Healthcare and Public Health
Risk Identification and
Site Criticality (RISC)

Toolkit Reference Guide

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1 Introduction

The Healthcare and Public Health (HPH) Risk Identification and Site Criticality (RISC) Toolkit provides an all-hazards risk assessment methodology and suite of self-assessment tools that can be used by public and private organizations within the HPH Sector to inform emergency preparedness planning, risk management activities, and resource investments. The RISC Toolkit provides owners/operators in the Sector with objective, authoritative data and nationally recognized standards-based evaluation criteria in an easy-to-follow, guided format. Through the risk assessment process, users can identify the threats and hazards facing them, measure the vulnerability of their operations to disruption, and estimate potential consequences resulting from actualized threats and hazards. Using the RISC Toolkit enables consistent, repeatable, and objective risk assessments, which can help inform decision making and create a more resilient healthcare system.

This Reference Guide provides a brief introduction to the components of the RISC Toolkit, followed by detailed explanations of the calculations performed within each of the RISC Toolkit modules and the Dashboard Navigator. Users can refer to this guide to get a better understanding of how risk is calculated and how the various modules of the RISC Toolkit are linked logically to each other. Specific instructions for using the RISC Toolkit can be found at the beginning of each individual module and in series of "pop-up" notes that may be cued as the user progresses through each module. For additional information and assistance, the user should consult the Frequently Asked Questions (FAQ) document which accompanies this Reference Guide.

2 Process Overview

2.1 General Information

Risk is measured as the product of three factors: the likelihood of a threat or hazard occurring (Threat), the vulnerability of an operation to disruption from the threat or hazard (Vulnerability), and the level of impact the threat or hazard will cause should it occur (Consequence). The HPH RISC Toolkit guides users through a determination of each of these factors via three automated modules, all connected through a simple, integrated dashboard. The three modules are:

1. **Threat/Hazard Assessment Module (THAM).** A data-driven tool to identify the most relevant threats and hazards facing a facility or asset. The THAM uses simple facility characteristics like geographic location along with objective, internet-based data on hazard occurrences to estimate the relative likelihood of 34 distinct event types, including intentional acts, natural hazards, and unintentional manmade events. In addition, the THAM can be used to record the frequency of 33 hazard types that are specific to the local/internal conditions at the facility being assessed and for which no Internet-based data is available. Accompanying the THAM is an End-to-End Narrative Methodology that describes step-by-step the calculations and data used to generate threat/hazard ratings for each event type.

2. **Rapid Infrastructure Survey Tool Vulnerability Module (RIST-V).** A survey-style questionnaire designed to measure the vulnerability of a facility or asset to the entire scope of the threat/hazard environment, based on accepted standards and guidance from throughout the healthcare, emergency preparedness, and physical and cybersecurity fields. The RIST-V uses a series of Yes/No and multiple choice questions to assess facility-level emergency preparedness and resilience, physical security, cybersecurity, and critical dependencies.

3. **Rapid Infrastructure Survey Tool Consequence and Criticality Module (RIST-C).** An HPH Sector-focused tool to estimate the human, property, and business impacts to a facility that may result from a specific threat or hazard. The RIST-C is used to assess the impacts of individual threats and hazards to build a measurable consequence profile. In addition, the RIST-C can be used to determine the importance (criticality) of a facility or asset to the proper functioning of the healthcare system as a whole. (Note: Criticality is not a component of risk, but rather can be used to identify key components of a healthcare system or organization.)

All modules of the RISC Toolkit are accessed through the Dashboard. As the user completes the process, the dashboard will automatically calculate risk to the assessed facility/asset according to the following formula:

$$Risk = T \times V \times C$$

where *T* is the relative likelihood of a specific threat or hazard occurring, expressed as a rating from 0.1 (low likelihood) to 4.0 (very high likelihood); *V* is the level of vulnerability to the threat or hazard, expressed as a factor from zero (no vulnerability) to one (very high vulnerability); and *C* is the consequence of the threat or hazard occurring, expressed as a rating from 1.0 (low consequence) to 4.0 (very high consequence). Risk can be calculated separately for as many threats or hazards as desired. When complete, the Dashboard provides a risk-ranked list of threats and hazards which managers can use to prioritize specific policies, planning activities, risk management efforts, and/or resource investments.

2.2   External vs. Local/Internal Hazards

The HPH RISC Toolkit enables the assessment of risk for two distinct types of events: external threats/ hazards for which there are objective, national-level data sources regarding frequency of occurrence (e.g., hurricanes, HAZMAT spills, active shooters); and local/internal hazards specific to a single facility and for which no national datasets exist (e.g., HVAC failure, violent patients, chemical theft). These two types of events are inherently different in their origin and impact—external events affect a region or community, whereas internal events by and large involve only one facility—and in how facilities prepare for and respond to them. Therefore, the components of the RISC Toolkit present these hazard types separately to facilitate the different processes an organization may use to address them. Additionally, technical reasons require that the Threat/Hazard Ratings for these two event types be calculated differently in the THAM (see Section 3.1 for more details). Because of this, Threat/Hazard Ratings and Risk Ratings cannot be compared between external and local/internal threats/hazards.

2.3   Comparisons of Multiple Facilities

Accompanying the RISC Toolkit is a Multi-facility Comparison Utility, also referred to as the Multi-viewer, that allows comparison of THAM, RIST-V, RIST-C, Criticality, and Risk results for multiple facilities at once. This utility can be used by coalitions; healthcare organizations; local, regional, or federal public health offices; and others to compare the threat, hazards, vulnerabilities, criticality, consequences, and risks associated with multiple facilities under their purview. The comparisons can be used for trend analysis, the identification of common vulnerabilities, the identification of anomalies, and other organization-specific analyses.

Upon completion of any of the individual modules of the RISC Toolkit, a data file is automatically saved that contains the responses and results of the module-specific assessment. (The file is saved in the

'Data' folder within the directory in which the RISC Toolkit is located.) To use the Multi-Viewer, the user should perform or collect THAM, RIST-V, and RIST-C assessments/data from individual facilities, and then follow the instructions in the Multi-Viewer to import the auto-generated data files. The viewer will allow the user to view individual facility results side-by-side as well as a set of aggregated results and statistics such as average, minimum, and maximum ratings or scores.

3 Calculations

3.1 Threat/Hazard Assessment Module (THAM)

The THAM produces a rating from 0.1 (Low) to 4.0 (Very High) for each of 34 external threat and hazard event types (intentional, unintentional, and natural) plus 33 internal, facility-specific event types. Each Threat/Hazard Rating is an indicator of likelihood of occurrence of the threat/hazard at the assessed facility relative to all other facilities and threat/hazard event types. The calculations used to determine these ratings are different for external and local/internal hazards as described below.

3.1.1 External (National) Hazards

The estimation of likelihood of specific external threats and hazards is based on national databases containing records of threat/hazard occurrences. From these databases, predictive factors (e.g., geographic location) that correlate to a hazard's frequency of occurrence were identified. For event types for which no such databases exist, authoritative reports and analyses were used to identify factors and incidence rates. Together, the overall incidence of a threat/hazard and the relative likelihood of occurrence of that particular hazard at a facility compared to others are used to create threat/hazard ratings that can be compared against each other.

The Threat/Hazard Rating is calculated in two steps. First, the facility is rated based on the likelihood of an event type occurring at the facility versus all other facilities or locations. For most hazards, national databases of event occurrences are used to identify the locations with the most occurrences of the event over a given time span. That number of occurrences is used to define the top of the rating scale (i.e., 4). For some event types, other factors are used to define the preliminary rating, such as proximity to a hazard (e.g., a nuclear reactor) or a characteristic of the facility or operation itself (e.g., the type of information handled at the facility).

In the second step, the preliminary rating is scaled according to the absolute frequency of occurrence of the event type. This step allows for comparison of different events against each other. Each preliminary rating is multiplied by a modifier—a number between 0.1 and 1.0—that is an indicator of the likelihood of that event nationally compared to all others. In other words, the most frequently occurring events have a multiplier of 1.0 (i.e., the preliminary rating does not change) and the least likely have a multiplier of 0.1.

Because the THAM assesses a multitude of threats and hazards that capture a wide frequency of occurrence (tsunami events are very infrequent—fewer than 10 per year, while lightning strikes are very frequent—more than 100,000 per year), the modifier is based on a log-transformed event frequency. The equation below describes how the modifier is calculated:

$$RM = \frac{log(E)}{log(E_M)}$$

where RM is the Relative Modifier; E is the number of events per year of the event type of interest; and E_M is the number of events per year of the most frequent event type. The Threat/Hazard Rating is obtained by multiplying the preliminary rating (1 – 4) by the relative modifier.

An example: a facility in Hawaii is given a preliminary rating of 4 for the tsunami hazard because the facility is less than 3 km from the nearest shore, and tsunamis in the U.S. are most likely to occur in Alaska and Hawaii. However, because of the rarity of tsunamis in general (three events nationally in the past 20 years), the modifier for the tsunami hazard is 0.1, and thus the final Hazard Rating is 0.4.

3.1.2 Local/Internal Hazards

Occurrence of local/internal event types is dependent on the exact conditions or patterns of occurrence at a given facility, and cannot be inferred based on nearby or similar facilities. There are no databases that track the occurrence of such events. Threat/Hazard Ratings for local/internal hazards, therefore, are not derived using the same two-step calculations as external hazards. Instead, the user provides estimated frequencies of occurrence based on historical records and local data sources and subject matter expert input. This frequency is directly related to a Threat/Hazard Rating as described in Table 1.

Table 1. Local/Internal Hazard Ratings.

Rating Category	Hazard Rating	Hazard Occurrence Description	Hazard Occurrence Range
Very High	4	Frequent	At least once per year.
High	3	Occasional	At least every 5 years.
Moderate	2	Unlikely	At least every 20 years.
Low	1	Rare	More than 20 years between occurrences.

3.2 Rapid Infrastructure Survey Tool Vulnerability Module (RIST-V).

The RIST-V consists of a series of Yes/No and multiple choice questions designed to characterize a facility's emergency management, physical security, and cybersecurity posture, as well as its level of dependency on external utilities and services. The responses to these questions are tallied into an overall Vulnerability Score, a single number on the scale of 0 – 100 (least to greatest vulnerability). A series of sub-scores are also reported: four scores for the four major components of vulnerability (resilience management, physical security, critical dependencies, and cybersecurity). Additional sub-scores are provided for each of the sub-sections within these four areas. By providing measurements of vulnerability within each section or sub-section of the tool, owners/operators of a facility can identify aspects of their operation that are contributing to vulnerability, and determine specific actions that can be taken to reduce that vulnerability and increase resilience.

Calculation of the Vulnerability Score is simply a tally of the answers to each question, weighted so that each of the four sections of the RIST-V contribute equally to the overall score. Within each section or sub-section, the Vulnerability Score is the percentage of questions answered in the negative direction (increasing

vulnerability). Each question in a section is given equal weight. For multiple choice questions, each option is assigned a fraction so that "partial credit" can be given. The final overall Vulnerability Score is the average of the scores for each of the four individual sections.

3.2.1 Threat/Hazard–Vulnerability Mapping

The overall Vulnerability Score depicts the extent of the facility's vulnerability to the entire all-hazards landscape (i.e., is not hazard-specific). However, risk, as assessed in the RISC Toolkit, is threat/hazard specific. To translate the all-hazards Vulnerability Score to threat/hazard-specific vulnerability, each threat and hazard in the THAM is mapped to the relevant sub-sections of the RIST-V. Each threat/hazard thus receives a weighted Vulnerability Score, which is calculated as the percentage of *relevant* questions answered in the negative direction. For example, physical security training will play a role in mitigating the risk associated with an active shooter event, but will not affect the risk associated with a hurricane. (See Appendix A for a table illustrating threat/hazard-vulnerability mapping.)

The all-hazards Vulnerability Score and sub-scores and the threat/hazard-specific Vulnerability Scores are automatically imported into the Dashboard. In the risk table on the main page of the Dashboard, the threat/hazard-specific Vulnerability Scores (divided by 100) are multiplied by the Threat/Hazard Ratings to produce a $T \times V$ intermediate score, which can be used for prioritization of threats/hazards for subsequent consequence assessment (see Section 3.3.1 below).

3.3   Rapid Infrastructure Survey Tool Consequence and Criticality Module (RIST-C)

The RIST-C consists of survey questions, in the same Yes/No and multiple choice format used in the RIST-V, that are used to provide two separate outputs: a Consequence Rating and a Sector Criticality Rating. The Consequence rating is a relative measure of impact of a specific threat/hazard to the facility itself, in terms of property loss or damage, business costs, and potential injuries or deaths. The Criticality Rating describes the level of impact to the HPH Sector as a whole that would result from the loss of function of the facility or asset.

3.3.1 Consequence Rating

The Consequence Rating is composed of three Impact Ratings: human impacts, which are the potential for injury or loss of life to staff, patients, and others on site; property impacts, which reflect damages to and loss of property and equipment; and business impacts, which are monetary losses due to business interruption as well as regulatory and legal costs. These impact estimates are relative ratings (similar to the Threat/Hazard Ratings from the THAM) on a scale of one to four. They are derived from user-provided valuations of property and business activities plus enumerations of specific staff and patient/customer populations. The Consequence Rating is an average of the three Impact Ratings.

Impact and Consequence Ratings are specific to a single threat or hazard. Therefore, the user can generate individual ratings for any number of threats/hazards. Each rating should be based on a reasonably expected worst-case scenario for the event type assessed. Unlike the THAM, which calculates ratings for many threats and hazards simultaneously, the user must repeat the RIST-C consequence estimates separately for each threat/hazard assessed. Which threats and hazards are assessed is at the discretion of the user; however, it is recommended that those events that have the highest $T \times V$ intermediate score as reported in the Dashboard be prioritized for consequence assessment.

3.3.2 Criticality Rating

The RIST-C also contains questions that are used to derive general measurements of criticality (such as population served and unique services provided) as well as questions specific to the subsector with which the facility is affiliated (e.g., direct patient healthcare, health plans and payers, pharmaceuticals). The responses to these questions are compiled into a single Criticality Rating (from one to four) that can be used as a relative measure of the extent of impact the HPH Sector (or region, coalition, etc.) would experience after loss of the facility's services. The Criticality Rating is not part of risk, but is a separate metric that can be used by healthcare coalitions, organizations, and governmental bodies to identify key healthcare system assets.

3.4   Dashboard

As each module of the RISC Toolkit is completed, the responses and results are automatically imported into the Dashboard, and risk calculations are automatically performed based on the formula $\textbf{\textit{Risk}} = \textbf{\textit{T}} \times \textbf{\textit{V}} \times \textbf{\textit{C}}$. The Threat/Hazard Ratings from the THAM and the Consequence Rating from the RIST-C are used directly to populate the $\textbf{\textit{T}}$ and $\textbf{\textit{C}}$ variables, respectively. The Vulnerability Score from the RIST-V is divided by 100 to get the $\textbf{\textit{V}}$ rating. That is,

$$\textbf{\textit{T}} = \text{Threat/Hazard Rating}$$
$$\textbf{\textit{V}} = \text{Vulnerability Score} \div 100$$
$$\textbf{\textit{C}} = \text{Consequence Rating}$$

3.4.1 Presentation of results

The Dashboard presents the results of the individual RISC Toolkit modules as a table of individual threats/hazards and their associated risk results. External and local/internal threats/hazards are presented in two separate tables sorted based on which modules have been completed.

The threats/hazards assessed are organized according to the following scheme:

1. After completion of the THAM, threats/hazards are sorted by descending Threat/Hazard Rating. The results table at this point will be identical to the one reported by the THAM.
2. After completion of the RIST-V, the Dashboard calculates a $\textbf{\textit{T}} \times \textbf{\textit{V}}$ intermediate score, by which threats/hazards are sorted in descending order.
3. After completion of the RIST-C, the Dashboard calculates Risk, by which threats/hazards are sorted in descending order. All threats/hazards for which Consequence Ratings were generated in the RIST-C will be at the top of the table. The remaining threats/hazards (those which have no Consequence Rating and thus no Risk Rating) are sorted by $\textbf{\textit{T}} \times \textbf{\textit{V}}$ score.

Appendix A: Threat/Hazard Vulnerability Mapping

Table 2. Threat/Hazard mapping for the Resilience Management section of the RIST-V. Subsections are included (+) or not included (-) in the hazard-specific vulnerability score of each threat/hazard.

Threat/Hazard	2.1 Business Continuity	2.2 Emergency Management/Preparedness	2.3 Information Sharing	2.4 Climate Change
Insider Threat	+	+	+	-
Terrorism	+	+	+	-
Active Shooter	+	+	+	-
Cyber	+	+	+	-
Violent Crime	+	+	+	-
Property Crime	+	+	+	-
Earthquake	+	+	+	-
Tsunami	+	+	+	-
Landslide	+	+	+	-
Subsidence	+	+	+	+
Volcano	+	+	+	-
Damaging Winds	+	+	+	+
Drought	+	+	+	+
Flash Flood	+	+	+	+
Floods	+	+	+	+
Hail	+	+	+	+
Ice Storm	+	+	+	+
Snow Fall/ Blizzard	+	+	+	+
Storm Surge	+	+	+	+
Tornado	+	+	+	+
Wildfire	+	+	+	+
Extreme Heat	+	+	+	+
Extreme Cold	+	+	+	+

Threat/Hazard	2.1 Business Continuity	2.2 Emergency Management/Preparedness	2.3 Information Sharing	2.4 Climate Change
Hurricane	+	+	+	+
Space Weather	+	+	+	-
Thunderstorm	+	+	+	+
Influenza	+	+	+	-
Aircraft Crash	+	+	+	-
Facility HAZMAT	+	+	+	-
Highway HAZMAT	+	+	+	-
Maritime HAZMAT	+	+	+	-
Railway HAZMAT	+	+	+	-
Pipeline HAZMAT	+	+	+	-
External Radiological	+	+	+	-
Communications Failure	+	+	+	-
Electrical Failure	+	+	+	-
Fire Alarm Failure	+	+	+	-
Generator Failure	+	+	+	-
HVAC Failure	+	+	+	-
Information Systems Failure	+	+	+	-
Medical Gas Failure	+	+	+	-
Medical Vacuum Failure	+	+	+	-
Natural Gas Failure	+	+	+	-
Sewer Failure	+	+	+	-
Steam Failure	+	+	+	-
Water Failure	+	+	+	-
Fuel Shortage	+	+	+	-
Supply Shortage	+	+	+	-
Internal Fire	+	+	+	-
Internal Flood	+	+	+	-

Threat/Hazard	2.1 Business Continuity	2.2 Emergency Management/Preparedness	2.3 Information Sharing	2.4 Climate Change
Gas/ Emissions Leak	+	+	+	-
Heliport Accident	+	+	+	-
Dam Inundation	+	+	+	-
Water Contamination	+	+	+	-
Bomb Threat	+	+	+	-
Civil Disturbance	+	+	+	-
Forensic Admission	+	+	+	-
HAZMAT Theft	+	+	+	-
Hostage Situation	+	+	+	-
Child Abduction	+	+	+	-
Labor Action	+	+	+	-
Suspicious Package/ Substance	+	+	+	-
Violent Patient	+	+	+	-
VIP Situation	+	+	+	-
Internal Biological exposure	+	+	+	-
Internal HAZMAT Exposure	+	+	+	-
Internal Radiological Exposure	+	+	+	-

Table 3. Threat/Hazard mapping for the Physical Security section of the RIST-V. Subsections are included (+) or not included (-) in the hazard-specific vulnerability score of each threat/hazard.

Threat/Hazard	3.1 Physical Security Organization, Policies, and Plans	3.2 Personnel Surety	3.3 Security Training	3.4 Security Force Profile	3.5 Physical Access Control	3.6 Lighting, Surveillance and Intrusion Detection	3.7 Badging and Internal Security
Insider Threat	+	+	+	+	+	+	+
Terrorism	+	+	+	+	+	+	+
Active Shooter	+	+	+	+	+	+	+
Cyber	-	-	-	-	-	-	-
Violent Crime	+	-	+	+	+	+	+
Property Crime	+	-	+	+	+	+	+
Earthquake	-	-	-	-	-	-	-
Tsunami	-	-	-	-	-	-	-
Landslide	-	-	-	-	-	-	-
Subsidence	-	-	-	-	-	-	-
Volcano	-	-	-	-	-	-	-
Damaging Winds	-	-	-	-	-	-	-
Drought	-	-	-	-	-	-	-
Flash Flood	-	-	-	-	-	-	-
Floods	-	-	-	-	-	-	-
Hail	-	-	-	-	-	-	-
Ice Storm	-	-	-	-	-	-	-
Snow Fall/ Blizzard	-	-	-	-	-	-	-
Storm Surge	-	-	-	-	-	-	-
Tornado	-	-	-	-	-	-	-
Wildfire	-	-	-	-	-	-	-
Extreme Heat	-	-	-	-	-	-	-

Threat/Hazard	3.1 Physical Security Organization, Policies, and Plans	3.2 Personnel Surety	3.3 Security Training	3.4 Security Force Profile	3.5 Physical Access Control	3.6 Lighting, Surveillance and Intrusion Detection	3.7 Badging and Internal Security
Extreme Cold	-	-	-	-	-	-	-
Hurricane	-	-	-	-	-	-	-
Space Weather	-	-	-	-	-	-	-
Thunderstorm	-	-	-	-	-	-	-
Influenza	-	-	-	-	-	-	-
Aircraft Crash	-	-	-	-	-	-	-
Facility HAZMAT	-	-	-	-	-	-	-
Highway HAZMAT	-	-	-	-	-	-	-
Maritime HAZMAT	-	-	-	-	-	-	-
Railway HAZMAT	-	-	-	-	-	-	-
Pipeline HAZMAT	-	-	-	-	-	-	-
External Radiological	-	-	-	-	-	-	-
Communications Failure	-	-	-	-	-	-	-
Electrical Failure	-	-	-	-	-	-	-
Fire Alarm Failure	-	-	-	-	-	-	-
Generator Failure	-	-	-	-	-	-	-
HVAC Failure	-	-	-	-	-	-	-
Information Systems Failure	-	-	-	-	-	-	-
Medical Gas Failure	-	-	-	-	-	-	-
Medical Vacuum Failure	-	-	-	-	-	-	-
Natural Gas Failure	-	-	-	-	-	-	-
Sewer Failure	-	-	-	-	-	-	-
Steam Failure	-	-	-	-	-	-	-
Water Failure	-	-	-	-	-	-	-

Threat/Hazard	3.1 Physical Security Organization, Policies, and Plans	3.2 Personnel Surety	3.3 Security Training	3.4 Security Force Profile	3.5 Physical Access Control	3.6 Lighting, Surveillance and Intrusion Detection	3.7 Badging and Internal Security
Fuel Shortage	-	-	-	-	-	-	-
Supply Shortage	-	-	-	-	-	-	-
Internal Fire	-	-	-	-	-	-	-
Internal Flood	-	-	-	-	-	-	-
Gas/ Emissions Leak	-	-	-	-	-	-	-
Heliport Accident	-	-	-	-	-	-	-
Dam Inundation	-	-	-	-	-	-	-
Water Contamination	-	-	-	-	-	-	-
Bomb Threat	+	-	+	+	+	+	+
Civil Disturbance	+	-	+	+	+	+	+
Forensic Admission	-	+	-	-	-	-	-
HAZMAT Theft	+	+	+	+	+	+	+
Hostage Situation	+	+	+	+	+	+	+
Child Abduction	+	+	+	+	+	+	+
Labor Action	+	+	+	+	+	+	+
Suspicious Package/ Substance	+	-	+	-	+	+	-
Violent Patient	+	-	+	+	-	-	-
VIP Situation	+	+	+	+	+	+	+
Internal Biological exposure	-	-	-	-	-	-	-
Internal HAZMAT Exposure	-	-	-	-	-	-	-
Internal Radiological Exposure	-	-	-	-	-	-	-

Table 4. Threat/Hazard mapping for the Critical Dependencies section of the RIST-V. Subsections are included (+) or not included (-) in the hazard-specific vulnerability score of each threat/hazard.

Threat/Hazard	4.1 General Dependencies	4.2 Information Technology (IT)	4.3 Electricity	4.4 Natural Gas	4.5 Water	4.6 Wastewater and Waste Disposal	4.7 Communications	4.8 Transportation	4.9 Critical Products
Insider Threat	+	+	-	-	-	-	-	-	-
Terrorism	+	+	+	+	+	+	+	+	+
Active Shooter	-	-	-	-	-	-	-	-	-
Cyber	+	+	-	-	-	-	-	-	-
Violent Crime	-	-	-	-	-	-	-	-	-
Property Crime	-	-	-	-	-	-	-	-	-
Earthquake	+	+	+	+	+	+	+	+	+
Tsunami	+	+	+	+	+	+	+	+	+
Landslide	+	+	+	+	+	+	+	+	+
Subsidence	+	+	+	+	+	+	+	+	+
Volcano	+	+	+	+	+	-	+	+	+
Damaging Winds	+	-	+	-	-	-	+	-	-
Drought	+	-	-	-	+	+	-	-	-
Flash Flood	+	-	+	-	+	+	-	+	+
Floods	+	+	+	+	+	+	+	+	+
Hail	+	-	+	-	-	-	+	+	+
Ice Storm	+	-	+	-	-	-	+	+	+
Snow Fall/ Blizzard	+	-	+	-	-	-	+	+	-
Storm Surge	+	+	+	-	+	+	+	+	+
Tornado	+	+	+	+	+	+	+	+	+
Wildfire	+	+	+	+	+	+	+	+	+
Extreme Heat	+	-	+	-	-	-	+	-	-
Extreme Cold	+	-	+	+	+	+	+	-	-

Threat/Hazard	4.1 General Dependencies	4.2 Information Technology (IT)	4.3 Electricity	4.4 Natural Gas	4.5 Water	4.6 Wastewater and Waste Disposal	4.7 Communications	4.8 Transportation	4.9 Critical Products
Hurricane	+	+	+	+	+	+	+	+	+
Space Weather	+	+	+	+	-	-	+	+	+
Thunderstorm	+	+	+	-	-	-	+	+	-
Influenza	-	-	-	-	-	-	-	-	-
Aircraft Crash	+	+	+	+	+	+	+	+	+
Facility HAZMAT	+	-	-	-	+	+	-	+	+
Highway HAZMAT	+	-	-	-	-	-	-	+	+
Maritime HAZMAT	+	-	-	-	-	-	-	-	+
Railway HAZMAT	+	-	-	-	-	-	-	-	+
Pipeline HAZMAT	+	-	-	+	+	+	-	-	+
External Radiological	+	-	-	-	+	-	-	+	+
Communications Failure	+	-	-	-	-	-	+	-	-
Electrical Failure	+	-	+	-	-	-	+	-	-
Fire Alarm Failure	+	-	-	-	-	-	-	-	-
Generator Failure	+	-	+	-	-	-	-	-	-
HVAC Failure	+	-	-	-	-	-	-	-	-
Information Systems Failure	+	+	-	-	-	-	-	-	-
Medical Gas Failure	+	-	-	-	-	-	-	-	-
Medical Vacuum Failure	+	-	-	-	-	-	-	-	-

Threat/Hazard	4.1 General Dependencies	4.2 Information Technology (IT)	4.3 Electricity	4.4 Natural Gas	4.5 Water	4.6 Wastewater and Waste Disposal	4.7 Communications	4.8 Transportation	4.9 Critical Products
Natural Gas Failure	+	-	-	+	-	-	-	-	-
Sewer Failure	+	-	-	-	-	+	-	-	-
Steam Failure	+	-	-	-	-	-	-	-	-
Water Failure	+	-	-	-	+	-	-	-	-
Fuel Shortage	+	-	-	+	-	-	-	-	-
Supply Shortage	+	-	-	-	-	-	-	-	+
Internal Fire	+	-	-	-	-	-	-	-	-
Internal Flood	+	-	+	-	+	-	-	-	-
Gas/ Emissions Leak	+	-	-	+	-	-	-	-	-
Heliport Accident	+	-	+	-	-	-	+	-	-
Dam Inundation	+	+	+	+	+	+	+	+	+
Water Contamination	+	-	-	-	+	-	-	-	-
Bomb Threat	-	-	-	-	-	-	-	-	-
Civil Disturbance	+	-	+	-	-	-	-	+	-
Forensic Admission	-	-	-	-	-	-	-	-	-
HAZMAT Theft	-	-	-	-	-	-	-	-	-
Hostage Situation	-	-	-	-	-	-	-	-	-
Child Abduction	-	-	-	-	-	-	-	-	-
Labor Action	-	-	-	-	-	-	-	-	-
Suspicious Package/ Substance	-	-	-	-	-	-	-	-	-
Violent Patient	-	-	-	-	-	-	-	-	-

Threat/Hazard	4.1 General Dependencies	4.2 Information Technology (IT)	4.3 Electricity	4.4 Natural Gas	4.5 Water	4.6 Wastewater and Waste Disposal	4.7 Communications	4.8 Transportation	4.9 Critical Products
VIP Situation	-	-	-	-	-	-	-	-	-
Internal Biological exposure	-	-	-	-	-	-	-	-	-
Internal HAZMAT Exposure	-	-	-	-	-	-	-	-	-
Internal Radiological Exposure	-	-	-	-	-	-	-	-	-

Table 5. Threat/Hazard mapping for the Cybersecurity section of the RIST-V. Subsections are included (+) or not included (-) in the hazard-specific vulnerability score of each threat/hazard.

Threat/Hazard	5.1 Identify	5.2 Protect	5.3 Detect	5.4 Response	5.5 Recovery
Insider Threat	+	+	+	+	+
Terrorism	+	+	+	+	+
Active Shooter	-	-	-	-	-
Cyber	+	+	+	+	+
Violent Crime	-	-	-	-	-
Property Crime	-	-	-	-	-
Earthquake	-	-	-	-	-
Tsunami	-	-	-	-	-
Landslide	-	-	-	-	-
Subsidence	-	-	-	-	-
Volcano	-	-	-	-	-
Damaging Winds	-	-	-	-	-
Drought	-	-	-	-	-

Flash Flood	-	-	-	-	-
Floods	-	-	-	-	-
Hail	-	-	-	-	-
Ice Storm	-	-	-	-	-
Snow Fall/ Blizzard	-	-	-	-	-
Storm Surge	-	-	-	-	-
Tornado	-	-	-	-	-
Wildfire	-	-	-	-	-
Extreme Heat	-	-	-	-	-
Extreme Cold	-	-	-	-	-
Hurricane	-	-	-	-	-
Space Weather	-	-	-	-	-
Thunderstorm	-	-	-	-	-
Influenza	-	-	-	-	-
Aircraft Crash	-	-	-	-	-
Facility HAZMAT	-	-	-	-	-
Highway HAZMAT	-	-	-	-	-
Maritime HAZMAT	-	-	-	-	-
Railway HAZMAT	-	-	-	-	-
Pipeline HAZMAT	-	-	-	-	-
External Radiological	-	-	-	-	-
Communications Failure	-	-	-	-	-
Electrical Failure	-	-	-	-	-
Fire Alarm Failure	-	-	-	-	-
Generator Failure	-	-	-	-	-
HVAC Failure	-	-	-	-	-
Information Systems Failure	-	-	-	-	-
Medical Gas Failure	-	-	-	-	-
Medical Vacuum Failure	-	-	-	-	-

Natural Gas Failure	-	-	-	-	-
Sewer Failure	-	-	-	-	-
Steam Failure	-	-	-	-	-
Water Failure	-	-	-	-	-
Fuel Shortage	-	-	-	-	-
Supply Shortage	-	-	-	-	-
Internal Fire	-	-	-	-	-
Internal Flood	-	-	-	-	-
Gas/ Emissions Leak	-	-	-	-	-
Heliport Accident	-	-	-	-	-
Dam Inundation	-	-	-	-	-
Water Contamination	-	-	-	-	-
Bomb Threat	-	-	-	-	-
Civil Disturbance	-	-	-	-	-
Forensic Admission	-	-	-	-	-
HAZMAT Theft	-	-	-	-	-
Hostage Situation	-	-	-	-	-
Child Abduction	-	-	-	-	-
Labor Action	-	-	-	-	-
Suspicious Package/ Substance	-	-	-	-	-
Violent Patient	-	-	-	-	-
VIP Situation	-	-	-	-	-
Internal Biological exposure	-	-	-	-	-
Internal HAZMAT Exposure	-	-	-	-	-
Internal Radiological Exposure	-	-	-	-	-