratings bring a systematic way of triaging vulnerabilities that improves risk management and helps ensure the most severe bugs are fixed first. Review and update the system and process annually.	Functional	Subset Of	Risk Management Program	RSK-01	Mechanisms exist to facilitate the implementation of strategic, operational and tactical risk management controls.	10	
			Functional	Intersects With	Risk Framing	RSK-01.1	Mechanisms exist to identify: (1) Assumptions affecting risk assessments, risk response and risk monitoring; (2) Constraints affecting risk assessments, risk response and risk monitoring; (3) The organizational risk tolerance; and (4) Priorities, benefits and trade-offs considered by the organization for managing risk.	5	
			Functional	Intersects With	Risk-Based Security Categorization	RSK-02	Mechanisms exist to categorize systems and data in accordance with applicable laws, regulations and contractual obligations that: (1) Document the security categorization results (including supporting rationale) in the security plan for systems; and (2) Ensure the security categorization decision is reviewed and approved by the asset owner.	5	
			Functional	Intersects With	Impact-Level Prioritization	RSK-02.1	Mechanisms exist to prioritize the impact level for systems, applications and/or services to prevent potential disruptions.	5	
16.7	Use Standard Hardening Configuration Templates for Application Infrastructure	Use standard, industry-recommended hardening configuration templates for application infrastructure components. This includes underlying servers, databases, and web servers, and applies to cloud containers, Platform as a Service (PaaS) components, and SaaS components. Do not allow in-house developed software to weaken configuration hardening.	Functional	Intersects With	System Hardening Through Baseline Configurations	CFG-02	Mechanisms exist to develop, document and maintain secure baseline configurations for technology platforms that are consistent with industry-accepted system hardening standards.	10	
			Functional	Intersects With	Configure Systems, Components or Services for High-Risk Areas	CFG-02.5	Mechanisms exist to configure systems utilized in high-risk areas with more restrictive baseline configurations.	8	
			Functional	Intersects With	Software Design Review	TDA-06.5	Mechanisms exist to have an independent review of the software design to confirm that all cybersecurity & data privacy requirements are met and that any identified risks are satisfactorily addressed.	5	
			Functional	Intersects With	Customized Development of Critical Components	TDA-12	Mechanisms exist to custom-develop critical system components, when Commercial Off The Shelf (COTS) solutions are unavailable.	5	
			Functional	Intersects With	Web Security Standard	WEB-07	Mechanisms exist to ensure the Open Web Application Security Project (OWASP) Application Security Verification Standard is incorporated into the organization's Secure Systems Development Lifecycle (SSDLC) process.	5	
16.8	Separate Production and Non-Production Systems	Maintain separate environments for production and non-production systems.	Functional	Intersects With	Secure Development Environments	TDA-07	Mechanisms exist to maintain a segmented development network to ensure a secure development environment.	5	
			Functional	Intersects With	Separation of Development, Testing and Operational Environments	TDA-08	Mechanisms exist to manage separate development, testing and operational environments to reduce the risks of unauthorized access or changes to the operational environment and to ensure no impact to production systems.	5	
16.9	Train Developers in Application Security Concepts and Secure Coding	Ensure that all software development personnel receive training in writing secure code for their specific development environment and responsibilities. Training can include general security principles and application security standard practices. Conduct training at least annually and design in a way to promote security within the development team, and build a culture of security among the developers.	Functional	Intersects With	Role-Based Cybersecurity & Data Privacy Training	SAT-03	Mechanisms exist to provide role-based cybersecurity & data privacy-related training: (1) Before authorizing access to the system or performing assigned duties; (2) When required by system changes; and (3) Annually thereafter.	5	
			Functional	Intersects With	Continuing Professional Education (CPE) - DevOps Personnel	SAT-03.8	Mechanisms exist to ensure application development and operations (DevOps) personnel receive Continuing Professional Education (CPE) training on Secure Software Development Practices (SSDP) to appropriately address evolving threats.	5	
16.10	Apply Secure Design Principles in Application Architectures	Apply secure design principles in application architectures. Secure design principles include the concept of least privilege and enforcing mediation to validate every operation that the user makes, promoting the concept of "never trust user input." Examples include ensuring that explicit error checking is performed and documented for all input, including for size, data type, and acceptable ranges or formats. Secure design also means minimizing the application infrastructure attack surface, such as turning off unprotected ports and services, removing unnecessary programs and files, and renaming or removing default accounts.	Functional	Subset Of	Secure Engineering Principles	SEA-01	Mechanisms exist to facilitate the implementation of industry-recognized cybersecurity & data privacy practices in the specification, design, development, implementation and modification of systems and services.	10	
			Functional	Intersects With	Centralized Management of Cybersecurity & Data Privacy Controls	SEA-01.1	Mechanisms exist to centrally-manage the organization-wide management and implementation of cybersecurity & data privacy controls and related processes.	5	
			Functional	Intersects With	Alignment With Enterprise Architecture	SEA-02	Mechanisms exist to develop an enterprise architecture, aligned with industry-recognized leading practices, with consideration for cybersecurity & data privacy principles that addresses risk to organizational operations, assets, individuals, other organizations.	5	
			Functional	Intersects With	Developer Architecture & Design	TDA-05	Mechanisms exist to require the developers of systems, system components or services to produce a design specification and security architecture that: (1) Is consistent with and supportive of the organization's security architecture which is established within and is an integrated part of the organization's enterprise architecture; (2) Accurately and completely describes the required security functionality and the allocation of security controls among physical and logical components; and (3) Expresses how individual security functions, mechanisms and services work together to provide required security capabilities and a unified approach to protection.	5	
			Functional	Intersects With	Secure Coding	TDA-06	Mechanisms exist to develop applications based on secure coding principles.	5	
			Functional	Intersects With	Web Security Standard	WEB-07	Mechanisms exist to ensure the Open Web Application Security Project (OWASP) Application Security Verification Standard is incorporated into the organization's Secure Systems Development Lifecycle (SSDLC) process.	5	

FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
			Functional	Intersects With	Web Application Framework	WEB-08	Mechanisms exist to ensure a robust Web Application Framework is used to aid in the development of secure web applications, including web services, web resources and web APIs.	5	
16.11	Leverage Vetted Modules or Services for Application Security Components	Leverage vetted modules or services for application security components, such as identity management, encryption, and auditing and logging. Using platform features in critical security functions will reduce developers' workload and minimize the likelihood of design or implementation errors. Modern operating systems provide effective mechanisms for identification, authentication, and authorization and make those mechanisms available to applications. Use only standardized, currently accepted, and extensively reviewed encryption algorithms. Operating systems also provide mechanisms to create and maintain secure audit logs.	Functional	Intersects With	Secure Coding	TDA-06	Mechanisms exist to develop applications based on secure coding principles.	5	
			Functional	Intersects With	Software Assurance Maturity Model (SAMM)	TDA-06.3	Mechanisms exist to utilize a Software Assurance Maturity Model (SAMM) to govern a secure development lifecycle for the development of systems, applications and services.	5	
			Functional	Intersects With	Customized Development of Critical Components	TDA-12	Mechanisms exist to custom-develop critical system components, when Commercial Off The Shelf (COTS) solutions are unavailable.	5	
			Functional	Intersects With	Developer Configuration Management	TDA-14	Mechanisms exist to require system developers and integrators to perform configuration management during system design, development, implementation and operation.	5	
			Functional	Intersects With	Software / Firmware Integrity Verification	TDA-14.1	Mechanisms exist to require developer of systems, system components or services to enable integrity verification of software and firmware components.	5	
16.12	Implement Code-Level Security Checks	Apply static and dynamic analysis tools within the application life cycle to verify that secure coding practices are being followed.	Functional	Intersects With	Software Design Review	TDA-06.5	Mechanisms exist to have an independent review of the software design to confirm that all cybersecurity & data privacy requirements are met and that any identified risks are satisfactorily addressed.	5	
			Functional	Intersects With	Cybersecurity & Data Privacy Testing Throughout Development	TDA-09	Mechanisms exist to require system developers/integrators consult with cybersecurity & data privacy personnel to: (1) Create and implement a Security Test and Evaluation (ST&E), or similar plan; (2) Implement a verifiable flaw remediation process to correct weaknesses and deficiencies identified during the security testing and evaluation process; and (3) Document the results of the security testing/evaluation and flaw remediation processes.	5	
			Functional	Intersects With	Static Code Analysis	TDA-09.2	Mechanisms exist to require the developers of systems, system components or services to employ static code analysis tools to identify and remediate common flaws and document the results of the analysis.	5	
			Functional	Intersects With	Dynamic Code Analysis	TDA-09.3	Mechanisms exist to require the developers of systems, system components or services to employ dynamic code analysis tools to identify and remediate common flaws and document the results of the analysis.	5	
16.13	Conduct Application Penetration Testing	Conduct application penetration testing. For critical applications, authenticated penetration testing is better suited to finding business logic vulnerabilities than code scanning and automated security testing. Penetration testing relies on the skill of the tester to manually manipulate an application as an authenticated and unauthenticated user.	Functional	Equal	Application Penetration Testing	TDA-09.5	Mechanisms exist to perform application-level penetration testing of custom-made applications and services.	10	
16.14	Conduct Threat Modeling	Conduct threat modeling. Threat modeling is the process of identifying and addressing application security design flaws within a design, before code is created. It is conducted through specially trained individuals who evaluate the application design and gauge security risks for each entry point and access level. The goal is to map out the application, architecture, and infrastructure in a structured way to understand its weaknesses.	Functional	Equal	Threat Modeling	TDA-06.2	Mechanisms exist to perform threat modelling and other secure design techniques, to ensure that threats to software and solutions are identified and accounted for.	10	
17	Incident Response Management	Establish a program to develop and maintain an incident response capability (e.g., policies, plans, procedures, defined roles, training, and communications) to prepare, detect, and quickly respond to an attack.	Functional	Subset Of	Incident Response Operations	IRO-01	Mechanisms exist to implement and govern processes and documentation to facilitate an organization-wide response capability for cybersecurity & data privacy-related incidents.	10	
			Functional	Intersects With	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	5	
17.1	Designate Personnel to Manage Incident Handling	Designate one key person, and at least one backup, who will manage the enterprise's incident handling process. Management personnel are responsible for the coordination and documentation of incident response and recovery efforts and can consist of employees internal to the enterprise, service providers, or a hybrid approach. If using a service provider, designate at least one person internal to the enterprise to oversee any third-party work. Review annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	5	
			Functional	Intersects With	Incident Response Plan (IRP)	IRO-04	Mechanisms exist to maintain and make available a current and viable Incident Response Plan (IRP) to all stakeholders.	5	
			Functional	Intersects With	Integrated Security Incident Response Team (ISIRT)	IRO-07	Mechanisms exist to establish an integrated team of cybersecurity, IT and business function representatives that are capable of addressing cybersecurity & data privacy incident response operations.	5	
17.2	Establish and Maintain Contact Information for Reporting Security Incidents	Establish and maintain contact information for parties that need to be informed of security incidents. Contacts may include internal staff, service vendors, law enforcement, cyber insurance providers, relevant government agencies, Information Sharing and Analysis Center (ISAC) partners, or other stakeholders. Verify contacts annually to ensure that information is up-to-date.	Functional	Intersects With	Situational Awareness For Incidents	IRO-09	Mechanisms exist to document, monitor and report the status of cybersecurity & data privacy incidents to internal stakeholders all the way through the resolution of the incident.	5	
			Functional	Intersects With	Incident Stakeholder Reporting	IRO-10	Mechanisms exist to timely-report incidents to applicable: (1) Internal stakeholders; (2) Affected clients & third-parties; and (3) Regulatory authorities.	5	
			Functional	Intersects With	Cyber Incident Reporting for Sensitive Data	IRO-10.2	Mechanisms exist to report sensitive/regulated data incidents in a timely manner.	5	
			Functional	Intersects With	Vulnerabilities Related To Incidents	IRO-10.3	Mechanisms exist to report system vulnerabilities associated with reported cybersecurity & data privacy incidents to organization-defined personnel or roles.	5	
			Functional	Intersects With	Supply Chain Coordination	IRO-10.4	Mechanisms exist to provide cybersecurity & data privacy incident information to the provider of the product or service and other organizations involved in the supply chain for systems or system components related to the incident.	5	
17.3	Establish and Maintain an Enterprise Process for Reporting Incidents	Establish and maintain an documented enterprise process for the workforce to report security incidents. The process includes reporting timeframe, personnel to report to, mechanism for reporting, and the minimum information to be reported. Ensure the process is publicly available to all of the workforce. Review annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Equal	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	10	
17.4	Establish and Maintain an Incident Response Process	Establish and maintain a documented incident response process that addresses roles and responsibilities, compliance requirements, and a communication plan. Review annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	5	
			Functional	Intersects With	Incident Response Plan (IRP)	IRO-04	Mechanisms exist to maintain and make available a current and viable Incident Response Plan (IRP) to all stakeholders.	5	
			Functional	Intersects With	Integrated Security Incident Response Team (ISIRT)	IRO-07	Mechanisms exist to establish an integrated team of cybersecurity, IT and business function representatives that are capable of addressing cybersecurity & data privacy incident response operations.	5	
17.5	Assign Key Roles and Responsibilities	Assign key roles and responsibilities for incident response, including staff from legal, IT, information security, facilities, public relations, human resources, incident responders, and analysts. Review annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Subset Of	Incident Response Operations	IRO-01	Mechanisms exist to implement and govern processes and documentation to facilitate an organization-wide response capability for cybersecurity & data privacy-related incidents.	10	
			Functional	Intersects With	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	5	
			Functional	Intersects With	Incident Response Plan (IRP)	IRO-04	Mechanisms exist to maintain and make available a current and viable Incident Response Plan (IRP) to all stakeholders.	5	
			Functional	Intersects With	Integrated Security Incident Response Team (ISIRT)	IRO-07	Mechanisms exist to establish an integrated team of cybersecurity, IT and business function representatives that are capable of addressing cybersecurity & data privacy incident response operations.	5	
17.6	Define Mechanisms for Communicating During Incident Response	Determine which primary and secondary mechanisms will be used to communicate and report during a security incident. Mechanisms can include phone calls, emails, secure chat, or notification letters. Keep in mind that certain mechanisms, such as emails, can be affected during a security incident. Review annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	5	
			Functional	Intersects With	Incident Response Plan (IRP)	IRO-04	Mechanisms exist to maintain and make available a current and viable Incident Response Plan (IRP) to all stakeholders.	5	
			Functional	Intersects With	Integrated Security Incident Response Team (ISIRT)	IRO-07	Mechanisms exist to establish an integrated team of cybersecurity, IT and business function representatives that are capable of addressing cybersecurity & data privacy incident response operations.	5	
			Functional	Intersects With	Situational Awareness For Incidents	IRO-09	Mechanisms exist to document, monitor and report the status of cybersecurity & data privacy incidents to internal stakeholders all the way through the resolution of the incident.	5	
17.7	Conduct Routine Incident Response Exercises	Plan and conduct routine incident response exercises and scenarios for key personnel involved in the incident response process to prepare for responding to real-world incidents. Exercises need to test communication channels, decision making, and workflows. Conduct testing on an annual basis, at a minimum.	Functional	Intersects With	Incident Response Testing	IRO-06	Mechanisms exist to formally test incident response capabilities through realistic exercises to determine the operational effectiveness of those capabilities.	5	
17.8	Conduct Post-Incident Reviews	Conduct post-incident reviews. Post-incident reviews help prevent incident recurrence through identifying lessons learned and follow-up action.	Functional	Equal	Root Cause Analysis (RCA) & Lessons Learned	IRO-13	Mechanisms exist to incorporate lessons learned from analyzing and resolving cybersecurity & data privacy incidents to reduce the likelihood or impact of future incidents.	10	
17.9	Establish and Maintain Security Incident Thresholds	Establish and maintain security incident thresholds, including, at a minimum, differentiating between an incident and an event. Examples can include: abnormal activity, security vulnerability, security weakness, data breach, privacy incident, etc. Review annually, or when significant enterprise changes occur that could impact this Safeguard.	Functional	Intersects With	Incident Handling	IRO-02	Mechanisms exist to cover the preparation, automated detection or intake of incident reporting, analysis, containment, eradication and recovery.	5	
			Functional	Intersects With	Incident Response Plan (IRP)	IRO-04	Mechanisms exist to maintain and make available a current and viable Incident Response Plan (IRP) to all stakeholders.	5	
			Functional	Intersects With	Integrated Security Incident Response Team (ISIRT)	IRO-07	Mechanisms exist to establish an integrated team of cybersecurity, IT and business function representatives that are capable of addressing cybersecurity & data privacy incident response operations.	5	

FDE #	FDE Name	Focal Document Element (FDE) Description	STRM Rationale	STRM Relationship	SCF Control	SCF #	Secure Controls Framework (SCF) Control Description	Strength of Relationship (optional)	Notes (optional)
18	Penetration Testing	Test the effectiveness and resiliency of enterprise assets through identifying and exploiting weaknesses in controls (people, processes, and technology), and simulating the objectives and actions of an attacker.	Functional	Subset Of	Vulnerability & Patch Management Program (VPMP)	VPM-01	Mechanisms exist to facilitate the implementation and monitoring of vulnerability management controls.	10	
			Functional	Intersects With	Penetration Testing	VPM-07	Mechanisms exist to conduct penetration testing on systems and web applications.	5	
18.1	Establish and Maintain a Penetration Testing Program	Establish and maintain a penetration testing program appropriate to the size, complexity, industry, and maturity of the enterprise. Penetration testing program characteristics include scope, such as network, web application, Application Programming Interface (API), hosted services, and physical premise controls; frequency; limitations, such as acceptable hours, and excluded attack types; point of contact information; remediation, such as how findings will be routed internally; and retrospective requirements.	Functional	Equal	Penetration Testing	VPM-07	Mechanisms exist to conduct penetration testing on systems and web applications.	10	
18.2	Perform Periodic External Penetration Tests	Perform periodic external penetration tests based on program requirements, no less than annually. External penetration testing must include enterprise and environmental reconnaissance to detect exploitable information. Penetration testing requires specialized skills and experience and must be conducted through a qualified party. The testing may be clear box or opaque box.	Functional	Equal	Penetration Testing	VPM-07	Mechanisms exist to conduct penetration testing on systems and web applications.	10	
18.3	Remediate Penetration Test Findings	Remediate penetration test findings based on the enterprise's documented vulnerability remediation process. This should include determing a timeline and level of effort based on the impact and prioritization of each identified finding.	Functional	Intersects With	Risk Remediation	RSK-06	Mechanisms exist to remediate risks to an acceptable level.	5	
			Functional	Intersects With	Continuous Vulnerability Remediation Activities	VPM-04	Mechanisms exist to address new threats and vulnerabilities on an ongoing basis and ensure assets are protected against known attacks.	5	
			Functional	Intersects With	Software & Firmware Patching	VPM-05	Mechanisms exist to conduct software patching for all deployed operating systems, applications and firmware.	5	
18.4	Validate Security Measures	Validate security measures after each penetration test. If deemed necessary, modify rulesets and capabilities to detect the techniques used during testing.	Functional	Intersects With	Control Functionality Verification	CHG-06	Mechanisms exist to verify the functionality of cybersecurity and/or data privacy controls following implemented changes to ensure applicable controls operate as designed.	5	
18.5	Perform Periodic Internal Penetration Tests	Perform periodic internal penetration tests based on program requirements, no less than annually. The testing may be clear box or opaque box.	Functional	Equal	Penetration Testing	VPM-07	Mechanisms exist to conduct penetration testing on systems and web applications.	10	