



# Arkansas' Shelter Initiative

for Residences and Schools

*Mitigation Case Studies*

*August 2005*



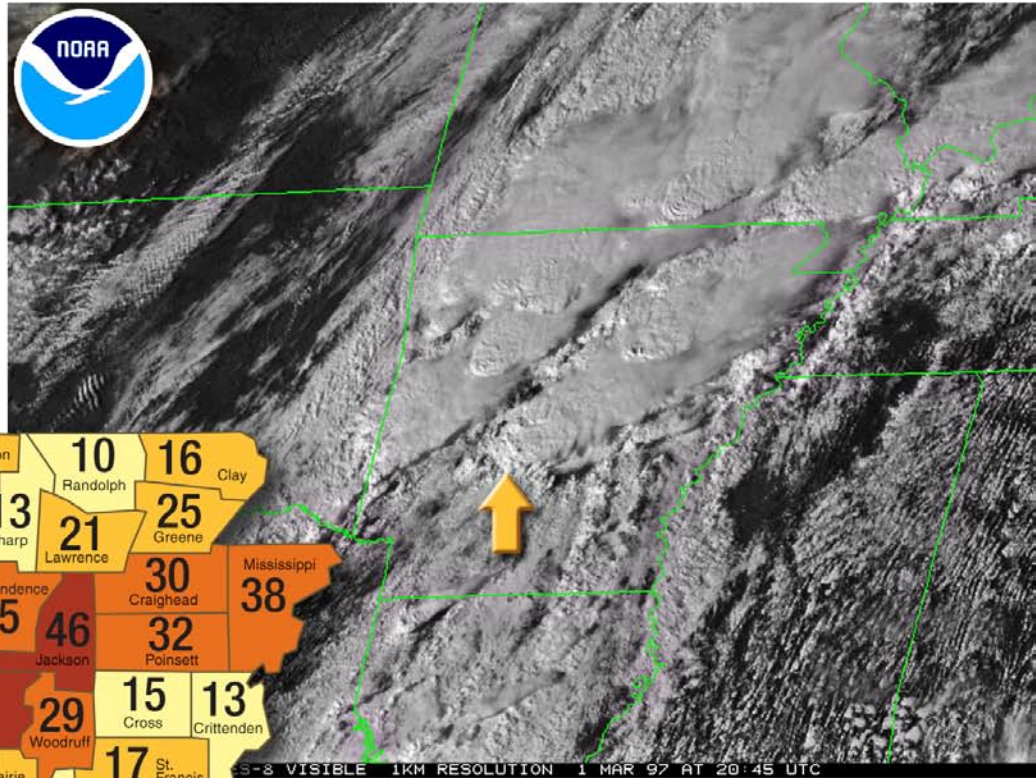
**FEMA**

## Arkansas' Shelter Initiative for Residences and Schools

### Tornadoes: A Deadly Encounter

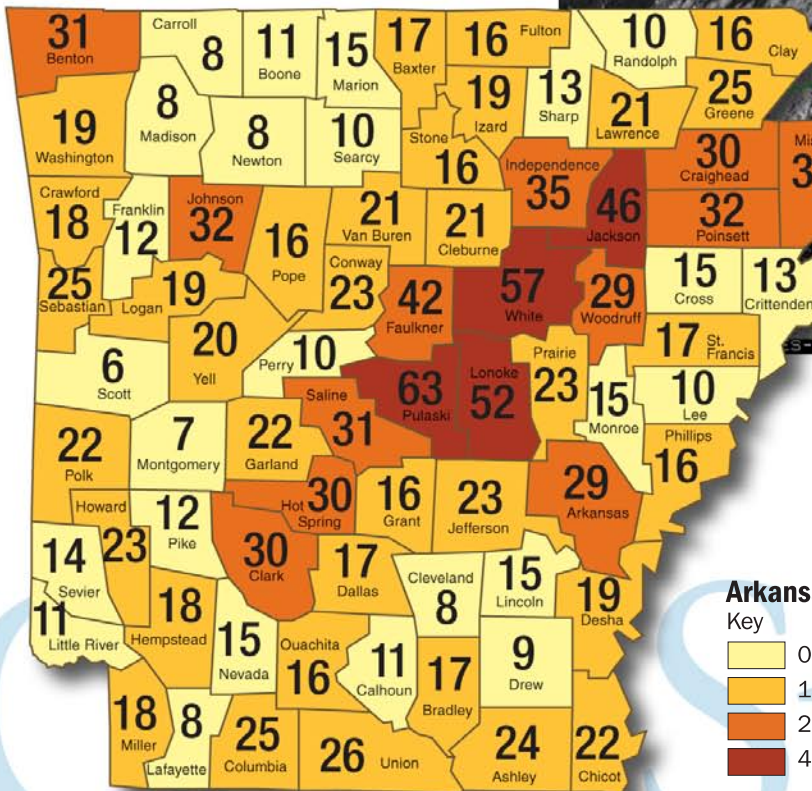
On the afternoon of March 1, 1997, 16 tornadoes ripped through a 260-mile stretch of Arkansas, resulting in the loss of 25 lives and injuring more than 400 people. Four of the 16 tornadoes were responsible for all of the fatalities, most of the injuries, and property damage. By the end of the day, the total damage to properties across the state was estimated at over \$115 million.

Nearly one-half of College Station, a community with approximately 770 residents in Pulaski County, was destroyed by one of the four "killer" tornadoes on that March afternoon. It left a damage path 27 miles long and almost a mile wide. It produced F2 and F3 tornadoes and resulted in five deaths in the College Station area south of Little Rock.

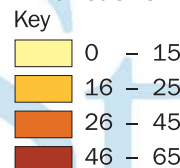


*Geostationary Operational Environmental Satellite (GOES) visible image at 20:45 Universal Coordinated Time (UTC) on March 1, 1997, showing tornadic thunderstorms over Arkansas (arrow shows tornadic cell near Arkadelphia).*

SOURCE: NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION (NOAA)



### Arkansas Tornadoes By County (1950-2004)



A total of 1,555 tornadoes were recorded during the 1950-2004 time period.

SOURCE: NATIONAL WEATHER SERVICE (NWS)

# Mitigation Case Studies

Number of tornadoes (F3 and higher) between 1950 and 2004 in the Tornado Alley states.

(SOURCE: NATIONAL CLIMATIC DATA CENTER (NCDC) / NOAA)

## Why Was Arkansas Hit?

Arkansas is one of several states in “Tornado Alley,” a commonly used term for a broad area of relatively high tornado occurrences in the central United States (<http://www.noaa.gov/tornadoes.html>). The graphic (shown at right) indicates the states in Tornado Alley and the number of tornadoes designated F3 or higher that occurred between January 1950 and December 2004.

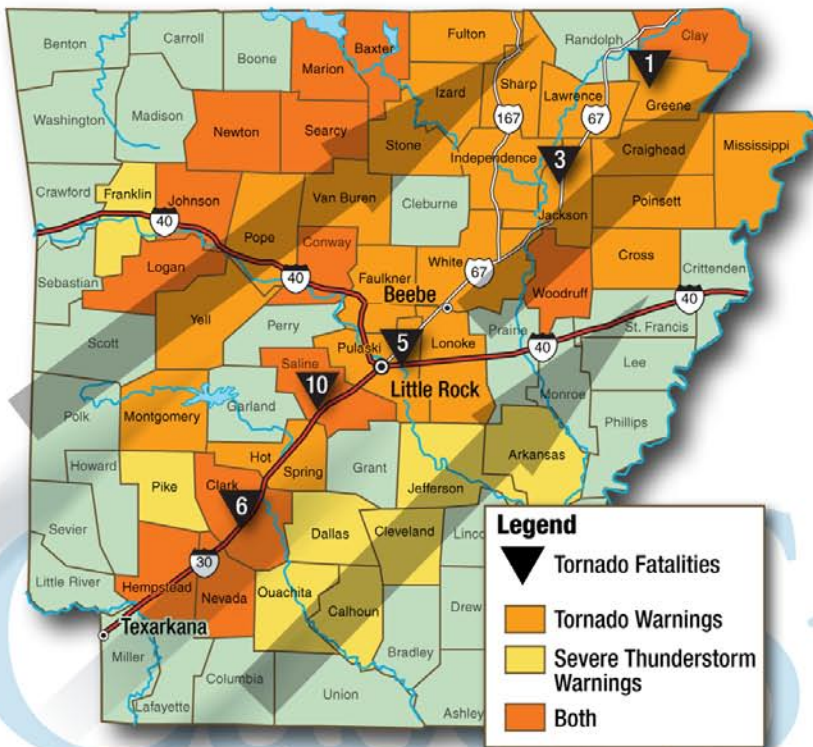
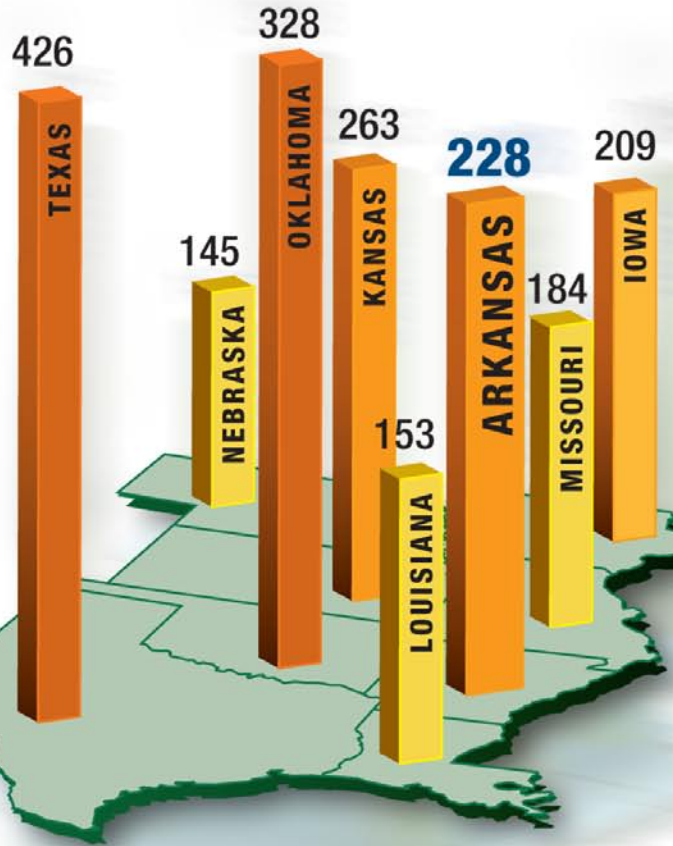
The State of Arkansas has had a long history of deadly tornadoes and ranks fourth, after Texas, Oklahoma, and Kansas, with 228 tornadoes that are F3 and higher. According to the National Climatic Data Center (NCDC) of NOAA, the state has experienced more than 1,500 tornadoes since 1950. Some areas have experienced more tornadoes than others. Counties in the center of the state—Pulaski, Lonoke, White, and Faulkner and Jackson (toward the northeast)—experienced a larger number during this timeframe compared to other counties.

In 1968, an F4 tornado that was 300 yards wide stayed on the ground for 2 miles, killing 14 people and injuring approximately 270. In a 1996 tornado event, over 1,900 homes and 200 commercial properties were destroyed or heavily damaged, resulting in three deaths and damage of approximately \$150 million.

Since 1950, 25 tornadoes have struck Sebastian County. With respect to tornadoes, the State of Arkansas ranked third in the Nation in deaths and fifth in injuries. The National Oceanic and Atmospheric Administration (NOAA) lists the frequency of tornadoes in Arkansas as 6 to 15 per 1,000 square miles per year. The state can expect an average of nearly 30 tornadoes annually, with 9 of them categorized as strong to violent based on the Fujita Scale (F2 to F5). Please refer to the FEMA publication *Community Wind Shelters: Background and Research* for more information on the Fujita Scale.

Map showing the 2001 tornado tracks. Tornadoes have been more prevalent all over the state and along Interstate 30 from Texarkana to Little Rock and along the U.S. Highway 67/167 corridor from Little Rock to Beebe.

(SOURCE: NWS)



## The Push Towards Mitigation

After surveying the damage to the state, the Governor of Arkansas ordered state agencies to get involved in the recovery effort by coordinating their efforts. The Director of the Arkansas Employment Security Department was placed in charge of the Tornado Recovery and Community Enhancement (TRACE) team. The TRACE team established “one-stop shopping” centers for state services in the areas with the worst damage. This type of service allowed tornado victims and those in need to be provided with efficient assistance. The TRACE team is only activated after a disaster or as needed by the Governor.

### “Prepare for Tomorrow’s Disaster...Today!”

In 1996, the Governor recognized the state’s vulnerability to future severe weather events and declared an annual statewide Severe Weather Awareness Week. As part of this annual week, the National Weather Service (NWS) and Arkansas Department of Emergency Management (ADEM) scheduled a media campaign, including press releases, public service announcements, and televised appearances. The 2001 Severe Weather Awareness Week was expanded to include a Disaster Preparedness Tour (February 12-23), using the theme “Prepare for Tomorrow’s Disaster...Today!”

Using this campaign as a focal point, the Mitigation and Public Affairs Team (composed of staff from FEMA Region VI and ADEM) created a public education campaign with the goal to protect the lives and property of Arkansans and to reduce the cost of future natural disasters. The Disaster Preparedness Tour spanned 2 weeks, making 12 stops in 11 cities. It featured a mobile display showing photos of damage across the state, mitigation projects, and relevant outreach material. A full-size, 4-foot by 6-foot, 14-gauge metal safe room accompanied the display to seven locations on the tour.

## Effective Outreach and Mitigation: What the 2001 Tour Accomplished

- In a 2-week period, FEMA and ADEM representatives reached more than 7,500 Arkansans in face-to-face visits promoting disaster preparedness and mitigation. Others were reached through the media.
- In Hot Springs, a local radio station requested FEMA to provide a display for the upcoming weekend home show. The 3-day event attracted more than 7,000 people. Of those, approximately 5,000 visited the display.
- Visits to ADEM’s website increased and additional requests for more information on preparedness and mitigation were received through the website’s e-mail.

*“States and localities are critical leaders in disaster reduction.”*

— Michael D. Brown, Under Secretary for the Emergency Preparedness and Response Directorate of the Department of Homeland Security

- A local radio station in Newport (a small city in the northeastern part of the state) asked that they be included in the tour originally planned for the larger Arkansas cities. The radio station broadcasted live from a new home improvement store and interviewed FEMA and ADEM representatives, as well as the county judge, county emergency manager, and representatives from the City of Newport.



- On February 21, 2001, all schools in the state participated in a severe weather alarm test and drill.

### Safe Homes: Safe Rooms In Residences

The residential safe room concept was the highlight and best practice of the tour because it demonstrated an effective way to reduce risk damage caused by deadly tornadoes.

A safe room is a reinforced room built in a new or existing above-ground structure that can provide protection during storms. A safe room is often a closet or bathroom that has been modified to provide occupant protection in the event of a tornado or hurricane. While constructing site-built safe rooms, FEMA 320, *Taking Shelter from the Storm: Building a Safe Room Inside Your House*, should be referred to for guidance. This document includes detailed drawings, construction plans, and cost estimates for in-residence safe rooms.



Views of residential safe room construction. Completed safe room, left, functions as a closet during daily use. Doors must meet FEMA 320 or National Performance Criteria for Tornado Shelters standards.



### Taking Shelter From the Storm:

Building a Safe Room Inside Your House  
Includes Construction Plans and Cost Estimates  
FEMA 320, Edition 2 / March 2004



FEMA 320

An alternative to the site-built safe room is a commercially-manufactured safe room that, depending on the type, can be installed above-ground, below-ground, or partially below-ground. In-ground safe rooms have no state regulations; however, they must meet the local codes. They must be constructed of a waterproof material, properly ventilated, and contain doors that meet the National Performance Criteria for Tornado Shelters.

A safe room costs anywhere between \$2,000 and \$6,000. “The difference in the two figures,” says Jennifer Gordon, Public Affairs Officer for ADEM, “is that it is less expensive to have the room installed during the construction phase of a home as opposed to doing an addition.” Regardless of the cost, it is recommended that the safe room meet the requirements established by FEMA 320 or meet the National Performance Criteria for Tornado Shelters.

As of March 2005, more than \$7 million in state funding (Arkansas Safe Room Program) had been made available to provide homeowners with a monetary incentive (in the form of a rebate) for putting a safe room in their homes. In-ground (sometimes called underground) safe rooms are also eligible for the rebate in primary residences. The rebate will cover up to \$1,000 or 50 percent of the cost, whichever is less. The rebates are not available for secondary homes or apartment complexes.

### Are basements safe enough to be used as safe rooms?

Some tornadoes (F2 and above) have resulted in the loss of floor framing, collapse of basement walls, and death or injuries to individuals in the basement. What constitutes an acceptable level of protection is an individual decision. For those homes that do not contain safe rooms, basements are considered the next safest place to seek shelter. While a basement is considered a good location to install a safe room, it may not be the most feasible alternative, as they often have access limitations.

SOURCE: <http://fema.gov/plan/prevent/saferoom/faq.shtm>



### Definitions:

Typically, the term **safe room** refers to a single room within a residence meant for use as a shelter during a natural disaster (tornadoes, hurricanes, etc.). The term **community shelter** refers to a larger room—either within a building (such as a school) or a separate building—that can provide shelter to more people than a safe room. Some communities, such as those in Arkansas, use the terms “safe room” and “shelter” interchangeably.

### Building New Homes with Safety in Mind: Homes for Sale

In the case of new homes, developers have started to publicize safe rooms in their advertisements and have successfully used this feature as an amenity to market properties throughout the state.

#### GREENBRIAR, AR \$134,500

Your own private pond on 2.25 acres in Greenbrier! This amazing find is one of a kind boasting 3 BR, 1.5 BA, two living areas, safe room in basement and a separate workshop!

#### FORT SMITH, AR \$892,000

Over 6,000 sq. ft., 3 levels, 6 BR, 5 full BA, a powder room, a safe room and two separate offices with built-ins... 1,600 sq. ft. in covered verandas... all located in a gated community.



*Interiors of a school shelter during construction.*

SOURCE: WESTERN ARKANSAS PLANNING AND DEVELOPMENT DISTRICT (WAPDD)

### Safe Schools: Can Schools Be Safe Havens?

Schools are often considered pillars of a community's identity. Shelters in schools can be convenient and recognizable locations for residents to gather when a community is threatened by a tornado or severe weather. When not in use as a shelter, the space can be used for community activities.

*Construction of a College Station elementary school shelter. (SOURCE: WAPDD)*



*Exteriors of the completed shelters at Barling Elementary School in Fort Smith.*

(SOURCE: WAPDD)



## The Arkansas School Shelter Program

Arkansas built a shelter in 2002 within an elementary school located in College Station. As of June 2005, there were 66 community shelters in the state; 58 of them were built in school districts. The most prominent example is Sebastian County's Fort Smith public schools with a total of 15 shelters. Most of the shelters within or around the schools have a capacity for 500; some can house up to 1,000 people.

More than 100,000 children, teachers, and local residents in 60 school districts across Arkansas are safer because of the shelters built to protect them through mitigation grants from ADEM and FEMA. The shelter program began in 1999 and, since then, at least 350,000 square feet of shelter space has been constructed in schools and is being used on a daily basis as libraries, computer rooms, or physical education centers. According to ADEM, the total cost for the project is approximately \$40 million at an estimated cost of \$395 per child.

## School Shelter Best Practices

There are several examples of how individual school districts are taking action to protect their students; here are just a few:

- Jackson County's Tuckerman School District retrofitted the hallways in three of its older buildings (two high schools and one elementary school) for use as safe rooms. The safe rooms were constructed of concrete floors and walls, reinforced with steel rebar, reinforced roofs, and new steel doors. The hallways also provided additional seismic strengthening to withstand earthquake forces.



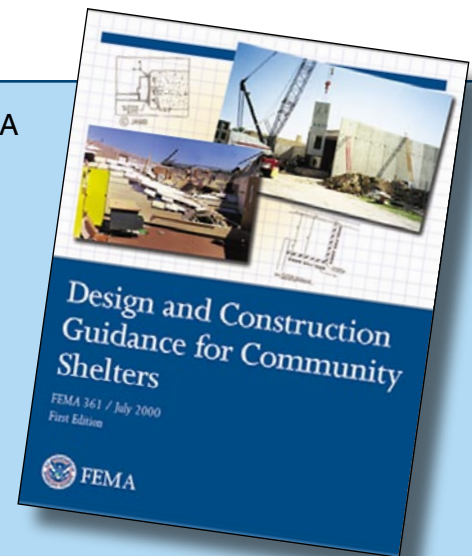


*The College Station Elementary School shelter during construction (left) and the completed stand-alone shelter (right). (SOURCE: WAPDD)*



- After the 1999 tornadoes damaged several of White County's Beebe School District's schools, Hazard Mitigation Grant Program (HMGP) funds were used to retrofit the hallways of several of the buildings for use as safe rooms.
- At College Station Elementary School, the shelter site was selected based on the needs of the population within both the community and the Pulaski County School District. The College Station shelter is designed to hold approximately 600 occupants, providing shelter for the students, faculty, residents, and guests in the school district, as well as an equal number of College Station residents in compliance with the Americans with Disabilities Act (ADA).
- The City of Fort Smith (Sebastian County) has a population of approximately 80,270. Since 1954, it has been hit by 24 tornadoes. The Fairview Elementary School contains a free-standing community tornado shelter on the school property, adjacent to existing school buildings. It is designed to accommodate all 560 students and 60 staff, plus an equal number of residents (total capacity of 1,000). The safe room is a single-story structure (approximately 6,375 square feet) and includes restrooms, storage, and mechanical space.

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### Building a Community Shelter

A community shelter is a windowless room that can accommodate a large number of people, from as few as 12 to several hundred. They are specially designed and constructed for natural hazards as stated in the guidelines in FEMA 361, *Design and Construction Guidance for Community Shelters*.

### An Automated Alarm System in Place

Each shelter in the Fort Smith area has a satellite dish that is coordinated to receive radio alarm signals from the city's weather service. These signals are the same frequency as the NOAA alarm.



Exterior and interior of the shelter at Raymond Orr Elementary School in Fort Smith. (SOURCE: WAPDD)

### Effective Outreach and Education: Getting the Word Out to Both Students and Residents

Arkansas' Department of Education provided funds to continue educating both students and local residents on disasters specific to their communities and how they can protect themselves from these disasters.

#### ■ Pulaski County's Arkansas School for the Blind

Middle and high school students provided emergency and disaster preparation kits to the blind and deaf communities of central Arkansas. This project involved collecting shelter supplies, including special vibrating and/or flashing smoke detectors. Please refer also to FEMA's publication *Community Wind Shelters: Background and Research*

for more information on shelter supplies. Instructions and emergency information sheets were developed in Braille and large print. The funds were also used to develop an emergency shelter site on campus that contains generators as back-up in case power is lost due to ice storms, tornadoes or other severe weather conditions. The shelter is open to local community residents, and an awareness campaign was held to inform the surrounding residents about the shelter.



#### ■ Faulkner County's Vilonia Middle School

Through the efforts of the school's Video Production Network, students interviewed firefighters, police, and emergency personnel to develop professional videos and brochures on tornado awareness safety and also on ice storm preparedness. The videos were provided free of charge to the public as a resource for community organizations, various clubs, churches, senior centers, nursing homes, and all of the schools.

### ■ Crawford County's J.J. Izard Elementary School

The 3rd and 4th grade students of J.J. Izard Elementary learned tornado safety issues from local emergency personnel and prepared an oral presentation about a tornado safety program. On weekends, students offered the program to the community and provided posters.

## A Shelter Operation Plan

A successful shelter requires a successful operations plan to cover the process or steps to be followed before, during, and after a tornado watch and/or warning. A shelter operations plan should include the following:

### Before the tornado watch or tornado warning:

- Form a shelter management team
- Define responsibilities of each member
- Establish and follow shelter maintenance procedures and schedules
- Establish and follow drill procedures and a drill schedule

### When a tornado watch is issued and in effect:

- Alert the shelter management team
- Monitor weather conditions
- Inspect the shelter and access routes to the shelter to ensure the area is ready for occupants

### When a tornado warning is issued:

- Activate the shelter management team
- Alert the students and staff and direct them to go to the shelter
- Count and record all individuals in the shelter
- Secure the shelter
- Monitor the storm from within the shelter

### After the tornado warning has expired:

- Determine if weather conditions allow occupants to leave the shelter
- Clean the shelter and restock any emergency supplies

## Basic Shelter Supplies

Shelter space should contain, at a minimum, the following safety equipment:

- **Flashlights** with continuously charging batteries (one flashlight per 10 shelter occupants)
- **Fire extinguishers** appropriate for use in a closed environment with human occupancy, surface-mounted on the shelter wall (number required based on occupancy type)
- **First aid kits** rated for shelter occupancy
- **NOAA weather radio** with continuously charging batteries
- **Radio** with continuously charging batteries for receiving commercial radio broadcasts
- **Extra batteries** for radios and flashlights
- **Audible sounding device** that continuously charges or operates without a power source (e.g., canned air horn) to signal rescuer workers if shelter egress is blocked

## What Kind Of Financial Support Is Available?

Two of the most commonly used Federal grants for constructing safe rooms are the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM). Since 2004, several school districts and communities throughout the state have received more than \$25 million from FEMA's HMGP and more than \$4 million from FEMA's PDM program. Matching state funds (25 percent) for the school district and community safe rooms have totaled more than \$7 million. Please refer to FEMA's website <http://www.fema.gov/plan/prevent/saferoom/funding.shtm> for additional information on funding and initiatives.

These two programs share the same purpose of protecting communities from natural disasters, but have different periods of funding availability and eligibility considerations. The HMGP provides funds to states and local communities after a disaster declaration to protect public or private property through various mitigation measures, such as acquiring structures from hazard-prone areas, retrofitting structures, constructing safe rooms, or developing mitigation plans. For additional information, refer to FEMA's website <http://www.fema.gov/government/grant/hmgp/index.shtm>.

The PDM program is a nationally competitive program that provides funds to states and communities, including Tribal governments, so they may continue to reach a higher level of risk management capability through the implementation of hazard mitigation planning and mitigation projects prior to a disaster event. Community officials should contact their State Emergency Management Agency for updated information and future funding opportunities. For more information, refer to FEMA's website <http://www.fema.gov/government/grant/pdm/index.shtm>.

The primary responsibility for selecting and administering mitigation activities resides with the state. Mitigation grant programs, including the HMGP, are administered through the state. Each state sets mitigation priorities and selects project applications that are developed and submitted by local jurisdictions. Funding for these programs is limited; therefore, states and local government officials must make difficult decisions as to the most effective use of grant funds. After the eligibility review, the state forwards the applications consistent with state mitigation planning objectives to FEMA for review and approval. FEMA awards mitigation grant funds to the state, which disburses those funds to its communities. Approved projects are implemented by the communities.

ADEM manages a number of programs that make funding, equipment, and/or training available to jurisdictions and agencies in Arkansas. The list below gives a brief outline of the programs available.

### **Arkansas Residential Safe Room Program**

This state program assists Arkansas homeowners who choose to install a shelter or safe room on their property. The program covers up to 50 percent of the cost and installation not to exceed \$1,000.

### **Arkansas Hazard Mitigation Program**

The Arkansas Hazard Mitigation Program provides funding for projects in cities, counties, or municipalities that have had repetitive damage situations, whether it is from floods, wind storms, earthquakes, or other types of disasters. State mitigation programs challenge communities to select priority sites where repetitive damages occur and find permanent solutions to these problems. The state cap on projects is \$150,000 (50 percent state, 50 percent local).

## Protecting the State's Citizens for Today and Tomorrow

The State of Arkansas' commitment to safety against tornadoes and other severe weather conditions is evident in both the local and state government agencies working together to find solutions to reduce risks and protect residents by promoting safe rooms in residences and community shelters in public schools.

## Sources of Information

Refer to FEMA's *Community Wind Shelters: Background and Research*, August 2002, <http://www.fema.gov/government/grant/pdm/index.shtm>.

## Related Websites

- Arkansas Department of Emergency Management (ADEM), <http://www.adem.state.ar.us/>
- Arkansas Emergency Management Grants, <http://www.adem.state.ar.us/> (*click on Grants*)
- Arkansas Department of Education, <http://arkansased.org>
- Electronic Grants System, <http://www.fema.gov/government/grant/egrants.shtm>
- Funding and Initiatives for Safe Rooms and Community Shelters, <http://www.fema.gov/plan/prevent/saferoom/pubinits.shtm>
- Funding Guidelines for the Hazard Mitigation Grant Program (HMGP), <http://www.fema.gov/government/grant/hmgp/index.shtm>
- Funding Guidelines for Pre-Disaster Mitigation (PDM), <http://www.fema.gov/government/grant/pdm/index.shtm>
- National Performance Criteria for Tornado Shelters, <http://www.fema.gov/plan/prevent/saferoom/criteria.shtm>
- National Oceanic and Atmospheric Administration (NOAA), <http://www.noaa.gov/>
- NOAA National Weather Service (NWS), <http://www.nws.noaa.gov/>
- Safe Rooms and Community Shelters, [http://www.fema.gov/hazard/tornado/to\\_saferoom.shtm](http://www.fema.gov/hazard/tornado/to_saferoom.shtm)
- Tornado Information, <http://www.fema.gov/business/guide/section3e.shtm>
- Wind Science and Engineering Research Center at Texas Tech University, <http://www.wind.ttu.edu>
- Western Arkansas Planning and Development District (WAPDD), <http://www.wapdd.org>



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