

COMMONWEALTH OF VIRGINIA

Emergency Operations Plan



HAZARD-SPECIFIC ANNEX #7 EARTHQUAKE RESPONSE

VIRGINIA DEPARTMENT
OF
EMERGENCY MANAGEMENT

2012 November

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RECORD OF CHANGES

Change #	Date	Description of Change	Page #	Initials

Lead Agency

- Virginia Department of Emergency Management (VDEM)
- Virginia Department of Mines, Minerals, and Energy (DMME)

Support Agencies and Organizations

- State Corporation Commission (SCC)
- Department of Environmental Quality (DEQ)
- Virginia Tech Seismological Observatory

Purpose

The Commonwealth of Virginia Earthquake Response Annex is a hazard-specific component of the Commonwealth of Virginia Emergency Operations Plan (COVEOP). It has been developed to provide a sound basis for earthquake preparedness and to establish the organizational framework and operational concepts and procedures designed to minimize the loss of life and property and to expedite the restoration of essential services following an earthquake.

Scope & Applicability

An earthquake is a phenomenon that results from the sudden release of stored energy in the earth's crust. At the earth's surface, seismic waves generated by an earthquake can cause significant shaking and displacement of the ground, which may lead to loss of life and destruction of property. Most earthquakes occur naturally, but some result from human activities such as mining, blasting, deep-injection of water or wastewater, and reservoir and building construction. In its most generic sense, the word earthquake is used to describe any seismic event, whether a natural phenomenon or an event caused by humans, that generates seismic waves.

Earthquakes in the eastern U.S. are low probability, high-consequence events. Although earthquakes may occur only once during a generation, they can have devastating impacts. Death, injuries, and extensive property damage are possible. Some secondary hazards caused by earthquakes may include fire, hazardous material release, landslides, flash flooding, avalanches, tsunamis, and dam failures. A moderate earthquake can cause serious damage to non-reinforced buildings, building contents, and non-structural systems, and can cause

disruption to transportation routes, communication systems, and power, water, and fuel lines. Damaging earthquakes although infrequent, can occur in areas of lower seismic activity. In these regions buildings are seldom designed to deal with an earthquake threat; therefore, they are extremely vulnerable.

In spite of extensive research and sophisticated equipment, it is impossible to predict an earthquake, although experts can estimate the likelihood of an earthquake occurring in a particular region.

Virginia is located near the center of the North American plate and experiences a much lower rate of seismicity than the western portion of the U.S. Earthquakes in Virginia usually occur on faults at depths of 3 to 15 miles. There are two known areas of seismic activity in Virginia. The Central Virginia seismic zone extends across much of the central Piedmont and includes the City of Richmond. The Giles County seismic zone is an extension of the Eastern Tennessee seismic zone and includes several counties in Southwestern Virginia.

The largest recent earthquake in Virginia occurred on August 23rd, 2011, in Louisa County, 38 miles NW of Richmond. The magnitude 5.8 event caused minor to severe damage to surrounding structures and was felt as far away as eastern Canada.

While it is important to identify historical earthquake occurrences within the Commonwealth, it is also important to acknowledge that impacts can be felt within the Commonwealth from outside sources. Effects from an intraplate earthquake in another state could be felt in Virginia. A loss of utilities, for example, could occur should generation

facilities in neighboring states become damaged due to an earthquake.

Planning Assumptions

- Citizens of the Commonwealth are not accustomed to the affects of an earthquake and may not initially grasp the magnitude of the situation or know how to properly respond.
- Aftershocks will normally occur following an earthquake and can cause additional alarm and damage. Aftershocks can sometimes occur for many months after the initial earthquake.
- A detailed and credible common operating picture may not be achievable for 24 to 48 hours, or longer, after the earthquake – response operations may have to begin without a complete or detailed situation and critical needs assessment.
- The earthquake and/or aftershocks may trigger secondary disasters such as fires or dam/levee breaches that can cause significant damage and potentially compromise the safety of response and recovery personnel or degrade response efforts.
- Normal means of communication, transportation, and infrastructure capability (utilities such as electricity generation and distribution), may be severely disrupted in areas within and beyond the immediate affected area(s) of an earthquake.
- The possibility of widespread interruptions of water distribution system and sanitation infrastructure, such as potable water and sewage pumping stations, treatment facilities, and private wells/septic systems will create the potential for serious public health problems.
- Citizens may require evacuation, sheltering, mass care, and medical assistance.
- State and Federal assistance may be required to carry out response and short term recovery efforts to save lives, reduce human suffering and reduce damage to property.
- An earthquake may be large enough to cause significant damage to buildings and structures and generate a large amount of debris. This debris may block roadways and limit movement for evacuees and response personnel and vehicles.
- Local medical facilities may be damaged. Remaining hospital capacity may be inadequate to treat casualties and other medical emergencies, requiring some severely injured patients to be relocated to facilities outside of the affected area.
- Commonwealth agencies responsible for state emergency response may experience facility or other asset damage, requiring them to activate their Continuity Plan. Should this occur, response and recovery operations may be delayed.
- Building/structural damage resulting from an earthquake will require safety inspections prior to the buildings/structures being re-occupied. A large earthquake resulting in significant damage to buildings and structures may overwhelm local and state resources.
- Fatalities resulting from an earthquake will vary based on when the earthquake strikes.

Policies

- All agencies assigned responsibilities within this annex will develop and maintain the necessary plans, standard operating procedures, mutual aid

agreements, and model contracts to successfully accomplish their tasks.

Organizational Structure

The Virginia Emergency Response Team (VERT) will coordinate the state's response to the effects of an earthquake.

Local government has the primary responsibility for the response to an earthquake or the resulting damage within their jurisdiction.

If it is immediately apparent that the earthquake has caused major damage and has exceeded State and local capabilities for response, the State may request federal assistance. The President may declare a major disaster and the Federal government will activate the National Response Framework (NRF), including the Catastrophic Incident Annex. Under the NRF, FEMA will begin coordinating the mobilization of Federal resources necessary to support State and local response activities within the affected areas. In accordance with the Stafford Act, the Federal government may provide direct Federal assistance at the request of the State, including resources necessary to save lives and protect public health and property.

Concept of Operations

When an earthquake occurs, local authorities within affected areas will use available resources to protect life and property and reduce, to the extent possible, the suffering and hardships on individuals. If local resources prove to be inadequate or are exhausted, assistance shall be requested from other jurisdictions through mutual aid procedures.

When requirements exceed the capability of local government, requests for State assistance shall be forwarded to the VERT in accordance with standard protocols.

The immediate response to a major earthquake will focus on saving lives, providing resources to sustain life, and incident response stabilization.

1. Initial Response/Situational Awareness

Given that an earthquake is a no-notice event, it is critical to obtain situational awareness of the event so that the appropriate resources can be deployed into the affected areas.

While the ability to perform reconnaissance and to gather, verify, consolidate, and distribute confirmed situation information is vital to the response, it is equally important that initial response strategies are developed with an accurate picture of the potential scope of the disaster. It is anticipated that resource requests will be relayed to mutual aid partners without delay. When local resources are exceeded, the State will assess and deploy available resources to localities until state capabilities are exceeded. At that time resource requests will be forwarded to mutual aid partners (surrounding states). Should these sources be unable to provide a resource, the state will forward resource requests to Federal response partners.

Identifying the potential scope of damage following a major earthquake is critical to mounting an effective response; however, this effort may be initially hampered by limited communications capabilities, transportation infrastructure damage, information overload, limited staff, and fragmented or conflicting damage reports.

Immediately following the earthquake, it may be possible to establish an initial assessment of the impact using available analytical tools. This assessment can be used to direct initial response activities toward those areas that are most likely to be seriously affected, given the location and magnitude of the earthquake and shaking potential.

Key information required for analysis includes:

- Location of the epicenter
- Magnitude and intensity of the earthquake
- Location and orientation of the source fault (if known)
- Site conditions that may result in greater than expected damage (steep or unstable

slopes, saturated soil, areas underlain by fill material, large bridges and dams, etc.)

2. Emergency Response

Emergency response actions are those taken immediately after an earthquake to save lives, alleviate suffering, and prevent further damage. The emergency response phase of a major earthquake can last from days to weeks, during which emergency services may be overwhelmed by demand. *See also Attachment 1.*

One of the most difficult aspects of emergency response after an earthquake will be identifying the specific nature and locations of damage caused by the earthquake and prioritizing available resources to respond to them.

Fire Suppression and Hazardous Materials Containment

Fire suppression and hazardous materials containment will be conducted in accordance with ESF #4 and #10, respectively.

Search and Rescue

Search and rescue operations will be conducted in accordance with ESF #9.

Debris Clearance

Debris removal will be managed in accordance with ESF #3.

Emergency Public Information

Providing the public with information regarding the ongoing emergency situation and protective action guidance is key to protecting life and property. This information may include warnings and advice on the continuing threat of fire, unsafe areas, building collapse, aftershocks, and other hazards should also be conveyed. Emergency public information will be managed in accordance with ESF #15.

Emergency Public Shelters and Mass Care

Operations will be conducted in accordance with ESF #6 and the Mass Care & Sheltering Support Annex.

Access Control and Re-Entry

Control of access to areas severely affected by an earthquake will be accomplished by local authorities. State assistance will be provided if requested in accordance with the Evacuation & Re-entry Support Annex.

3. Sustained Response/Recovery

Given the level of damage to housing, business, and infrastructure; the direct impact on the population; and the effect on the regional economy, full recovery from a major earthquake may take years, if not longer. Nonetheless, rapid initiation of recovery operations is critical to restoring confidence in the community.

Recovery measures, including general infrastructure repair and community reconstruction will be managed at the state level in accordance with ESF #14 and the Recovery Programs Support Annex.

Roles & Responsibilities

Agency response actions are to be conducted in accordance with the appropriate ESF. The roles and responsibilities outlined below are specific to an earthquake incident.

Virginia Department of Emergency Management

- Obtain the potential scope of the earthquake, including the magnitude, depth and location of the rupture, and shaking information from the Virginia Department of Mines, Minerals, and Energy, USGS, and Virginia Tech Seismological Observatory.
- Collect and analyze situation information received from all available sources.

Virginia Department of Mines, Minerals, and Energy

- Consolidate available information about the potential scope of the earthquake, including the depth and location of the rupture and the magnitude and intensity of the event from federal, state, and local sources, and provide this information to Virginia Department of Emergency Management. *See Attachment 2.*
- Identify affected areas that are more susceptible to property damage from an earthquake based on local geologic conditions and provide these locations to the Virginia Department of Emergency Management to better target response efforts.
- Collect, evaluate, and share information on damaged energy systems and estimate the impact within the affected areas.
- Provide an earthquake SME when needed/available.

State Corporation Commission

- Monitor, assess, and inspect natural gas and fuel pipelines. Provide damage assessment updates to the VEOC.
- Collect, evaluate, and share information on damaged electrical systems and estimate the impact within the affected areas.

Department of Environmental Quality

- Activate specialized response teams to identify any hazardous material spills and releases (to include petroleum pipeline breaks) and/or mitigate environmental impacts.
- Provide field staff to monitor and/or sample land and/or air to identify contamination from a variety of sources which may include leaking underground

storage tanks and particulates that have entered the air through debris cleanup.

Virginia Tech Seismological Observatory

- Provide available information regarding the potential scope of the earthquake, including the magnitude, and depth and location of the rupture.
- Provide an earthquake SME when needed/available.

Authorities & References*References*

- FEMA Homeland Security Exercise and Evaluation Program
- National Response Framework, 2008

Attachment 1 – Critical Information for the First 24 Hours

The following information should be collected as soon as reasonably possible to protect life and property.

- Number and locations of deaths and injuries.
- Location and extent of secondary events, including aftershocks, fires, landslides, and hazardous materials events.
- Requirements for major evacuations and estimated number of people displaced.
- Location of severely damaged or collapsed structures
- Location and estimated number of people trapped in collapsed structures.
- Status of communication systems, including:
 - Public telephone and wireless systems (to include internet)
 - VDEM and other critical State radio/communication systems
 - Local Public Safety Answering Points (PSAP) “911 centers”
 - Radio and televisions (emergency public information access points)
- Damage to critical public buildings and other infrastructure, including:
 - Emergency Operation Centers
 - Police and fire facilities
 - Hospitals, shelters, and skilled nursing facilities
 - Bridges and tunnels
 - Schools
 - Jails
 - Public transportation networks (air, rail, and highway).
 - Other facilities deemed to be critical infrastructure
- Status of and damage to major utility systems or infrastructure, including:
 - Water
 - Sewer
 - Power / Electrical (to include nuclear facilities)
 - Natural gas
- Critical resource shortfalls impacting public health and safety.

Attachment 2 – Earthquake Scales Crosswalk¹

Richter Magnitude Scale	Modified Mercalli Intensity Scale
1.0 to 3.0	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and Higher	VIII or Higher
Defined Modified Mercalli Intensity Scale Rating	
I	Not Felt except by a very few under especially favorable conditions
II	Felt only by a few persons at rest, especially on upper floors of buildings
III	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.
IV	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	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	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	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	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	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

¹ United States Geological Survey, Earthquakes Hazard Program