Strategic National Risk Assessment 2015

Findings

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Homeland Security

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Introduction

Our Nation faces a wide range of risks, from terrorism and disease to natural hazards and a changing climate. Risk is the potential for an unwanted outcome resulting from an incident, event, or occurrence, as determined by its likelihood and the associated impacts.[1] The Strategic National Risk Assessment (SNRA) provides general context and key findings related to threats and hazards posing significant risks to the United States.[2] Managing these risks is a shared responsibility that depends on unity of effort among whole community[3] partners.

The SNRA supports a risk-based, all-hazards strategy for preparedness as directed by the Post-Katrina Emergency Management Reform Act of 2006 (PKEMRA) and the continued implementation of the National Preparedness System.[4] This Assessment also supports other risk assessment efforts conducted by whole community partners as appropriate, to include the Threat and Hazard Identification and Risk Assessment (THIRA) process.

The SNRA[5] benefits whole community partners by providing:

- A risk-based foundation for the Goal and the National Preparedness System;
- Support for capabilities-based planning, training, exercises, and evaluation across all mission areas of Prevention, Protection, Mitigation, Response, and Recovery;
- The ability for whole community partners to share common understanding and awareness of national threats and hazards and the resulting risks to support decision making and help ensure they are ready to act and can do so independently and collaboratively; and
- A set of findings and common descriptions of threats and hazards,[6] allowing partners in preparedness and resiliency to establish a shared understanding of risk across the homeland security enterprise and work more collaboratively.

[1] DHS Risk Lexicon, 2010 edition.

[2] The U.S. Department of Homeland Security (DHS) makes a helpful distinction between 'contingent' risks, those which have a definite beginning and end, and 'persistent' risks which are a part of the steady state national risk background. The scope of the 2015 SNRA approximately coincides with the space of homeland security contingent risks, with some exceptions, notably including climate change. The SNRA is a continuing stand-alone assessment conducted in support of the implementation of the National Preparedness System; in its role as a DHS assessment, it complements other DHS studies for the purpose of informing DHS strategic planning.

[3] For the purposes of this document, whole community partners include: individuals, communities, the private and nonprofit sectors, faith-based organizations, and all levels of government (local, regional/metropolitan, state, tribal, territorial, insular area, and Federal).

[4] The National Preparedness System outlines an organized process for everyone in the whole community to move forward with their preparedness activities and achieve the National Preparedness Goal.

[5] The SNRA refers to the complete documentation from 2011 and 2015, which includes: 2015 SNRA Findings (this document), the Draft 2015 SNRA Technical Appendix, the Draft SNRA 2011 Unclassified Documentation of Findings; the 2011 Unclassified SNRA (public version; December 2011); the Draft 2011 Classified SNRA Technical Report.

[6] The scope of the 2015 SNRA approximately coincides with the space of homeland security contingent risks, with some exceptions, notably including climate change.

The first iteration of the SNRA was accomplished in 2011 to inform the development of the National Preparedness Goal (the Goal)[7]. The 2015 update to the SNRA, similar to the 2011 iteration, provides a strategic view of risk to support the whole community's collective understanding of the range of threats, hazards, and related challenges facing the Nation.[8] However, the 2015 SNRA builds upon the first SNRA to provide greater visibility of long-term risk trends that affect national preparedness. The 2015 SNRA estimates national-level risks over the next three to five years and identifies evolving trends, drivers, and conditions, including climate change, that could impact national preparedness needs beyond the five-year period.

[7] The National Preparedness Goal (2011) is "a secure and resilient nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk."

[8] The scope of the 2015 SNRA approximately coincides with the space of homeland security contingent risks, with some exceptions, notably including climate change.

Overview

The SNRA is a process implemented by the Federal Government to identify the threats and hazards that pose the greatest risk to the Nation[9] and provide necessary context for those threats and hazards to support national preparedness planning. The SNRA informs and supports the National Preparedness Goal, the National Preparedness System, which is based on "*Identifying and Assessing Risk*"[10], the National Preparedness Report (NPR)[11], and other efforts throughout the whole community to enhance security and resiliency. Whole community partners use risk assessments to inform efforts to build and sustain capabilities, including planning, training, and exercises.

The 2015 SNRA process reviewed the national risk environment and included the following:

- A revisit and refresh of the 2011 SNRA analysis and findings;
- Expansion of the quantitative evidence base of the 2011 SNRA, which included additional threats and hazards;
- An examination of the potential impacts of climate change upon national preparedness;
- A review of evolving threats to the Nation; and
- Qualitative analysis of additional threats and hazards.

The SNRA findings include:

- Natural hazards, including hurricanes, earthquakes, tornadoes, droughts, wildfires, winter storms, and floods, present a significant and varied risk across the country.
- A virulent strain of pandemic influenza could kill hundreds of thousands of Americans, affect millions more, and result in economic loss. Additional human and animal infectious diseases, including those previously undiscovered, may present significant risks.
- Technological and accidental hazards, such as transportation system failures, dam failures, or chemical substance spills or releases, have the potential to cause extensive fatalities and have severe economic impacts, and the likelihood of occurrence may increase due to aging infrastructure.
- Damage to the electric grid from a space weather event or a deliberate attack could cause cascading impacts through other infrastructure systems, with the potential for loss of life and economic disruption.

[9] The scope of the 2015 SNRA approximately coincides with the space of homeland security contingent risks, with some exceptions, notably including climate change.

[10] Whole community partners currently identify and assess risk through the THIRA process at the jurisdictional level and the SNRA identifies and assess risk at the national-level. Jurisdictional partners include states, territories, tribal governments and urban areas. FEMA Regions also conduct the THIRA process on an annual basis.

[11] The intent of the NPR is to provide the Nation—not just the Federal Government—with practical insights on core capabilities that can inform decisions about program priorities, resource allocation, and community actions.

- Terrorist organizations or affiliates may seek to acquire, build, and use weapons of mass destruction. Conventional terrorist attacks, including those by "lone actors" employing physical threats such as explosives, and armed attacks, present a continued risk to the Nation.

The threat and hazard identification process of the SNRA highlighted a number of additional threats and hazards, including:

- Natural hazards including heat waves, plant disease, tsunamis, volcanic eruptions, antibiotic resistance and other emerging infectious diseases;
- Technological/accidental hazards including combustible/flammable cargo rail accidents, industrial accidents resulting in fires/explosions, migrant surges, catastrophic oil spills, and pipeline failures;
- Cross-cutting hazards such as electric grid failures from natural and accidental causes, and fires resulting in urban conflagration; and
- Cyber-attacks, which could have their own catastrophic impacts and could initiate other hazards, such as power grid failures, financial system failures, and data breaches that amplify the potential impact of cyber-attacks.

While the SNRA represents a significant step toward understanding the Nation's threats and hazards, it contains data limitations and assumptions that will require additional study, review, and revision.

Strategic National Risk Assessment Scope

The SNRA evaluated risks from known threats and hazards with the potential to significantly impact the Nation's security and resilience.[12] It assesses contingency events with defined beginning and endpoints, rather than persistent, steady-state risks.[13] SNRA participants—Federal agencies, Department of Homeland Security (DHS) components, and the Intelligence Community, among others—developed a list of national-level threats and hazards (Tables 1 and 2) for consideration in the SNRA. The events are grouped into three categories: (1) natural hazards; (2) technological/accidental hazards; and (3) adversarial, human-caused threats/hazards.

To accomplish the 2015 SNRA, participants reviewed the unclassified publicly disseminated 2011 SNRA findings and determined whether or not their departments and agencies possessed data that would change the findings from the 2011 SNRA, and/or identify new threats and hazards to those identified in 2011. In addition, the participants conducted research and analysis on available data sets,[14] to develop a baseline understanding of which national-level threats and hazards pose the greatest concern to the Nation. SNRA participants developed or updated risk summary sheets for quantitatively assessed risks (identified in Table 1); or conducted a concise qualitative literature review for those risks where data was not available to complete a quantitative assessment (identified in Table 2).

For the purposes of the quantitative assessment, SNRA participants identified thresholds of impact[15] necessary to create a national-level event.

- These thresholds were informed by subject matter expertise and available data.
- For some events, economic impacts were used as thresholds, while for others, fatalities or injuries/illnesses were deemed more appropriate as the threshold to determine a national-level event. In no case, however, were economic and casualty thresholds treated as equivalent to one another (i.e., dollar values were not assigned to fatalities).
- Event descriptions in Table 1 that do not explicitly identify a threshold signify that no minimum impact threshold was employed. This allows the assessment to include threats and hazards for which the psychological impact could cause it to become a national-level event, even though it may result in a low number of casualties or a small economic loss.[16]

[12] The scope of the 2015 SNRA approximately coincides with the space of homeland security contingent risks, with some exceptions, notably including climate change.

[13] DHS studies persistent risks and their entire risk space, which is reflected in the 2014 QHSR.

[14] Specific data sets and sources are cited in the SNRA supporting documentation.

[15] The 2011 SNRA referred to impacts as 'consequences.' This term is retained only where it is specific to a technical meaning differing from impacts, but otherwise 'impact' is the term used by the 2015 project. Impact categories are defined in the 2015 SNRA risk summary sheets and the 2011 SNRA Documentation of Findings. Thresholds identified are addressed in the 2011 SNRA Documentation of Findings and the 2015 SNRA Technical Appendix.

[16] An example would be a dirty bomb that resulted in low to no fatalities but resulting in nationwide psychological stress and/or shock.

The threats and hazards identified by SNRA participants are presented in Tables 1-3.

- Table 1 lists the threats and hazards that were analyzed within the quantitative and comparative framework established by the 2011 SNRA.
- Table 2 lists threats and hazards that were identified by SNRA participants as relevant to national preparedness, but which did not have sufficient likelihood or impact data for comparative analysis with the threats and hazards of Table 1. These hazards were studied qualitatively.
- Table 3 lists cross-cutting hazards, new to the SNRA in 2015, including failures of the electric grid and urban fires. These are cross-cutting hazards, as they are both stand-alone events in the SNRA, and are also identified as second-order effects of other threats and hazards in the SNRA. Since the SNRA methodology applied to the events of Table 1 requires threats and hazards to be mutually exclusive in scope (to avoid double counting of risk), these cross-cutting hazards also required separate treatment.

With the exception of climate change, only events with a distinct beginning and end, and those with an explicit nexus to homeland security missions, were included. This approach excluded:

- Political, economic, and societal trends that may contribute to a changing risk environment, but are not related to national preparedness (e.g., economic trends);[17] and
- Chronic societal concerns, such as illicit drugs, and those that are generally not related to national preparedness, such as cancer or car accidents.

Table 1: Threats and Hazards Quantitatively Assessed in the SNRA

Threat/Hazard Type	Threat/Hazard Description and Impact Threshold
Natural	
Animal Disease Outbreak[18]	An unintentional introduction of the foot-and-mouth disease (FMD) virus into the domestic livestock population in a U.S. state
Drought*	A drought occurs in the U.S. resulting in direct economic losses greater than $1 billion[19]

[17] The SNRA project reviewed and analyzed authoritative U.S. Government studies of trends of direct relevance to national preparedness.

[18] The above event description describes the actual scenario modeled in 2011 for the SNRA. It represents a specific scenario of a more general SNRA hazard event, defined as: "An unintentional introduction of an animal disease into the domestic livestock or poultry population occurs in the U.S. resulting in direct economic losses greater than $100 million." FMD was selected as a representative proxy for all animal disease threats to the U.S. expansion of the underlying data set to include additional animal diseases is a priority for the next iteration of the SNRA.

[19] Thresholds in the SNRA were designed by participants to capture exceptional events which rise above the national risk baseline: thresholds in Table 1 generally represent the best possible compromise between this intention and the constraints of data availability. Uniformity in thresholds across similar events was attempted where possible, but was not always possible. For example, many of the natural disaster hazards share a threshold of $100 million, while drought, winter storms, and space weather have a $1 billion threshold. For drought and winter storms, a higher threshold was required to capture only those exceptional drought and storm events that rise above the normal national risk baseline: multiple instances of droughts and winter storms causing direct economic damages in the

Threat/Hazard Type	Threat/Hazard Description and Impact Threshold
Earthquake	An earthquake occurs within the U.S. resulting in direct economic losses greater than $100 million
Flood	A flood occurs within the U.S. resulting in direct economic losses greater than $100 million
Human Pandemic Outbreak***	A severe outbreak of pandemic influenza with a 25 percent gross clinical attack rate spreads across the U.S. populace
Hurricane	A tropical storm or hurricane impacts the U.S. resulting in direct economic losses of greater than $100 million
Space Weather***	The sun emits bursts of electromagnetic radiation and energetic particles causing utility outages and damage to infrastructure in the U.S., resulting in direct economic losses greater than $1 billion
Tornado**	A single tornado or a tornado outbreak occurs in the U.S. resulting in direct economic losses greater than $100 million
Wildfire	A wildfire occurs within the U.S. resulting in direct economic losses greater than $100 million
Winter Storm*	A winter storm event occurs within the U.S. resulting in direct economic losses of $1 billion or greater
Technological / Accidental	
Biological Food Contamination	Accidental conditions where introduction of a biological agent (e.g., *Salmonella*, *E. coli*, botulinum toxin) into the food supply results in 100 hospitalizations or greater and a multistate response
Chemical Substance Spill or Release	Accidental conditions where a release of a large volume of a chemical acutely toxic to human beings (a toxic inhalation hazard, or TIH) from a chemical plant, storage facility, or transportation mode results in either one or more off-site fatalities, or one or more fatalities (either on- or off-site) with off-site evacuations or sheltering-in-place
Dam Failure	Accidental conditions where dam failure and inundation in the U.S. result in one fatality or greater
Radiological Substance Release	Accidental conditions where reactor core damage in the U.S. causes release of radiation
Transportation System Failure*	Accidental conditions where a bridge failure occurs within the U.S., resulting in one fatality or greater[20]

hundreds of millions occur every year in the Nation. Space weather events are also constant occurrences: a higher threshold was required to capture events surpassing the "100-year storm," which the electric power industry has suggested would cause direct economic loss in the billions of dollars, at minimum.

[20] The scope of the Transportation System Failure hazard is determined by the data that was actually used as the basis for the quantitative estimates of likelihood and impacts. The unclassified data available for the 2015 SNRA consisted of bridge failure data.

Threat/Hazard Type	Threat/Hazard Description and Impact Threshold
Human Caused / Adversarial	
Aircraft as a Weapon***	A hostile non-state actor(s) crashes a commercial or general aviation aircraft into a physical target within the U.S. causing at least one fatality or injury other than or in addition to the attacker(s), in an act characterized by the U.S. Government as terrorist in nature
Armed Assault***	A hostile non-state actor(s) uses assault tactics to conduct strikes on vulnerable target(s) within the U.S. resulting in at least one fatality or injury other than or in addition to the attacker(s), in an act characterized by the U.S. Government as terrorist in nature
Biological Terrorism Attack (non-food)	A hostile non-state actor(s) acquires, weaponizes, and releases a biological agent against an outdoor, indoor, or water target, directed at a concentration of people within the U.S.
Chemical/Biological Food Contamination Terrorism Attack	A hostile non-state actor(s) acquires, weaponizes, and disperses a biological or chemical agent into food supplies within the U.S. supply chain
Chemical Terrorism Attack (non-food)	A hostile non-state actor(s) acquires, weaponizes, and releases a chemical agent against an outdoor, indoor, or water target, directed at a concentration of people using an aerosol, ingestion, or dermal route of exposure
Explosives Terrorism Attack***	An act of terrorism using one or more explosive or incendiary devices against people or property within the U.S.
Nuclear Terrorism Attack	A hostile non-state actor(s) acquires an improvised nuclear weapon through manufacture from fissile material, purchase, or theft, and detonates it within a major U.S. population center
Physical Attack on the Power Grid*	A hostile non-state actor(s) causes physical damage to an aspect of the power grid resulting in a loss of power in one or more metropolitan areas for three or more hours
Radiological Terrorism Attack	A hostile non-state actor(s) acquires radiological materials and disperses them through explosive or other means (e.g., a radiological dispersal device or RDD) or creates a radiation exposure device (RED)
* ** ***	New in SNRA 2015 New in SNRA 2015: Added 2012 Revised in SNRA 2015

Table 2: Threats and Hazards Qualitatively Identified in the SNRA

Threat/Hazard Type	Threat/Hazard Description
Natural	
Antibiotic Resistance*	Antibiotic-resistant pathogens, or “superbugs,” have acquired mutations resulting in the reduction or elimination of the effectiveness of antibiotics
Emerging Infectious Diseases Other than Influenza*	Newly recognized diseases or known “re-emerging” or “resurgent” diseases that may have been previously controlled but are now reappearing with increasing occurrence, or threaten to increase over previously endemic levels or new populations or geographic areas—this also includes pathogens that have developed new attributes such as increased resistance or virulence

Threat/Hazard Type	Threat/Hazard Description
Heat Wave*	A period of elevated temperature with an identifiable beginning and end occurs in the U.S. resulting in fatalities
Plant Disease*	A major outbreak of a plant pathogen or pest occurs in the U.S. resulting in significant direct economic losses
Tsunami[21]	A tsunami with a wave of approximately 50 feet impacts the Pacific Coast of the U.S.
Volcanic Eruption[22]	A volcano in the Pacific Northwest erupts impacting the surrounding areas with lava flows and ash and areas east with smoke and ash
Technological / Accidental	
Combustible/ Flammable Cargo Accident (Rail)*	Accidental conditions where a fire or an explosion of combustible or flammable substances transported by rail occurs within the U.S., resulting in fatalities
Industrial Accident (Fire/Explosion)*	A technological accident of an industrial nature, involving an industrial site or production facility (e.g., factories) that results in a fire or explosion
Migrant Surge/Mass Migration*[23]	A concentrated flow or surge of migrants into the U.S. across maritime or land borders occurs
Oil Spill*	An oil spill of national significance requiring contingency/surge operations to mitigate
Pipeline Failure*	Accidental conditions where a failure or an explosion of hazardous substances transported by pipeline occurs within the U.S. resulting in fatalities
Human Caused / Adversarial	
Cyber-Attack	A cyber attack resulting in substantial harm to persons or critical infrastructure, significant data breaches, or the erosion of U.S. national security.
* ** ***	New in SNRA 2015 New in SNRA 2015: Added 2012 Revised in SNRA 2015

[21] The above event description describes the actual scenario modeled in 2011 for the SNRA project. It represents a specific scenario of a more general SNRA hazard event, defined as: "A tsunami impacts the U.S. resulting in direct economic losses greater than $100 million." As the extent to which the SNRA-modeled scenario represents the total risk to the Nation of tsunamis could not be determined by the 2011 or 2015 SNRA participants, it was qualitatively analyzed and not compared with other threat or hazard events within the SNRA methodological framework.

[22] The above event description describes the actual scenario modeled in 2011 for the SNRA project. It represents a specific scenario of a more general SNRA hazard event, defined as: "A volcanic eruption occurs in the U.S. resulting in direct economic losses greater than $100 million." As the extent to which the SNRA-modeled scenario represents the total risk to the Nation of volcanic eruptions could not be determined by the 2011 or 2015 SNRA participants, it was qualitatively analyzed and not compared with other threat or hazard events within the SNRA methodological framework.

[23] Migrant Surge/Mass Migration falls within the class of human-caused unintentional events, which the 2015 SNRA labels Technological/Accidental for consistency with the 2011 SNRA.

Table 3: Cross-Cutting Threats and Hazards Identified for Study in the SNRA

Threat/Hazard Type	Threat/Hazard Description
Electric Grid Failure (Natural/Accidental) (Cross-Cutting)*	Electrical grid failure and loss of power meeting the grid disturbance reporting thresholds of the U.S. Department of Energy, of natural or accidental (non-adversarial) cause
Urban Fire/ Conflagration*	Accidental or other incident triggered conditions where normal firefighting capabilities are significantly degraded, and an urban area becomes engulfed in a conflagration
* ** ***	New in SNRA 2015 New in SNRA 2015: Added 2012 Revised in SNRA 2015

The Current National Risk Environment

Analytic Approach

The quantitative analysis of the SNRA drew data and information from a variety of sources, including existing U.S. Government models and assessments, historical records, structured analysis, and judgments of experts from different disciplines. The information was used to assess the risk of identified incidents as a function of frequency[24] and impacts. More specifically, asking:

- With what frequency is it estimated that an event will occur?
- What are the impacts of the event(s) if it does occur?

Frequency was estimated as the potential number of occurrences or attacks, per year, which met or exceeded the established threshold[25] for the event. For the majority of events (including threats with unclassified analyses in the 2015 SNRA), frequency estimates were based on statistical analysis of historic data, or directly from historical data where extensive records were available.[26] Chemical, Biological, Radiological, and Nuclear (CBRN) adversarial/human-caused frequencies were estimated primarily using elicitation from subject matter experts.[27]

The SNRA examined the impacts associated with six categories of harm: loss of life, injuries and illnesses, direct economic costs, social displacement, psychological distress, and environmental impact. This multifaceted view of potential impacts draws attention to the broad and often interdependent effects of incidents that require whole community preparation and cooperation across the homeland security enterprise. For instance, fostering resilient communities relates to both mitigating human and economic impacts and addressing the psychological and social distress caused by the incident. Similarly, other types of resilience involve withstanding environmental and infrastructure degradations to ensure continued delivery of essential services.

The SNRA relied on the best available quantitative estimates of frequency and impact from existing U.S. Government assessments, peer-reviewed literature, and expert judgment. Where sufficient quantitative information was not available, events were assessed qualitatively. The estimates of the frequency and impacts for each of the events considered were compared where appropriate. No effort was made to create a single "risk judgment" for any event type, because it was deemed infeasible to aggregate all impact types into a single metric. Instead, the assessment treated impact categories separately (e.g., economic impacts are reported separately from fatality impacts). This allowed stakeholders to apply their own expert judgments to the findings and decide how those findings should inform core capabilities in the Goal.

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[24] Frequency was used in the SNRA to capture likelihood because some events have the potential to occur more than once a year.

[25] When interpreting the frequency results, it is important to consider that the frequency data in the SNRA is directly related to the threshold included in each national-level event definition. For example, the results for floods indicate that floods causing greater than $100 million in direct economic losses are estimated to occur with a frequency between once every two years and ten times per year, with a best estimate of four times per year.

[26] SNRA analysts examined the data sets for a particular event and identified how many incidents within the scope of the event occurred at or above the established threshold per year.

[27] Expert elicitations for adversarial/human caused frequencies were accomplished for the classified SNRA.

All sources and estimates were documented to promote credibility, defensibility, and transparency within the assessment. Uncertainty in frequency and impacts was explicitly included in the analysis by representing low and high bounds in addition to best estimates. Examples of sources of uncertainty include incomplete knowledge of adversary capabilities and intent, variability in possible event severity and location, and lack of historical precedence.

The assessment was performed at a strategic national-level and provides the ability to draw rough comparisons and identify broad differences in risk across the quantitatively assessed events—within an order of magnitude. Given the uncertainty inherent in assessing risks at a national-level and the lack of information about some of the events included—many of which are likely to occur very infrequently—the assessment was designed to avoid false precision. Instead, the assessment identifies only those differences in risk that are still significant despite the associated uncertainties.

The analysis of available information—even if that analysis is imprecise and contains a wide degree of uncertainty—supports better decision making, as long as key limitations and assumptions are noted. Participants designed the SNRA to capture the best information available regarding homeland security risks to inform the Goal and supporting preparedness efforts. There are two additional considerations for preparedness partners:

- This is a *strategic* national risk assessment. The SNRA addresses national risk based on total impacts to the Nation, not limited by geographic boundaries. As such, it does not present a full view of the risk facing communities. To complement preparedness planning, it is also necessary to consider local, regional/metropolitan, state, tribal, territorial, and insular area variations in risk.
- Given the emphasis in PPD-8 on contingency events with defined beginning and endpoints (e.g., hurricanes, terrorist attacks), the current SNRA does not explicitly assess persistent, steady-state risks like border violations, illegal immigration,[28] drug trafficking, and intellectual property violations, which are important challenges for DHS and the homeland security enterprise.

Findings

The results of the 2015 SNRA include a comparison of risks for potential incidents of the threats and hazards listed in Table 1, in terms of the likelihood (calculated as a frequency, i.e., number of events per year) and impacts of threats and hazards, and an analysis of the uncertainty associated with those incidents. The 2011 assessment found that a wide range of threats and hazards pose a significant risk to the Nation, affirming the need for an all-threats/hazards, capability-based approach to preparedness planning. The 2015 review of the publicly disseminated 2011 SNRA findings validated the diverse picture of national risks and affirmed the doctrine established by the 2011 Goal. The SNRA findings include:

- Natural hazards, including hurricanes, earthquakes, tornadoes, droughts, wildfires, winter storms, and floods, present a significant and varied risk across the country.

[28] Migrant surges across land or sea borders are included in the 2015 SNRA (Table 2).

- A virulent strain of pandemic influenza could kill hundreds of thousands of Americans, affect millions more, and result in economic loss. Additional human and animal infectious diseases, including those previously undiscovered, may present significant risks.
- Technological and accidental hazards, such as transportation system failures, dam failures, or chemical substance spills or releases, have the potential to cause extensive fatalities and have severe economic impacts, and the likelihood of occurrence may increase due to aging infrastructure.
- Damage to the electric grid from a space weather event or a deliberate attack could cause cascading impacts through other infrastructure systems, with the potential for loss of life and economic disruption.
- Terrorist organizations or affiliates may seek to acquire, build, and use weapons of mass destruction. Conventional terrorist attacks, including those by "lone actors" employing physical threats such as explosives, and armed attacks, present a continued risk to the Nation.

These findings supported the development and the refinement of the core capabilities in the 2015 revision of the Goal. In addition to the above findings articulated in the Goal, the 2015 SNRA re-affirmed that:

- Many events have the potential to occur more than once every 10 years, meaning that the Nation's preparedness will likely be tested in this decade;
- Although historic events provide a useful perspective on homeland security risks, the changing nature of society and the risk landscape means that the Nation must also be prepared for new hazards and threats or for events that result in greater impacts than have occurred in the past;
- Within an all-hazards preparedness context, particular events that present risk to the Nation—such as nuclear attacks or chemical releases—require additional specialized response activities; and
- Some events, such as explosives attacks or earthquakes, generally cause more localized impacts, while other events, such as human pandemics, may cause impacts that are dispersed throughout the Nation, thus creating different types of impacts for preparedness planners to consider.

SNRA participants identified a number of additional threats and hazards (Table 2), including:

- Natural hazards including heat waves, plant disease, tsunamis, volcanic eruptions, antibiotic resistance and other emerging infectious diseases;
- Technological/accidental hazards including combustible/flammable cargo rail accidents, industrial accidents resulting in fires/explosions, migrant surges, catastrophic oil spills, and pipeline failures; and
- Cyber-attacks, which could have their own catastrophic impacts and could initiate other hazards, such as power grid failures, financial system failures, and data breaches that amplify the potential impact of cyber-attacks.

These threats and hazards were analyzed qualitatively and without comparison with other events. The SNRA process also included examination of cross-cutting hazards such as failures of the electric grid and urban fires as both stand-alone events and as second-order effects of other threats and hazards.[29] These could not be analyzed in a quantitative comparative fashion because of their cross-cutting impacts across multiple threats and hazards.

Additional natural, technological/accidental, or human-caused hazards can also pose a risk to jurisdictions across the country and should be considered, as appropriate, in preparedness planning. Non-influenza diseases with pandemic potential and other animal diseases should also be considered. In addition, assessment participants identified a number of events for possible inclusion in future iterations of the SNRA, including utility interruptions more generally than electric power (gas, telecommunications and water); electro-magnetic pulse (EMP) attacks; explosives and other conventional attacks caused by non-terrorist actors, and threats of explosive attacks; and terrorist attacks using drones.

[29] Examination of cross-cutting hazards is valid so long as this overlap is clearly understood and communicated, and so long as double counting by aggregating hazards overlapping in scope is avoided.

Drivers and Evolving Threats

The 2015 SNRA included research on evolving threats, building off of previous Federal Emergency Management Agency (FEMA) strategic foresight research and additional U.S. Government reviews of evolving threats relevant to national preparedness. Certain threats and hazards frequently appeared in documents across governmental, intergovernmental, non-profit, and academic sources as potentially growing issues of concern for the U.S. as a whole and the world in the near-term and long-term. Of these, the SNRA analysis identified the following trends as having the strongest evidence for impacting national preparedness in the future.

Demographic Shifts in the U.S. and Potential Future Challenges

Over the next four decades, the U.S. population may undergo significant demographic changes that will have ramifications for the country economically, politically, and socially. Internal migratory shifts will shape the country demographically and could have wide ranging ramifications, as more Americans are living in metropolitan and coastal regions.[30] Changes to the climate and sea level rise could make homes and businesses congregated along coastal areas more prone to flooding. In addition, more concentrated populations could make evacuations more difficult, strain access to medical resources, and increase stress on aging critical infrastructure.[31]

Food and Water Insecurity

Climate change, global population growth, and economic development have the potential to create water and food insecurity in the coming decades. Food and water insecurity have the possibility of affecting the U.S. domestically and its relationships with numerous countries. Over the course of the next 10 years, many countries important to U.S. national security will experience water problems causing instability in those regions of the world. [32] As demand for these critical resources grow, global supplies may be insufficient to meet the demand.

Homegrown Violent Extremists

The terrorist threat to the Nation remains significant and continues to evolve. Individuals (lone offenders) and small groups acting on their own initiative are a tenacious threat and difficult to counter.[33] In recent years, the adept use of media by new groups has created unprecedented opportunities for their organizations to reach potential recruits and influence people.[34] Social media and the Internet have the potential to play a critical role in the immediate future in

[30] Federal Emergency Management Agency, *Strategic Foresight Initiative*, January 2012, p. 8.
[31] Federal Emergency Management Agency, "U.S. Demographic Shifts: Long-term Trends and Drivers and Their Implications for Emergency Management, *Strategic Foresight Initiative White Papers*, May 2011, p. 5, http://www.fema.gov/media-library/assets/documents/103600.
[32] National Intelligence Council, *Global Water Security*, February 2, 2012, p. iii.
[33] Department of Homeland Security, *2014 Quadrennial Homeland Security Review*, p. 18.
[34] Nicholas J. Rasmussen, Current Terrorist Threat to the United States, Testimony before the Senate Select Committee on Intelligence, February 12, 2015.

radicalizing and mobilizing homegrown extremists towards violence.[35] Homegrown violent extremists are a persistent threat to the country.[36]

[35] Ibid.

[36] Jerome P. Bjelopera, American Jihadist Terrorism: Combating a Complex Threat, Congressional Research Service, January 23, 2013; James R. Clapper, Worldwide Threat Assessment of the U.S. Intelligence Community, Testimony before the Senate Armed Services Committee, February 11, 2014; Department of Homeland Security, 2014 Quadrennial Homeland Security Review, p. 19; William L. Painter, Issues in Homeland Security Policy for the 113th Congress, Congressional Research Service, September 23, 2013; Federal Emergency Management Agency, Strategic Foresight Initiative, January 2012, p. 9; Government Accountability Office, Strategic Plan 2014–2019, p. 100; Nicholas J. Rasmussen, Current Terrorist Threat to the United States, Testimony before the Senate Select Committee on Intelligence, February 12, 2015.

Climate Change and National Preparedness

Scientific evidence indicates the climate is changing and significant economic, social, and environmental impacts are expected as a result. Climate change is an increasingly significant factor in assessing and managing risks and vulnerabilities to extreme events. Over the past 50 years, much of the U.S. experienced increases in prolonged periods of excessively high temperatures, heavy precipitation, and, in some regions, severe floods and droughts.[37] The best available scientific data indicates these trends will continue and will likely have further cascading effects on human health, infrastructure, and the economy.[38]

Primary Impacts

The impacts of climate change will vary across the Nation, but the following are examples of critical anticipated shifts in the frequency, intensity, and/or geographic range of natural hazards:

- Increasing heavy precipitation events will contribute to flash floods and urban floods.[39]
- Average global sea level has risen by approximately eight inches since reliable record keeping began in 1880 and is projected to rise another one to four feet by 2100.[40]
- Western forests in the U.S. will be more frequently affected by large and intense fires.[41]
- The frequency and intensity of heat waves will continue to increase.[42]
- Higher temperatures cause faster evaporation rates, which may lead to drought conditions even when there is no decrease in precipitation.[43]
- Over the last three to five decades, the heaviest rainfall events have become heavier and more frequent,[44] and these are projected to continue in most of the U.S.;[45] and
- Although many contributing factors make hurricanes difficult to predict, most models project an overall increase in the frequency of the strongest (Category 4 and 5) hurricanes by the end of the century.[46]

Due to the complexity of climatological forecasting and the myriad anticipated impacts, some uncertainty remains about the magnitude and types of future changes to natural hazards. It is clear, however, that increasing frequency, intensity, and impacts of hazards due to climate

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[37] NCA3 Highlights," *Climate Change Impacts in the United States: The Third National Climate Assessment: Highlights"* http://nca2014.globalchange.gov/Highlights, Pg. 24
[38] NCA3 Highlights, Pgs. 12–14
[39] U.S. Third National Climate Assessment (NCA3), "*Climate Change Impacts in the United States The Third National Climate Assessment*," U.S. Global Change Research Program, May 2014 http://nca2014.globalchange.gov/report, Pg. 75
[40] NCA3, Pg. 66
[41] NCA3, Pg. 192
[42] NCA3, Pg. 64
[43] NCA3 Highlights, Pg. 24
[44] NCA3 Highlights, Pg. 25
[45] NCA3, Pg. 37
[46] NCA3, Pg. 41

change may render historical risk profiles outdated, and, therefore, they may no longer be an adequate measure for identifying and addressing future risks.

Secondary Impacts

As climate change alters the natural hazard risk environment, secondary risk and vulnerability effects are likely. The social and health-related impacts of climate change will likely be more concentrated in communities already facing economic or health-related challenges.[47] Agricultural pressures associated with climate change may lead to rising food prices,[48] which in turn can contribute to food insecurity. More frequent heat waves, worsening air quality, and more favorable growing conditions for common allergens may increase chronic heat-, respiratory-, and allergy-related conditions.[49]

Future climate extremes may strain the reliability of critical infrastructure and availability of key resources, forcing the whole community to reconsider current and future resource needs. Degraded natural barriers such as salt marshes, reefs, mangrove forests, and barrier islands have a reduced capacity to buffer coastal infrastructure from extreme events like floods and storms. Even outside of coastal areas, climate change is expected to have a profound impact on the Nation's infrastructure, including a reduction in the reliability and capacity of transportation infrastructure and systems,[50] which are critical to lifesaving response efforts and disaster recovery.

The economic ramifications of climate change can affect resources and response capabilities at all levels of government. There has been a sizeable upward trend in the number of storm events causing large financial and other losses in the U.S.,[51] though this trend can be attributed to increases in property values at risk in addition to increases in storm activity. In addition to a rising economic toll of disaster response, the underlying drivers of local economies could be significantly altered as climate zones suitable for agricultural production and climate-driven tourism shift.[52] Such economic impacts have the potential to ripple across the Nation. For example, ports are deeply interconnected with inland areas through the goods imported and exported each year.[53] Their exposure to sea level rise is not just a concern for coastal communities, but has far-reaching implications for the Nation's economy as a whole.

Net Impacts

Climate change is expected to act as a hazard multiplier for many current threats and hazards, and in some cases will introduce new hazards to communities. The effects of climate change may cascade into a number of areas that are not directly weather related, affecting population shifts, public health, resources, and local economies. In other words, although a changing climate is not a threat or hazard unto itself, its impacts should be considered throughout risk analyses and

[47] NCA3 Pgs. 228–229
[48] NCA3, Pg. 228
[49] NCA3, Pg. 222
[50] NCA3 Highlights, Pg. 40
[51] NCA3, Pg. 65
[52] NCA3. Pgs. 334–339
[53] NCA3, Pg. 590

future decision making processes in all five mission areas—Prevention, Protection, Mitigation, Response, and Recovery.

Threats and Hazards of Greatest Concern by Whole Community Partners

The SNRA also supports the integration of other risk assessment efforts, including the THIRA processes occurring at multiple jurisdictional levels.[54] THIRAs from 2012 through 2014 were reviewed to identify the threats and hazards of greatest concern to urban areas, states, territories, and tribes across the Nation. The 2014 THIRA analysis highlighted five threats and hazards frequently selected by a wide range of urban areas, states, tribal nations, and territories: Flood, Utility Interruption, Hazmat Release—Chemical, Cyber Attack, and Explosive Devices (see Figure 1). Flood, the most frequently identified hazard, was included by 64 percent of all contributing jurisdictions as a hazard of greatest concern.

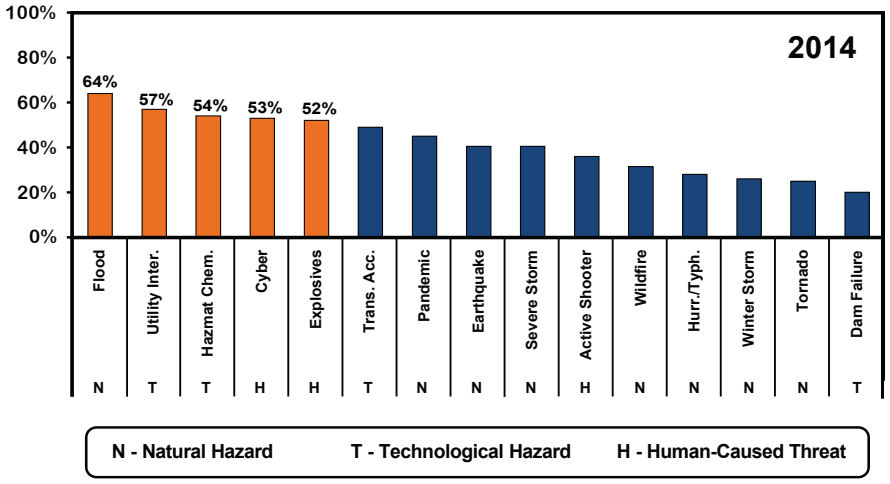

Figure 1: Most Frequently Identified Threats and Hazards in 2014 Jurisdictional THIRAs[55]

Year-over-year analysis indicates that the top five threats and hazards of greatest concern across jurisdictions remained largely consistent from 2012 through 2014, though in a slightly different order each year. In addition to the top five, other frequently identified threats and hazards throughout the three THIRA iterations include transportation accidents, human pandemic, and earthquakes. This reinforces that jurisdictions' perception of risk has not changed much since 2012. The 2015 SNRA participants reviewed this data to identify potential national-level risks not previously identified in the 2011 SNRA.

Figure 2 depicts the top 25 threats and hazards identified by all reporting jurisdictions across all groups (i.e., natural, technological, and human-caused) by year for 2012 and 2013.

[54] The THIRA process is completed by urban areas, states, tribal nations, territories, and the FEMA Regions.

[55] While these findings do show trends across several different perspectives, they are not intended to create a ranking of threats and hazards. Likewise, they are not intended to be representative of all possible threats and hazards within the jurisdictions, as many jurisdictions utilize varying approaches to selecting threats and hazards for inclusion in their THIRAs.

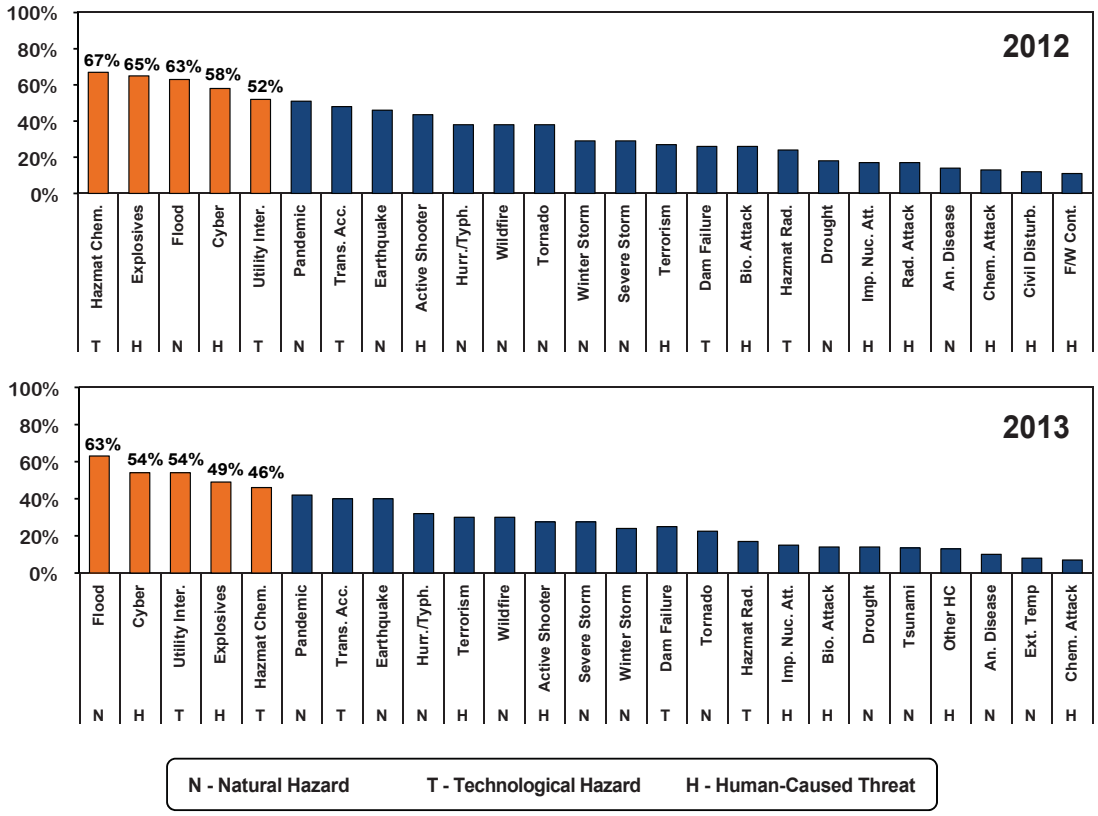

Figure 2: Top 25 Most Frequently Identified Threats and Hazards of Concern by Jurisdictions in 2012 and 2013[56]

[56] While these findings do show trends across several different perspectives, they are not intended to create a ranking of threats and hazards. Likewise, they are not intended to be representative of all possible threats and hazards within the jurisdictions, as many jurisdictions utilize varying approaches to selecting threats and hazards for inclusion in their THIRAs.

Final Notes

The SNRA process provides a broad analysis of the risks from the varied threats and hazards faced by the Nation. This assessment finds that a wide range of threats and hazards pose a significant threat to the Nation, affirming the need for an all-threats/hazards, capability-based approach to preparedness. The SNRA is designed to inform prioritization and tradeoff decisions by enabling the analysis of which capabilities are likely to have an impact at reducing identified high-risk events. Using the SNRA, the whole community can better understand which scenarios are more likely to impact them, what the consequences would be, and what risks merit special attention.

The SNRA process will continue to be implemented in support of the National Preparedness Goal, the National Preparedness System, and the all-hazards, capability-based planning approach to national risk management. Although the development and update of the SNRA are important steps, further analysis through the implementation of regional- and community-level risk assessments will help communities better understand their risks and form a foundation for their own security and resilience. The Nation's preparedness is dependent on whole community partners understanding the risks they face across all levels of government. In conjunction with local, regional/metropolitan state, tribal, territorial, insular area, and Federal partners, the SNRA process will be further implemented and refined in order to serve as a unifying national risk profile helping to facilitate preparedness efforts across the Nation.