

ATTACHMENT F TO THE SOUTH CAROLINA EMERGENCY OPERATIONS PLAN
VULNERABILITIES AND HAZARDS

A. Vulnerability Analysis (Demographics)

1. As of July 2017, the U.S. Census Bureau estimates South Carolina's population to be 5,024,369. This represents an increase of 10.9% from 2008.
2. Data estimates completed in December 2014 and maintained by the SC Department of Parks, Recreation and Tourism (SCPRT) show that over 29 million tourists visit the State annually.
3. The following statistics from the U.S. Census Bureau illustrate the high level of vulnerability of the State's population to potential hazards:
 - An estimated 30% of the State's total population resides in the 8 coastal counties
 - 16.7% of the State's estimated over 2.3 million housing units are mobile homes as opposed to the national average of 6.5%
 - 16.6% of the State's total population is 65 or older as opposed to the national average of 14.1%
 - 18.1% of the State's population lives below the poverty level as opposed to the national average of 15.4%
 - An estimated 6.9% of SC households do not have access to a vehicle
 - Thousands of persons have special medical or dietary needs which require special assistance or special sheltering
4. The proximity of the large percentage of the State's residential population to the coastline combined with a huge tourist population creates the potential for a catastrophic loss of life and property due to an array of hazards.

B. Hazard Analysis

1. South Carolina is threatened by natural and technological hazards. The South Carolina Emergency Management Division (SCEMD) researched and reviewed the risks of many hazards against the potential impact upon the State, Counties, tribal and supporting critical infrastructure.
2. Given the ever-growing population and infrastructure expansion, the risk assessment and planning process for South Carolina is a continuous program
3. The Hazard Analysis research and review included but was not limited to: geological, meteorological, health, human-caused (accidental and intentional), and energy failures.

4. The State conducted planning based on a hazard's relative frequency, potential severity, and historic information available.
5. The Analysis identified hazards as posing a threat both immediate (e.g. - hazardous chemical spill, hurricane, tornado, etc.) and long-term (e.g. - drought, chemical release, radiological release, etc.). These hazards have the potential to disrupt day-to-day activities, cause extensive property damage, and create mass casualties.
6. Historically, the greatest risk is from natural hazards (fires, tornadoes, floods, hurricanes, and earthquakes). However the continuing expansion of chemical usage and hazardous material transportation, to include transport of spent radiological fuel and low-level radiological waste, raises the technological hazards risk in South Carolina.
7. See the State of South Carolina Hazard Assessment which is part of The South Carolina Hazard Mitigation Plan for a detailed hazard analysis by county.
8. Table 1 (Hazard Rating Summary) in the basic plan provides a relative ranking of the hazards found in South Carolina based on probability of occurrence and potential level of consequence.

C. Significant Natural and Man-made Hazards to South Carolina

1. Hurricanes and Tropical Storms

- a. The State may be directly and indirectly affected by hurricanes and tropical storms.
- b. In the coastal counties, the greatest threat to life and property associated with a hurricane and tropical storm is storm surge. Storm surge is the abnormal rise in seawater level during a storm, measured as the height of the water above the normal predicted astronomical tide.
- c. Other effects include high winds, tornadoes, and inland flooding associated with heavy rainfall that accompanies these storms.
- d. The State has six (6) Counties with coastlines bordering the Atlantic Ocean with over 200 miles of general coastline. The SC Coastal Counties are:
 - Horry
 - Georgetown
 - Charleston

- Colleton
 - Beaufort
 - Jasper
- e. Two inland counties Dorchester and Berkeley are also threatened due to potential up-river surge along the Ashley and Cooper Rivers.
- f. Densely populated coastal areas, especially during peak tourist seasons, coupled with the generally low coastal elevations, significantly increase the State's vulnerability.
- g. See Appendix 1 (South Carolina Hurricane Plan) for more detailed information.
2. Earthquakes
- a. The 2001 Comprehensive Seismic Risk and Vulnerability Study for the State of South Carolina confirmed that the State is extremely vulnerable to earthquake activity.
- b. South Carolina experiences multiple earthquakes annually. These are typically low-level events with magnitudes less than 4.0. According to the USGS, over 200 of these low-level events occurred in South Carolina from 1974-2015.
- c. Approximately 70% of these occur a region referred to as the Middleton Place-Summerville Seismic Zone (MPSSZ).
- d. See Appendix 3 (South Carolina Earthquake Plan) for more detailed information.
3. Droughts
- a. According to the U.S. Drought Monitor, South Carolina experiences drought on an annual basis (D0- Abnormally Dry to D4- Exceptional Drought).
- b. The length and severity of drought in South Carolina has varied greatly over the last 25 years.
- c. See Appendix 10 (South Carolina Drought Response Plan) for more detailed information.

4. Extreme Heat

- a. Periods of high heat coupled with high humidity occur frequently in South Carolina during the months of June through September. The intensity of the effects varies based on the physical location in the State.
- b. Many of the State's populations are particularly vulnerable to extreme temperatures to include the aged, poor and homeless.

5. Fires

a. Structural Fires

- (1) The threats of structural fire events facing the State's approximately 490 fire departments create the potential for potentially catastrophic consequences and numerous fire related injuries, deaths, and widespread damage and loss.
- (2) While structure fires are occurring at lower rates across all areas of the State, both urban and rural structure fire severity is increasing each year.

b. Wildfires

- (1) Wildfires can infringe on developed and/or urban areas, and contribute to the structural fire problem. As the population grows and residential developments continue to expand into forested areas, wildland urban interface issues increase and more wildfires threaten homes.
- (2) People cause 96% of all SC wildfires, with the leading cause being careless outdoor burning. The second leading cause of wildfire is woods arson.
- (3) While wildfires occur throughout the year, the height of South Carolina's wildfire season usually occurs from late winter through spring.

6. Flooding

a. There are five distinctive types of flooding in South Carolina

(1) Coastal Flooding

- (a) Coastal flooding occurs when water is pushed inland as a result of storm surge and wind-driven

waves produced by hurricanes, tropical storms, nor'easters, and other coastal storms.

- (b) Coastal flooding during the highest of high tides. These tides occur during a spring tide when the moon is closest to the earth known as a perigee or King Tides. They are independent of floods caused from ocean storm surges or floods caused by rainfall. These tides can make flooding from storms and rain more severe. King Tides are predicted and expected over the course of the year.

(2) Dam/Levee Failure

- (a) South Carolina has approximately 3,000 State and Federally regulated dams and thousands of smaller, unregulated dams throughout the State.
- (b) Each dam or levee in the State has the potential to fail and release its impounded water, flooding the land downstream. The threat from dam failure increases from aging dams, and when additional dams are built for retention basins and amenity ponds in new developments. Many dams exist on smaller streams that are not mapped as floodplains or subject to floodplain regulation, leaving downstream residents unaware of potential risks.
- (c) See Appendix 4 (South Carolina Dam Failure Emergency Response Plan) for more detailed information.

(3) Local Drainage Problems

Local drainage problems can occur anywhere in the State where the ground is flat, where the drainage pattern has been disrupted, or where channels or culverts have not been maintained.

(4) Flash Flooding

- (a) Flash flooding occurs when short, heavy rainfall, accumulates in areas faster than the ground is able to absorb it.
- (b) Flash flooding can be exacerbated in many urban areas by inadequate drainage systems and urban growth that does not account for surface runoff.

(5) Riverine Flooding

- (a) Riverine Flooding occurs when an increase in water volume within a river channel causes an overflow onto the surrounding floodplain.
- (b) The State's low-lying topography, combined with its humid subtropical climate, makes it highly vulnerable to inland or riverine flooding.

7. Coastal Hazards

a. Coastal Erosion

- (1) Erosion is a process that breaks down and wears away land due to physical and chemical processes of water, wind, and general meteorological conditions. An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, climate or rainfall, and topography. The two major erosion mechanisms are wind and water. Wind that blows across sparsely vegetated or disturbed lands can cause erosion by picking up soil, carrying it through the air, and displacing it in another place. Water erosion occurs over land, and in streams and channels. Major storms can cause coastal erosion from the combination of high winds and heavy surf and storm surge. DHEC-OCRM revises long-term beach erosion rates, as well as the state's beachfront baseline and 40 year set back line every eight to ten years. This process was recently completed (early 2010), and the updated rates and beachfront jurisdictional line maps can be found at: http://www.scdhec.gov/environment/ocrm/permit_beachfront.htm. Based on this analysis of shoreline changes since the mid-1800s, and other independent researchers, South Carolina's beaches appear to be experiencing net erosion in general, but beach nourishment has been keeping pace with this underlying trend in most cases. Long-term shoreline change rates varies from marginally accretion along some standard beaches, to highly erosional (as much as 20 feet per year) in some highly dynamic inlet areas. Beginning with Hurricane Irene in 2011, Folly Beach in Charleston County has experienced above average erosion rates and is

considered one of the most vulnerable beaches in South Carolina.

b. Sea Level Rise

- (1) Coastal areas are sensitive to a variety of hazards, including storms, erosion, and gradual sea level rise (SLR) 90. It is difficult to predict the amount of sea level rise along the coast of South Carolina, but there are numerous factors related to this hazard, including land subsidence, groundwater depletion, wave action, hurricanes, and natural climate variation.
- (2) The EPA suggests that sea level rise may increase the impact of coastal storms. Modeling sea level rise is based on historical evidence. The Intergovernmental Panel on Climate Change (IPCC) released a climate change and sea level rise report in 2007. For coastal regions in the United States, it is estimated that we will see at least 0.6m of sea level rise, and more likely up to 2.0m rise.

8. Severe Thunderstorms, Hail and Lightning

- a. South Carolina is one of the more vulnerable states in the U.S. to thunderstorm events. A majority of the State experiences approximately 60 days per year with a thunderstorm event, while the most northern part of the State experiences approximately 50 days per year with a thunderstorm event.
- b. According to NOAA's Storm Events Database, for the 10-year period of 2007-2016, South Carolina experienced 5,904 reported Thunderstorm Wind events resulting in 4 deaths and 57 injuries, 142 Lightning events which resulted in 6 deaths and 51 injuries, and 2,598 Hail events which resulted in 31 injuries.

9. Severe Winter Weather

- a. Snow and ice storms, and associated cold temperatures, periodically threaten the State.
- b. Winter storms can damage property, create safety risks, destroy crops and valuable timber, damage infrastructure components such as power lines, and have enormous economic impacts.
- c. South Carolina can anticipate at least one significant winter storm per year.

- d. The greatest statewide 24-hour snowfall total was 24 inches which occurred in the Town of Rimini in February 1973.
- e. According to NOAA's Storm Events Database, for the 10-year period of 2007-2016, 138 Heavy Snow events, 70 Ice Storm events, 197 Winter Storm events which resulted in 2 deaths, and 197 Winter Weather events.

10. Tornadoes

- a. According to NOAA's Storm Events Database, for the 10-year period of 2007-2016, South Carolina experienced 175 Tornado events affecting 43 of SC's counties which resulted in 4 deaths and 83 injuries.
- b. The South Carolina State Climate Office Monthly Tornadoes (1950-2016) database shows that SC experiences the most tornadoes in March through July.
- c. Between 1950 and 2016, South Carolina experienced 402 (E) F0 tornadoes, 380 (E) F1 tornadoes, 132 (E) F2, 28 (E) F3, and 10 (E) F4 tornadoes. There are no (E) F5 tornadoes on record in SC.
- d. In 2004, South Carolina experienced 86 tornadoes, and a record of 44 tornadoes in a single day on September 7th, 2004 as Tropical Storm Frances passed near the State.
- e. The highest tornado death toll in South Carolina's history occurred on April 30, 1924 when two tornadoes struck the State. The paths of both were unusually long; each over 100 miles long. One tornado remained on the ground from Anderson County to York County. The second tornado (The "Horrell Hill Tornado"), was the more destructive of the two; its path was 135 miles from Aiken County to Florence County. Together, the two tornados killed 77 persons, injured 778, and destroyed 465 homes and many other buildings resulting in millions of dollars of damage.

11. Tsunami

- a. Tsunamis are ocean waves produced by earthquakes or underwater landslides and may occur at any time, day, or night.
- b. A tsunami is actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour in the open ocean.
- c. See Appendix 11 (South Carolina Tsunami Response Plan) for more detailed information.

12. Sink Holes, Land Slides and Mass Wasting

a. Sink Holes

- (1) Sinkholes form on karst terrain, which is a region of bedrock that can be dissolved by water. Water that is slightly acidic dissolves bedrock to form channels in the rock called conduits. When rain moves through the soil, it erodes and dissolves the karst bedrock. This action creates cracks that are part of the conduit system and moves soil particles through it. When soil is carried off, the soil surface above the conduit may form a small depression that acts as a funnel to gather more water, and repeats the soil movement cycle in the crevices and conduits
- (2) While sinkholes can occur suddenly and expectantly, there are signs that can signal a potential development. Additionally, sinkhole formation may be aggravated by development and urbanization from increased water usage, altered drainage pathways and land surfaces.

b. Land Slides and Mass Wasting

- (1) According to United States Geological Survey Landslide Hazards Program, landslides are geologic hazards that occur in all states, and cause \$1-2 billion dollars in damage, and over 25 average annual fatalities. Mass wasting is the downward movement of rock material. Landslides are a type of mass wasting, which refers to the sudden collapse of a slope, or also known as a slope failure. Other types of mass wasting include mudflow, earthflow, creep, rock fall, slump, and these are characterized by their speed of downward movement and the amount of moisture.
- (2) Upstate South Carolina most closely fits the typical landslide topography as outlined by the U.S. Geological Survey (USGS), with steep slopes on Table Rock, Caesars Head and Glassy Mountain as areas having rock slides. In the Piedmont, minor landslides are more prevalent due to slope failure of saprolite and soil, leading to gully formation. These are primarily triggered by rain events and erosion. In the state's Coastal Plain, riverbanks are susceptible to slope failure on a larger scale, causing erosion. While South Carolina is susceptible to landslides, no major events have occurred in the past.

13. Infectious Disease Outbreak or Other Public Health Emergency
 - a. Infectious disease outbreaks or other public health emergencies may occur in South Carolina with little or no notice.
 - b. Infectious disease can present special requirements for disease surveillance, rapid delivery of vaccines, antibiotics, or antiviral drugs, allocation of limited medical resources and expansion of health care services to meet a surge in demand for care.
 - c. See Appendix 5 (South Carolina Mass Casualty Plan) for more detailed information.
14. Active Shooter/Hostile Action
 - a. An active shooter is an individual(s) actively engaged in killing or attempting to continuously harm people. In most cases, active shooters use firearms, and there is generally no pattern or method to the selection of victims. Most active shooter/hostile action situations are over within 10 to 15 minutes.
 - b. See Appendix 13 (South Carolina Active Shooter/Hostile Action Consequence Management Plan) for more detailed information.
15. Civil Disturbance
 - a. Civil disturbances may occur at any time in South Carolina. However, civil disorder is often preceded by periods of increased tension caused by questionable social and/or political events such as controversial jury trials or law enforcement actions.
 - b. See Appendix 7 (South Carolina Civil Disturbance Plan) for more detailed information.
16. Hazardous Materials Spill or Release
 - a. The State's industrial capacity and the network of interstate highways and railways result in vulnerabilities to hazardous material releases from both stationary sites and transportation sources.
 - b. 3,648 facilities reported chemical inventories as required by federal EPCRA (Emergency Planning Community Right-to-Know Act) regulations. Of those 1,436 reported storing extremely hazardous substances exceeding the Threshold Planning Quantity as classified by Section 302/304 of the Federal Superfund Amendments and Reauthorization Act (SARA, Title III). Approximately 2,868 of these facilities also reported various

chemical inventories of more than 10,000 pounds as classified by Section 311/312 of the SARA, Title III.

- (1) These facilities are located throughout the State in both rural and densely populated areas and do not include retail gas stations, warehouses, most power sub-stations, or telephone relay battery storage sites.
 - (2) Data indicates the majority of these facilities are clustered along Interstate 85. While the greatest number of facilities are concentrated along that route, numerous other toxic release inventory facilities, are located throughout the State adjacent to large population centers.
 - (3) Many facilities located in coastal Counties could be impacted by hurricane force winds and rains.
- c. An accident/incident along the extensive network of interstate highways and railways that supply industries with chemical and petroleum products could result in a moderate to large accidental release of hazardous materials from a transportation source.

17. Radiological Release

a. Nuclear Facilities

- (1) There are four commercial nuclear power plants, one Department of Defense facility, and one Federal Department of Energy facility within the State of South Carolina, as well as at least one industrial facility that maintains a significant amount of radiological material on-site as a part of its process. In addition, there are three nuclear power plants located in two neighboring States from which a radiological release could affect South Carolina and its citizens.
- (2) Forty-one of South Carolina's 46 counties fall within the 10 or 50-mile Emergency Planning Zones of at least one nuclear power plant.
- (3) See Appendix 2 (South Carolina Operational Radiological Emergency Response Plan) for more detailed information.

b. Transportation of Nuclear Materials

- (1) The South Carolina Department of Health and Environmental Control (SCDHEC) maintains situational

awareness of the transport of radiological waste and materials into and through the State of South Carolina.

- (2) SCDHEC maintains the processes and procedures to address potential releases of radiological materials/waste during transportation.

18. Terrorism

- a. While there have not been any successful acts of terrorism committed in South Carolina, the many critical and high-profile facilities, high concentrations of population and other potentially attractive venues for terrorist activity make the State inherently vulnerable to a variety of terrorist methods.
- b. See Appendix 8 (South Carolina Terrorism Incident Plan) for more detailed information.

19. Cyber Attack

- a. DHS has identified cyber related threats as one of the primary threats to 14 of the 16 sectors of U.S. CI/KR.
- b. Based on current reporting, various nation-state adversaries and non-state actors have demonstrated the intent and capability to gain unauthorized access, exploit and/or attack both public and private sector computer networks. First-order dependencies and interdependencies between CI/KR sectors create vulnerabilities that can cause cascading negative effects to the physical environment and the citizens of South Carolina.
- c. Reliable and secure communications systems will be required to enable a coordinated multi-agency response in the event current communication systems are inoperable. Coordination and communication with CI/KR private sector owner/operators will be critical to an effective response and recovery effort.
- d. Significant cyber incidents initiate cascading effects that could affect each phase of emergency management including preparedness, response, recovery and mitigation.
- e. Interconnected computer networks regulate the flow of electrical power, natural gas, fuel, water, solid waste, financial services, medical care, public safety, telecommunications and transportation systems. The consequences of a Significant Cyber Incident could cause significant disruption of CI/KR operations and economic losses for South Carolina.

- f. Any Cyber Incident impacting private or public networks within South Carolina will be considered a criminal act. Criminal acts and resulting criminal investigative actions, to include the investigation, attribution, and apprehension of suspected threat actors, fall under the purview of the SLED.

D. Repatriation

1. In addition to natural and man-made hazards, over one million U.S. citizens and their dependents live, visit and travel in foreign countries. An emergency may occur at any time requiring these citizens and their dependents to immediately evacuate to the United States.
2. The US Department of State (DOS) is responsible for emergency repatriation operations and has designated Charleston, South Carolina as one of several Points of Entry (POE) on the east coast.
3. The US Department of Health and Human Services (HHS) is the lead Federal agency with responsibility for planning, coordinating and execution of the repatriation sites.
4. See Appendix 12 (South Carolina Repatriation Plan) for more detailed information.

E. Long-Term Power Outage

1. A long-term power outage (LTPO) affecting South Carolina poses a significant threat to the social, health, safety, and economic well-being of the citizens and visitors within South Carolina. Due to the nature of some of the threats (Black-Sky Hazards) that could cause a LTPO within South Carolina, an LTPO could occur with little to no warning and will involve multiple governmental jurisdictions and geographic areas.
2. The effects on the electric grid could require the need for the utilities to conduct black-start operations to re-energize the grid and restore electricity to the population of South Carolina.
3. Black-start restoration efforts have to be conducted in a certain manner that is based on the design and physics of the affected electric grid. The geography of the affected systems requiring support may or may not align with efforts to support life-sustaining and life-saving operations to the affected population.
4. Response to a LTPO will require a coordinated consequence management effort from all levels of government, volunteer organizations, and private sector partners. No single private sector entity or local, tribal, state, or federal government agency possesses the authority or expertise to act unilaterally. Response to a long-term power outage will involve two major

concurrent operational efforts; the restoration of power and lifesaving and life-sustaining efforts. Restoration of electric power will remain within the purview of the utility companies.

5. If a need for state engagement to support energy restoration efforts arises, the South Carolina Office of Regulatory Staff, as the lead of ESF-12 (Energy) as well as the lead state agency for the energy sector within South Carolina, coordinates those efforts from ESF-12 in the SEOC. However, the utility companies will maintain operational control over restoration efforts.

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