



Earthquake Drills for K-12 Schools: Requirements, Compliance, and Policy Considerations

Robert Jackson, OREA Intern

March 8, 2018

Summary

Twenty years ago, the General Assembly passed legislation requiring that certain school districts conduct at least two earthquake drills each school year. The impetus for the requirement was the threat posed by the New Madrid Fault Line, an earthquake prone zone that includes portions of West Tennessee.¹ The New Madrid Fault Line has a 7 to 10 percent chance of producing a major earthquake within any 50-year period. Major earthquakes can cause loss of life and significant damage to property.

According to an OREA review of the safety drill logs from schools in the 40 school districts identified by the Tennessee Department of Education as falling under the earthquake drill requirement, 84 percent of schools did not complete the required two earthquake drills in 2016-17. Of the 352 school logs reviewed, 89 schools (25 percent) had not conducted an earthquake drill, and 207 schools (59 percent) had conducted one of the two required drills.

¹ Between December 1811 and February 1812, the region experienced at least three separate magnitude 7 earthquakes with multiple strong aftershocks. These earthquakes, among the largest in the continental United States, caused portions of the Mississippi River to run backwards and created Reelfoot Lake.

Requirements for Earthquake Drills in Schools

School districts that lie entirely or partially within 100 miles of the New Madrid Fault Line are required to conduct at least two earthquake drills each school year, under both state law (*Tennessee Code Annotated* 49-1-302 (a)(16)) and State Board of Education rule (0520-01-03-.03). Earthquake drills are optional for other Tennessee districts. The Tennessee Department of Education (TDOE) has identified 40 school districts that are subject to the two earthquake drill requirements.

Exhibit 1: List of School Districts Subject to Earthquake Drill Requirements (as identified by the Tennessee Department of Education)

Alamo City	Hardeman County	Milan SSD
Arlington Community	Haywood County	Millington Municipal
Bartlett City	Henderson County	Obion County
Bells City	Henry County	Paris SSD
Bradford SSD	Hollow-Rock Bruceton SSD	Shelby County
Carroll County	Humboldt City	South Carroll County SSD
Chester County	Huntingdon SSD	Tipton County
Collierville	Jackson-Madison County	Trenton SSD
Crockett County	Lake County	Union City
Dyer County	Lakeland City	Weakley County
Dyersburg City	Lauderdale County	West Carroll SSD
Fayette County	Lexington City	West TN School for the Deaf
Germantown Municipal	McKenzie SSD	
Gibson SSD	McNairy County	

Source: Tennessee Department of Education, June 26, 2017.

School Compliance

Based on school safety logs provided by the 40 districts in Exhibit 1, OREA found 84 percent of the schools reviewed had not performed the required two earthquake drills for the 2016-17 school year. Of the 352 school logs reviewed, 89 schools (25 percent) had not conducted earthquake drills, and 207 schools (59 percent) had conducted one drill. (OREA’s review did not include logs from the seven Fayette County schools or from the 45 Shelby County charter schools, whose logs were not provided by the districts.)

The only school districts that had 100 percent compliance were Bells City and Lakeland City, both of which have a single school. In 12 of the 40 districts, all schools conducted at least one earthquake drill.²

School compliance with earthquake drills – and other school safety drills, such as those for

² The 12 districts were Alamo City, Arlington Community, Bartlett City, Bradford Special, Crockett County, Dyersburg City, Hollow Rock-Bruceton Special, Lake County, Lauderdale County, Lexington City, Millington Municipal, and Tipton County.

fires and armed intruders – is considered a district responsibility and is not monitored by the state.³

Districts use different monitoring methods to assess whether their schools comply with safety drill requirements.⁴ OREA’s review found that the sample log provided by TDOE does not clearly detail how many drills of each type are required. In addition, log forms used in some districts are outdated or incomplete and include incorrect information about the number of required drills.

Some districts subject to the earthquake drill requirement may be unaware of it because of its placement in a different part of the state code than fire drills and other school safety drill requirements. Because the law requiring earthquake drills was written as a directive for the State Board of Education (SBE) to pass a rule requiring such drills (which the board did in 1999), it was included in the code section with other SBE duties (*TCA 49-1-302*).⁵ Requirements for school fire drills and general non-evacuation drills, by contrast, are located in code sections addressing health and safety (*TCA 68-102-137*). In previous years, these safety drills were also included in a code section addressing teachers’ duties (*TCA 49-5-201*), along with a requirement for armed intruder drills. After drill requirements were removed from the code section on teachers’ duties in 2016, a renewed requirement for an armed intruder drill was adopted in 2017 and is now included in *TCA 49-6-807*.

Geographical Analysis

The schools and districts identified by TDOE as subject to the earthquake drill requirements fall into 18 counties – basically the West Tennessee counties that lie between the Mississippi and Tennessee rivers, with the exception of Benton and Decatur counties. It is not clear how these 18 counties were identified by TDOE. Although pinpointing a fault line from which to measure a 100-mile area is not a straightforward process, it seems clear that parts of Stewart and Benton counties fall within 100 miles of the fault line, but are not on TDOE’s list.⁶ In addition, TDOE has not included the Achievement School District (ASD), which has 31 schools in Shelby County; the Shelby County school district is currently included in TDOE’s list of districts subject to the earthquake drill requirements.

Exhibit 2 shows the 23 counties that fall wholly or partially within a 100-mile radius from the point of New Madrid, Missouri, the epicenter of the significant earthquakes that occurred in the 19th century. This measurement includes all the counties on TDOE’s list, as well as Benton

³ See OREA’s *Student Safety Drills: Requirements for Tennessee’s K-12 Schools* infographic for a list of school safety drill requirements for earthquakes, fires, and armed intruders. In addition, Tennessee schools that have one or more Automated External Defibrillators, or AEDs, must schedule annual CPR/AED training for all school personnel and conduct at least one CPR and AED drill each school year.

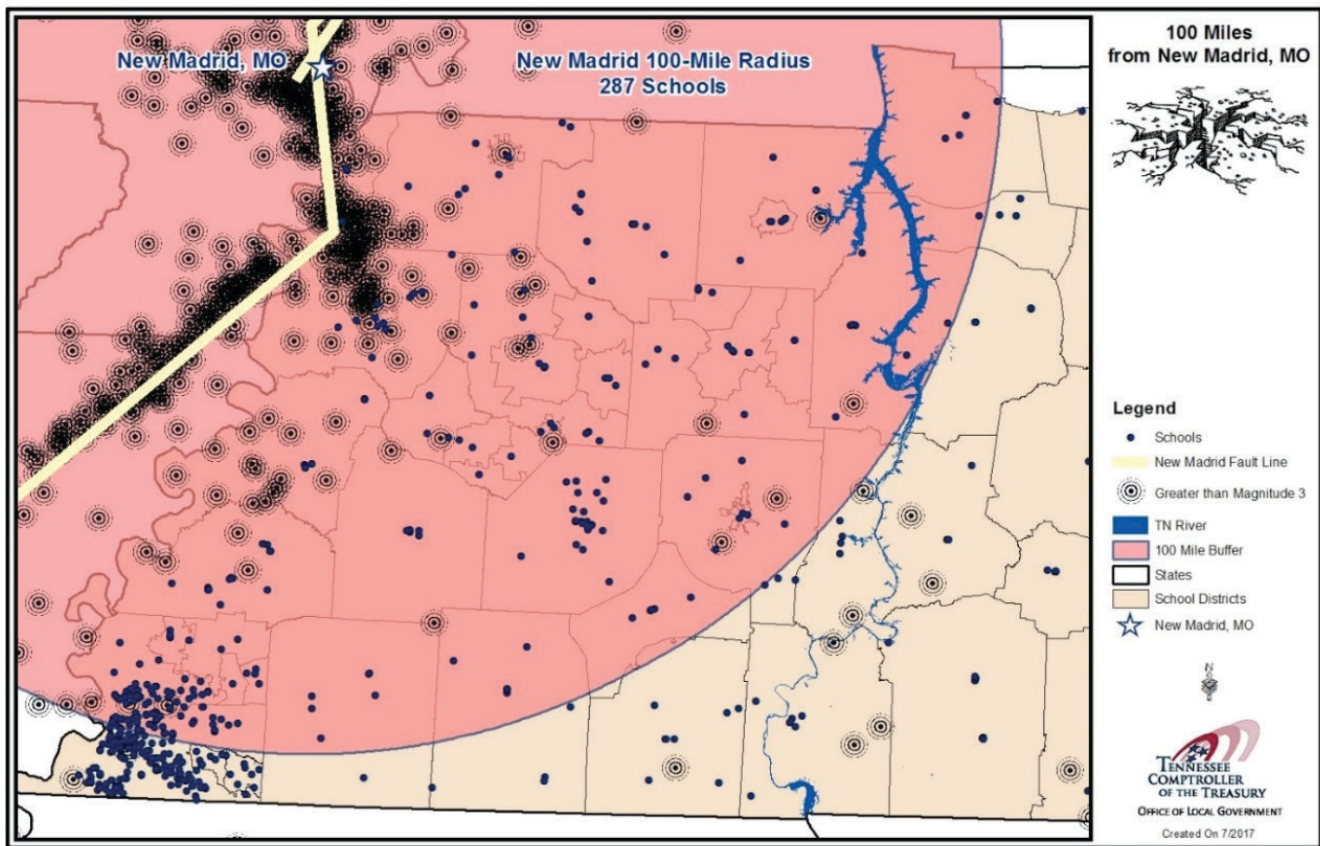
⁴ Some districts provide hard copy safety drill forms to their schools for use. At least one district uses an electronic verification system to ensure its schools comply with all safety drill requirements. The Tennessee Organization of School Superintendents has provided funding for an online portal that can allow school districts to electronically verify compliance with safety drill requirements.

⁵ The original public act both required and encouraged SBE to pass earthquake drill requirements as rules, using duplicate language, which was subsequently included in *Tennessee Code Annotated* for several years. Beginning in 2009, only the language requiring SBE to pass an earthquake drill remained in *TCA*.

⁶ Almost all of Benton County schools conducted the required two earthquake drills in 2016-17.

County and portions of four additional counties – Stewart, Houston, Humphreys, and Decatur.

Exhibit 2: Tennessee Counties, School Districts, and Schools within 100 miles of New Madrid, Missouri



Source: Comptroller's Office adaptation of map with seismic events greater than magnitude 3 provided by the United States Geological Survey.

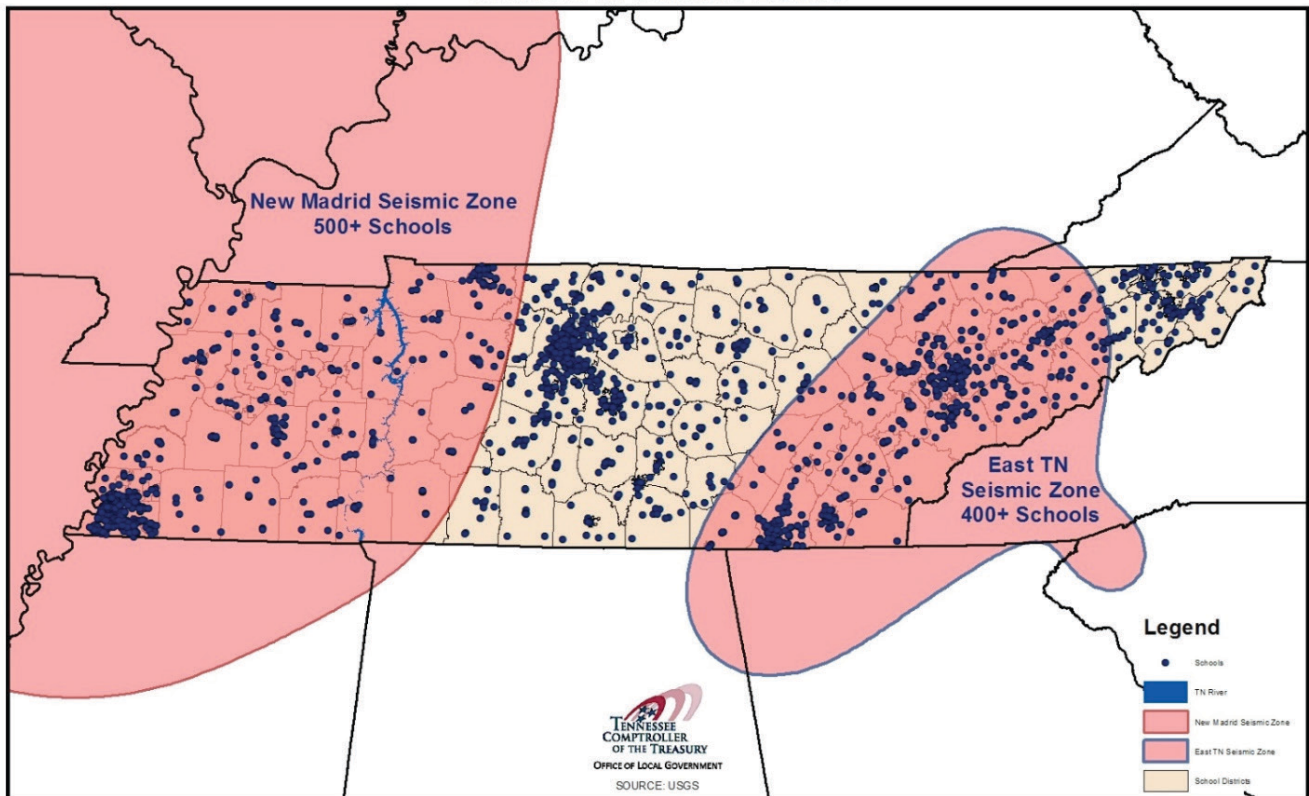
Both the law and geology, however, dictate the 100-mile measurement from the New Madrid Fault Line itself, not just from the city of New Madrid, because different points along a fault line can form the epicenter of a future earthquake. Out of these potential epicenters, scientists create seismic zones, which encompass the area that would be affected by an earthquake. Given the complexities of identifying and measuring from an underground fault line, OREA asked the Center for Earthquake Research and Information (CERI) at the University of Memphis and the United States Geological Survey (USGS) for their professional assessments of how to measure Tennessee's 100-mile radius requirement.

CERI responded with a letter stating that:

- there is no central point in the New Madrid seismic zone from which 100 miles can reasonably be measured
- designating the exact location of a 100-mile boundary is problematic
- the next large earthquake could occur anywhere in the fault system – [the New Madrid Fault Line] extends over 150 miles in a zigzag pattern from Marked Tree, [Arkansas], crossing well into [Northwest Tennessee], and northward to southern Illinois

The USGS indicated the current 100-mile radius calculation used to comply with Tennessee law does not extend far enough to encompass the potential area of earthquake hazard in part because of Tennessee’s geology. Tennessee’s sediment and ground structure means the energy released during an earthquake extends further outward from the epicenter and maintains larger amounts of its initial energy than earthquakes that occur in other regions of the United States, such as on the West Coast. As a result, the impact from earthquakes in Tennessee covers a larger area.

Exhibit 3: United States Geological Survey’s Calculation of Schools Potentially Impacted by Earthquakes



Source: Comptroller’s Office adaptation of map provided by the United States Geological Survey.

The map in Exhibit 3 also shows another seismic zone that encompasses portions of the state: the Eastern Tennessee Seismic Zone. The USGS has identified the Eastern Tennessee Seismic Zone as capable of “experiencing damaging shaking every 500 years.” School districts that lie wholly or partially within the Eastern Tennessee Seismic Zone are not required to conduct earthquake drills each year, though such districts may choose to do so. At least three districts in the Eastern Seismic Zone had logs indicating many of their schools conducted at least one earthquake drill in 2016-17: Campbell County, Claiborne County, and McMinn County.

Earthquake Drill Procedures

Earthquake drills are a type of non-evacuation drill. All Tennessee schools are currently required to conduct three non-evacuation safety drills annually, such as inclement weather, intruder, or earthquake safety drills, though districts determine which drills to conduct.

Earthquake drills may count toward the three required non-evacuation drills that all schools must conduct annually. While these drills are similar in that students are not evacuated from the building as they would be in a fire drill, for example, they may differ from each other based on factors such as whether classrooms need to be locked or whether students are moved to a safer location within the building first. Best practice for earthquake drills is for students to get on the floor immediately with their backs to windows and under a solid surface such as a desk if possible, cover their faces and chests, and hold on to their shelter or themselves, commonly known as the “drop, cover, and hold” procedure.

Policy Considerations

State policymakers may wish to consider the following two policy questions:

1. Should a method to calculate a 100-mile radius from the New Madrid Fault Line be specified?

A geologist at the Center for Earthquake Research and Information at the University of Memphis states that

For the sake of simplicity and to err on the side of safety, state government may want to consider designating mandatory earthquake drills for all schools west of the Tennessee River. . . . Many scientists, and probably emergency managers, would recommend that all schools west of the Tennessee River should require earthquake drills to simplify this legislation.⁷

The USGS indicated the current 100-mile radius calculation used to comply with Tennessee law does not extend far enough to encompass the potential area of earthquake hazard in part because of Tennessee’s geology.

If the state adopted this “west of the Tennessee River” calculation of the 100-mile area, an additional 19 schools (in Benton, Decatur, and Hardin counties), would be subject to the two earthquake drills per year requirement.

2. Should some or all Tennessee schools not subject to the New Madrid Fault Line requirement, such as those schools located within the Eastern Tennessee Seismic Zone, also conduct an earthquake drill or drills?

The USGS suggests that amending state law to require at least one earthquake drill per year, such as the yearly “ShakeOut” drill organized by the Central U.S. Earthquake Consortium, for all schools would increase earthquake preparedness for all Tennesseans. The USGS also recommends a second drill for schools where damaging shaking is expected at least once every 500 years, shown in the pink-shaded areas in the map in Exhibit 3.⁸

⁷ Gary Patterson, Geologist, Center for Earthquake Research and Information, The University of Memphis, undated letter to OREA, received July 31, 2017.

⁸ Oliver Boyd, Ph.D., Research Geophysicist, United States Geological Survey, letter to OREA, June 22, 2017.

Administrative Recommendations

The Department of Education should clarify for all school districts the current school safety drill requirements. Based on its current calculation of school districts required to conduct earthquake drills, TDOE should amend its list of districts to include the 31 Memphis schools in the Achievement School District, since it includes Shelby County schools on its list. After reviewing a draft of this report prior to publication, the department indicated that ASD schools have now been added to the list of those required to conduct earthquake drills.

School districts should update their school safety drill logs, regularly verify they are accurate, and conduct the required number of school safety drills each year. OREA found some districts may be unaware of the requirement for two earthquake drills each school year. OREA's review of hundreds of school safety drill logs found that some log forms are outdated or incomplete and do not reference all drill requirements. After reviewing a draft of this report prior to publication, the department notified all districts of required safety drills and provided each with a standardized drill log form. In addition, the department plans to pilot a free app for logging safety drills provided by the Department of Commerce and Insurance.



OFFICE OF RESEARCH AND EDUCATION ACCOUNTABILITY

Russell Moore, Director

425 Fifth Avenue North

Nashville, Tennessee 37243 • (615) 401-7866

www.comptroller.tn.gov/orea

