EARTHQUAKE OPERATIONS PLAN

2024 (Pre-Helene)

I. INTRODUCTION

A. PURPOSE

This appendix outlines the coordinating actions taken by the State Emergency Response Team (SERT) following an earthquake that impacts North Carolina.

B. SCOPE

This appendix includes the anticipated actions of the federal, state and local agencies, as well as private sector organizations.

II. SITUATION AND ASSUMPTIONS

A. SITUATION

Earthquakes primarily occur along fault lines (fractures in the rocks of the Earth's crust) but they can occur anywhere. Pressures under the crust can build over time and without advanced warning, these faults slip and cause an earthquake. The center of the earthquake, or epicenter, can occur at various depths and cause different magnitudes of shaking depending on rock and soil types. While the original earthquake is typically the strongest, significant aftershocks may occur for days and weeks afterwards and are capable of causing additional damage.

Scientists use various scales to determine the strength of an earthquake. The Magnitude Scale is an attempt to measure how much energy is released by an earthquake. Typically, earthquakes less than a 2.5 Magnitude are not felt, but are recorded on seismometers. Earthquakes with around a 3.0 Magnitude are felt by many people (shallow earthquakes with a magnitude less than 3.0 can be felt). Local damages usually begin near a Magnitude of 4.5. Earthquakes with a Magnitude of 6.0 are typically destructive with a major earthquake considered anything above a 7.0 Magnitude. Another scale that is used to measure earthquake intensity is the Modified Mercalli Intensity Scale. This scale describes how earthquakes "feel" and how much destruction the earthquake causes. Many factors determine the intensity of an earthquake at the surface of the earth, such as the depth where the earthquake originates and what kinds of rock and soil are at the surface. The Modified Mercalli Intensity Scale has ten levels designated by Roman numerals described in the table below.

Modified Mercalli Intensity Scale:

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes and windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

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North Carolina can experience earthquakes centered within the state, but also from earthquakes centered outside of the state in five seismic zones: Eastern Tennessee, Charleston South Carolina, Giles County Virginia, Central Virginia, and New Madrid. While earthquakes can be felt across all of North Carolina, the greatest threat is in western NC and along the North Carolina/South Carolina state line in southeastern NC.

While earthquakes do occur in North Carolina, large and damaging earthquakes are not common. The state has experienced 23 damaging earthquakes from 1735-2023. The greatest damage occurred during the 1861 Wilkesboro, 1886 Charleston South Carolina, 1916 Asheville, 1926 Mitchell County, and 2020 Sparta earthquakes. The most recent damaging earthquake in North Carolina occurred on August 9, 2020 in the town of Sparta, located in Alleghany County. The 5.1 Magnitude earthquake had a Modified Mercalli Intensity Scale of VI-VII (Strong to Very Strong Shaking with Light to Moderate Damage) and resulted in over 550 reports of damage to houses and commercial buildings across Alleghany County.

Although building codes are not as strict as areas prone to major earthquakes, newer buildings and bridges are designed to withstand some amount of shaking. Older buildings, typically built from brick or stone, are most at risk for damage or failure during an earthquake.

Earthquakes are also capable of causing land/rockslides in areas of steeply sloped terrain. This is especially a problem in the Mountains, where these land/rockslides may block major transportation routes.

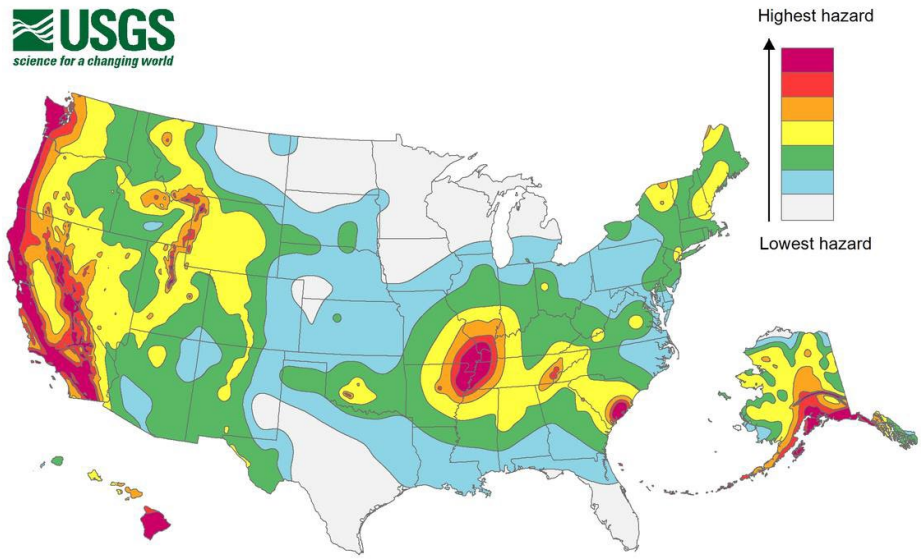

Figure 2: Earthquake hazard map showing peak ground accelerations having a 2 percent probability of being exceeded in 50 years, for a firm rock site. The map is based on the most recent USGS models for the conterminous U.S. (2018), Hawaii (1998), and Alaska (2007). The models are based on seismicity and fault-slip rates and take into account the frequency of earthquakes of various magnitudes. Locally, the hazard may be greater than shown, because site geology may amplify ground motions. (US Geological Survey)

B. ASSUMPTIONS

1. Earthquakes may strike without warning and can occur at any time.

2. Significant damage to infrastructure, including buildings such as hospitals, roads, bridges, gas lines, etc. can be expected. This may limit available resources and mobility in the affected area.

3. Aftershocks are expected. These aftershocks may be powerful enough to cause additional damage to already weakened structures.

4. Ground-based communications systems will be disrupted. Alternative means of communication will be needed, such as satellite phones and ham radios.

5. Disruptions to utilities will occur due to damage to power lines or by damage to a power plant facility itself.

6. After a significant earthquake, there is an immediate need to conduct safety inspections of buildings as residents need to be kept from using unsafe buildings. Qualified inspectors will evaluate buildings using Applied Technology

Council's Procedures for Post-earthquake Safety Evaluation of Buildings procedure (ATC-20 Building Safety Evaluation Forms and Placards). Green-tagged buildings are inspected as safe, yellow-tagged buildings have restricted use, and red-tagged buildings are unsafe.

III. ORGANIZATION AND ASSIGNMENT OF RESPONSIBILITIES

A. LEAD STATE AGENCY

1. NC DEPARTMENT OF PUBLIC SAFETY (NCDPS)

NORTH CAROLINA EMERGENCY MANAGEMENT (NCEM)

a. Support local government efforts through resource and technical assistance during emergencies and coordinate state and federal response and recovery activities.

b. Lead the state's actions in the earthquake response and serve as state liaison in discussions with federal agencies concerning the response actions to be taken.

c. Provide aerial imagery (video, photos, and photogrammetry) via unmanned aerial vehicles (UAVs).

d. Coordinate and deploy regional search and rescue teams as required to support local government operations.

B. LEAD TECHNICAL AGENCY

1. NC DEPARTMENT OF ENVIRONMENTAL QUALITY (NCDEQ)

DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES

NC GEOLOGICAL SURVEY

a. Provide a qualified geologist to serve as Earthquake Technical Advisor to the SERT Leader.

b. Collaborate with the U.S. Geological Survey (USGS) to run the Hazards US Multi-Hazard (HAZUS-MH) software as required to estimate earthquake damage based on the magnitude and location of the earthquake.

DIVISION OF AIR QUALITY (DAQ)
DIVISION OF WATER RESOURCES (DWR)

a. Assume the lead role in coordinating the emergency response to air and water quality problems resulting from an earthquake.

DIVISION OF ENVIRONMENTAL EDUCATION AND PUBLIC AFFAIRS

a. Assist local governments in evaluation ramifications from chemical spills or releases that adversely affect the environment.

C. SUPPORTING STATE AGENCIES

1. NC DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES (NCDA&CS)

NORTH CAROLINA FOREST SERVICE (NCFS)

a. Transport emergency food supplies through food distribution and state farms operations from NCDA&CS owned warehouses or other sources to distribution and/or mass feeding locations in disaster areas.

b. Respond to requests for other available transportation assets in support of emergency/disaster resource requirements. To include use of hauling units, pick-up trucks, and helicopters. Needs will be prioritized as missions are received and by risk to life, property, and resources.

c. Provide equipment and personnel for road clearing of debris or earth. This is from road shoulder to road shoulder only. Does not include rights of way.

2. NC DEPARTMENT OF HEALTH AND HUMAN SERVICES (NCDHHS)

DIVISION OF PUBLIC HEALTH (DPH)

a. Coordinate public health nurses to support local and state shelter requirements; provide consolation and maintain communication with deployed public health nurses.

b. Monitor health of shelter populations for potential infectious disease outbreaks and provide mitigation recommendations where appropriate.

c. Monitor well water for organic and inorganic contaminants at the NC State Laboratory of Public Health (NCSPLH) due to damage such as dam failure resulting from an earthquake.

DIVISION OF HEALTH SERVICE REGULATION (DHSR)

OFFICE OF EMERGENCY MEDICAL SERVICES (OEMS)

a. Assist in the development of local capabilities for the on-site coordination of all emergency medical services needed for triage, treatment, transportation, tracking, and evacuation of the affected population with medical needs.

b. Establish and maintain the cooperation of the various state medical and related professional organizations in coordinating the shifting of Emergency Medical Services resources from unaffected areas to areas of need.

DIVISION OF HEALTH SERVICE REGULATION (DHSR)

RADIATION PROTECTION SECTION

a. In the event of an earthquake affecting one of the three Nuclear Power Plants in NC (Harris, McGuire, or Brunswick) or Catawba in SC, each plant's emergency operations plan will be put into effect in conjunction with the NC EOP and Earthquake Operations Plan.

b. Dispatch to incident site if radiological release occurs.

c. Establish and supervise a system for radiological monitoring as needed.

3. OFFICE OF STATE FIRE MARSHAL (OSFM)

a. Coordinate firefighting assets to support local response efforts.

b. Coordinate restoration of firefighting services and protection post storm.

c. Coordinate personnel to support additional building inspection resources to augment local capabilities for damage assessments.

4. NC DEPARTMENT OF TRANSPORTATION (NCDOT)

DIVISION OF HIGHWAYS (DOH)

a. Erect and maintain such signs, lights, barricades or other traffic control devices as deemed appropriate to maintain or control traffic along the affected routes or detour routes.

b. Provide SERT partners lists of contractors/suppliers to assist in the cleanup efforts of sites outside the state maintained right of way.

c. Develop and administer contracts for the removal of debris from private roads. Such contracts will be pre-approved by NCEM prior to advertisement and award.

d. Provide structural engineering expertise to support municipal DOT in evaluation of bridges and roads systems.

5. NC DEPARTMENT OF PUBLIC SAFETY (NCDPS)

NORTH CAROLINA NATIONAL GUARD (NCNG)

a. Provide trained military police for traffic control.

b. Provide shelter support as needed.

c. Provide military forces to assist local law enforcement in the emergency area for security, control of entrance to and exit from disaster area, and protection of people and crowd control.

d. Provide NCNG mission capable packages.

STATE HIGHWAY PATROL (SHP)

a. Coordinate traffic control measures and isolation of the impacted area as needed.

b. Provide communications support.

c. Provide air support for reconnaissance of damage to transportation road systems.

6. UTILITY PROVIDERS

a. Provide decision makers with up-to-date power outage information and expected restoration times.

b. Provide support as needed to other utilities if able.

c. Restore electrical power to residences and business.

d. Repair and restore any downed power lines and/or transformers.

D. SUPPORTING FEDERAL AGENCIES

1. UNITED STATES GEOLOGICAL SURVEY (USGS)

a. Provide verification that an earthquake has occurred by providing an interface to view recent earthquakes in the US.

b. Distribute maps outlining the spatial extent and intensity of shaking.

IV. CONCEPT OF OPERATIONS

A. GENERAL

There are several tools which can help determine the location of the epicenter of the earthquake, as well as the distribution of the intensity of the shaking. The United States Geological Survey (USGS) website contains real time plots depicting all recent earthquakes in the US. Soon after the earthquake occurs, the USGS's "Did You Feel it" page will contain plots showing the spatial distribution of shaking, reported by website users. This plot will assist in determining which areas were most affected and where any State resources and personnel will need to be deployed.

B. RESPONSE ACTIONS

The State EOC will determines priorities for immediate assistance using damage reports from the counties and Civil Air Patrol Aerial Reconnaissance Teams (ART) information. Many concrete and masonry structures may be damaged by the earthquake and could present a danger to officials and civilians. Shelter needs will be assessed and coordinated based on the number of displaced citizens.

Building and infrastructure inspections will be scheduled and completed. Agencies and first responders involved in the recovery must remain aware of the potential for aftershocks as they are capable of causing additional damage. Initial recovery efforts will include, but are not limited to:

- Inspecting buildings and infrastructure for structural integrity;
- Clearing roadways of debris in the disaster area;
- Identifying potential consequences as a result of the earthquake;
- Controlling access to maintain order and protect civilians; and
- Begin the process of opening shelters and directing resources to assist those displaced by the earthquake.

Once weather conditions allow, the ARTs will begin an aerial reconnaissance of the disaster area. The Hazard Mitigation Section will also coordinate with FEMA, National Geodetic Survey and NCDOT for pre- and post-storm aerial (manned and unmanned) imagery data collection.

V. REFERENCES

A. Chapter 166A of the North Carolina General Statutes, North Carolina Emergency Management Act, as amended.

B. North Carolina Disaster Recovery Framework

C. NCEM Human Services Mass Feeding Plan

D. NCEM Human Services Shelter Guide