

Appendix K

QUALITATIVE ANALYSIS OF THE CURRENT STATE OF TORNADO WARNING SYSTEMS IN THE U.S.

Throughout the United States, many cities have siren-based communication systems to alert residents and visitors about emergencies that require immediate action (also known as rapid-onset events). The most common use of the sirens is to alert people of severe weather or tornadoes in the vicinity; however, they can be used to alert or warn citizens of many different types of disasters, including severe weather, chemical emergencies, HAZMAT spills, national security attacks, floods, fires, or other types of emergencies.

An assessment of more than 75 U.S. counties, cities, and towns was conducted to identify the similarities and differences among siren systems from community to community. An Internet search was conducted to identify at least one community from each tornado-prone State that used a siren system to alert of emergencies. Table K- 1 shows the number of counties, cities, or towns reviewed from each State; and although some communities from east and west coast States were assessed, the focus of this assessment was on States located in the tornado-prone region of the Midwestern United States commonly referred to as “tornado alley.” There was no systematic method for choosing communities; instead, communities were chosen for this assessment if they provided emergency communications procedures on a website that was accessible to the public.

Table K- 1. The number of qualifying community emergency management websites chosen, by State.

State	No. of Sources
Alabama	3
Alaska	/
Arizona	/
Arkansas	2
California	1
Colorado	3
Connecticut	/
Delaware	/
Florida	2
Georgia	4
Hawaii	1
Idaho	1
Illinois	4

State	No. of Sources
Montana	/
Nebraska	1
Nevada	/
New Hampshire	/
New Jersey	/
New Mexico	1
New York	/
North Carolina	/
North Dakota	/
Ohio	4
Oklahoma	5
Oregon	1
Pennsylvania	/

State	No. of Sources
Indiana	3
Iowa	4
Kansas	3
Kentucky	3 (5)
Louisiana	
Maine	
Maryland	
Massachusetts	
Michigan	2
Minnesota	2
Mississippi	4
Missouri	4

State	No. of Sources
Rhode Island	
South Carolina	
South Dakota	
Tennessee	3
Texas	4
Utah	1
Vermont	
Virginia	
Washington	1
West Virginia	
Wisconsin	4
Wyoming	3

The assessment showed that emergency information about tornadoes is disseminated via siren systems using a variety of methods before the tornado hits. The main differences found among these 76 communities pertained to siren usage (i.e., the types of emergencies that the sirens were used for), activation procedures, sounding patterns, and the guidance provided to the public on how to respond to siren soundings.

While some communities were found to use their sirens only for tornado emergencies, most of the sampled communities (59 out of 76) use their sirens for multiple types of events. Which types of emergencies the sirens are used for seems to be a decision made by each local community. Even jurisdictions that are adjacent to each other can use sirens for different types of emergencies. For example, Rankin County, Mississippi, sounds its sirens only for tornadoes, while adjacent Hinds County, Mississippi, sounds sirens for severe weather, national security events, and life-threatening situations that may impact the public (which are defined by the officials in charge of turning on the sirens). Problems with situational awareness may arise for residents who travel frequently between jurisdictions that use sirens differently.

There are differences in siren activation procedures among communities as well. In the majority of communities sampled, sirens are activated if the National Weather Service (NWS) issues a warning for the area served by the sirens. Other communities have decided to rely mainly on local officials, trained tornado spotters, and/or a local emergency team for determinations about whether (and when) to activate the sirens. In some places, the fire or police department is in charge of sounding the sirens.

The patterns of sounds used by siren systems also differ from community to community. While the majority of the 76 sampled locations did not provide publicly accessible online information about the lengths (in minutes) of their siren soundings, some did, and differences were found to exist even among this smaller sample. Some communities may sound the siren for a finite time interval, whereas others

may sound the siren continuously using a repeating time interval. Using a finite time interval, a siren may sound for 3 min and then stop, regardless of when the emergency begins and ends. On the other hand, when using a repeating time interval, a siren may sound for 3 min and turn off for 8 min, and repeat that pattern until the emergency is over. There is the potential for individuals familiar with a repeating time interval to become confused when visiting another community that uses a finite time interval pattern (and vice versa).

There are also differing practices in regard to the types of sounds used. In some cases, the sound pattern differs based upon whether there is an actual emergency or the community is simply testing the system. In others, the community disseminates different sounds or tones to distinguish between types of emergencies; e.g., the tones are different for system tests versus hazmat warnings versus weather warnings. Plymouth, Minnesota, for example, uses a steady siren for tornadoes and a warble (or wavering) siren for all other emergencies. Finally, sirens may be set at differing volume levels, based upon spacing and the landscape, from community to community.

Guidance provided to the public on how they should react when sirens are sounded varies across communities as well. In 10 of the 76 communities sampled, when a siren is sounded, individuals are supposed to turn to an information source, like a weather radio or news channel, to find more information. In 35 of the sampled communities, individuals are supposed to take cover and then tune into an emergency information source, like a weather radio or a local radio or television news station. However, only 18 of these 35 communities provide further guidance on what “taking cover” actually means. Generally, recommendations for “taking cover” state that if an individual is in a sturdy building, they should immediately shelter in a basement, storm cellar, or a small interior room on the lowest level of the structure. The same recommendation is given for sheltering in schools, factories, or shopping centers. Also, it is generally recommended to stay away from glass. Five communities recommended that individuals should cover their head with a blanket or get under a table or mattress when sheltering in an interior room. Thirteen of the sampled communities give even more guidance on where to shelter; they instruct their residents to evacuate mobile homes and vehicles upon hearing the sirens sounded for a tornado and to go into a sturdy building. If there is no sturdy building available, people are instructed to lay flat in a ditch and cover their heads but beware of flash floods.

Emergency communication issues can arise even within the same community. A city in Kentucky has both a siren and a public address system. Their intent is to use the siren to alert the public, and then to follow the alert with instructions on what to do via the public address system. This system provides a good example of how to structure alerts and warnings to prompt effective responses from the community before and during disasters. However, the problem is that the sirens can be heard throughout a half-mile radius, while the public address system can only be heard within a quarter-mile radius. This can cause confusion in the quarter-mile areas where people can hear a siren but not the public address system (www.lexingtonky.gov/index.aspx?page=1420).

Of the 76 communities sampled, all of which had outdoor sirens, 42 stated specifically that the purpose of these sirens is to alert only persons located outdoors. None of the communities stated that their purpose is to alert people located indoors as well as outdoors. In Houston, Georgia, the sirens are placed only in areas where citizens are unlikely to hear any other warning, rather than all throughout the city. In Madison County, Alabama, the sirens can be heard by about 75 percent of the population, while in Louisville, Kentucky, 94 percent of the population can be reached with the sirens. Little Rock, Arkansas,

states that its sirens are not intended to alert people who are indoors, whether or not they are sleeping, or who are in vehicles with the windows rolled up.

Overall, outdoor warning systems vary among communities within the United States, both within and outside of tornado-prone areas. Many communities, especially smaller towns and rural areas, even within tornado alley, do not have sirens. Additionally, there is significant variability in the design of tornado communication systems that can make it difficult to understand, from city to city and even within the same area, the information that they convey and how to appropriately respond.