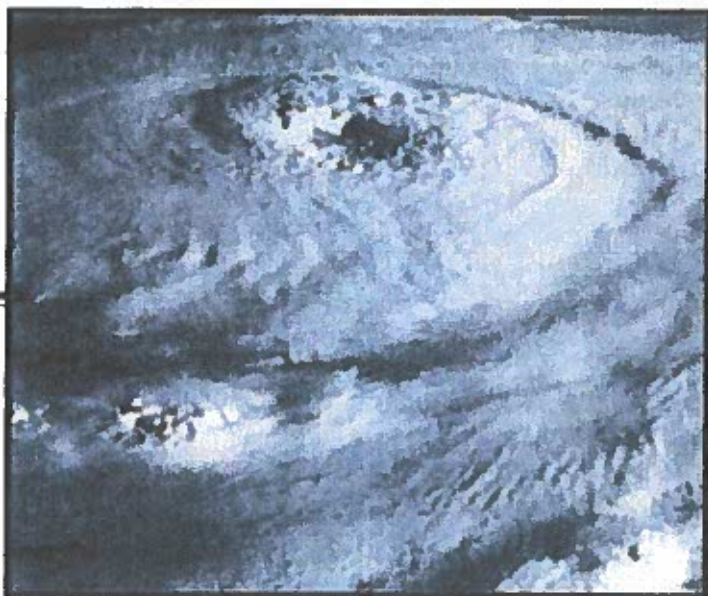




*Standards
for
Hurricane
Evacuation
Shelter
Selection*



**American
Red Cross**

Together, we can save a life

An interagency group comprised of the Federal Emergency Management Agency, the U.S. Army Corps of Engineers, the Environmental Protection Agency and Clemson University, has developed hurricane evacuation shelter selection standards. These standards reflect the application of technical data compiled in hurricane evacuation studies, other hazard information, and research findings related to wind loads and structural problems. These standards are supplemental to information contained in ARC 3041, *Mass Care: Preparedness and Operations* concerning shelter selection.

Planning considerations for hurricane evacuation shelters involve a number of factors and require close coordination with local officials responsible for public safety. Technical information contained in Hurricane Evacuation Studies, storm surge and flood mapping, and other data can now be used to make informed decisions about the suitability of shelters.

In the experience of the American Red Cross, the majority of people evacuating because of a hurricane threat generally provide for themselves or stay with friends and relatives. However, for those who do seek public shelter, safety from the hazards associated with hurricanes must be assured. These hazards include—

- Surge inundation.
- Rainfall flooding.
- High winds.
- Hazardous materials.

The following standards address the risks associated with each of these hurricane-associated hazards.

Surge Inundation

In general, hurricane evacuation shelters should not be located in areas vulnerable to hurricane surge inundation. The National Weather Service has developed mathematical models, such as Sea, Lake, and Overland Surges from Hurricanes (SLOSH) and Special Program to List Amplitudes of Surges from Hurricanes (SPLASH), that are critical in determining the potential level of surge inundation in a given area.

- Carefully review inundation maps in order to locate all hurricane evacuation shelters outside of Category 4 storm surge inundation zones.
- Avoid buildings subject to isolation by surge inundation in favor of equally suitable buildings not subject to isolation. Confirm that ground elevations for all potential shelter facilities and access routes obtained from topographic maps are accurate.
- Do not locate hurricane evacuation shelters on barrier islands.

Rainfall Flooding

Rainfall flooding must be considered in the hurricane evacuation shelter selection process. Riverine inundation areas shown on Flood Insurance Rate Maps (FIRMs), as prepared by the National Flood Insurance Program, should be reviewed. FIRMs should also be reviewed in locating shelters in inland counties.

- Locate hurricane evacuation shelters outside the 100-year floodplain.
- Avoid selecting hurricane evacuation shelters located within the 500-year floodplain.
- Avoid selecting hurricane evacuation shelters in areas likely to be isolated due to riverine inundation of roadways.
- Make sure a hurricane evacuation shelter's first floor elevation is on an equal or higher elevation than that of the base flood elevation level for the FIRM area.
- Consider the proximity of shelters to any dams and reservoirs to assess flow upon failure of containment following hurricane-related flooding.

High Winds

Consideration of any facility for use as a hurricane evacuation shelter must take into account wind hazards. Both design and construction problems may preclude a facility from being used as a shelter. Local building codes are frequently inadequate for higher wind speeds.

- If possible, select buildings that a structural engineer has certified as being capable of withstanding wind loads according to **ASCE (American Society of Engineers) 7-98** or **ANSI (American National Standards Institute) A58 (1982)** structural design criteria. Buildings must be in compliance with all local building and fire codes.
- Failing a certification (see above), request a structural engineer to rank the proposed hurricane evacuation shelters based on his or her knowledge and the criteria contained in these guidelines.
- Avoid uncertified buildings of the following types:
 - Buildings with long or open roof spans longer than 40 feet.
 - Unreinforced masonry buildings.
 - Pre-engineered (steel pre-fabricated) buildings built before the mid-1980s.
 - Buildings that will be exposed to the full force of hurricane winds.
 - Buildings with flat roofs or built with lightweight materials.
- Give preference to the following:
 - Buildings with 10°-30° pitched, hipped roofs; or with heavy concrete roofs.
 - Buildings no more than 60 feet high.
 - Buildings in sheltered areas (protected from strong winds).
 - Buildings whose access routes are not tree-lined.

Hazardous Materials

The possible impact from a spill or release of hazardous materials should be taken into account when considering any potential hurricane evacuation shelter.

All facilities manufacturing, using, or storing hazardous materials (in reportable quantities) are required to submit *Material Safety Data Sheets* (emergency and hazardous chemical inventory forms) to the Local Emergency Planning Committee (LEPC) and the local fire department. These sources can help you determine the suitability of a potential hurricane evacuation shelter or determine precautionary zones (safe distances) for facilities near potential shelters that manufacture, use or store hazardous materials.

- Facilities that store certain reportable types or quantities of hazardous materials may be inappropriate for use as hurricane evacuation shelters.
- Hurricane evacuation shelters should not be located within the ten-mile emergency planning zone (EPZ) of a nuclear power plant.
- Chapters must work with local emergency management officials to determine if hazardous materials present a concern for potential hurricane evacuation shelters.

Interior Building Safety Criteria During Hurricane Conditions

Based on storm data (e.g., arrival of gale-force winds), determine a notification procedure with local emergency managers regarding when to move the shelter population to pre-determined safer areas within the facility. Consider the following:

- Do not use rooms attached to, or immediately adjacent to, unreinforced masonry walls or buildings.
- Do not use gymnasiums, auditoriums, or other large open areas with long roof spans (longer than 40 feet) during hurricane conditions.
- Avoid areas near glass unless an adequate shutter protects the glass surface. Assume that windows and the roof will be damaged and plan accordingly.
- Use interior corridors or rooms.
- In multi-story buildings, use only the lower floors (no higher than 60 feet) and avoid corner rooms.
- Avoid any wall section that has portable or modular classrooms in close proximity, if these are used in your community.
- Avoid basements if there is any chance of flooding.

Least-Risk Decision Making

Safety is the primary consideration for the American Red Cross in selecting hurricane evacuation shelters. When anticipated demands for hurricane evacuation shelter spaces exceed existing capacity as defined by the preceding standards, there may be a need to utilize less preferred facilities. It is critical that shelter selection decisions be made carefully and in consultation with local emergency management and public safety officials. This process should include the following considerations:

- No hurricane evacuation shelter should be located in an evacuation zone for obvious safety reasons. All hurricane evacuation shelters should be located outside of Category 4 storm surge inundation zones. Certain exceptions may be necessary, but only if there is a high degree of confidence that the level of wind, rain, and surge activities will not surpass established shelter safety margins.
- When a potential hurricane evacuation shelter is located in a flood zone, it is important to consider its viability. By comparing elevations of sites with FIRMs, one can determine if the shelter and a major means of egress are in any danger of flooding. Zone AH (within the 100-year flood plain and puddling of 1-3 feet expected) necessitates a closer look at the use of a particular facility as a sheltering location. Zones B, C, and D may allow some flexibility. It is essential that elevations be carefully checked to avoid unnecessary problems.
- In the absence of certification or review by a structural engineer, any building selected for use as a hurricane evacuation shelter must be in compliance with all local building and fire codes. Certain exceptions may be necessary, but only after evaluation of each facility, using the aforementioned building safety criteria.
- The Red Cross uses the planning guideline of 40-square feet of space per shelter resident. During hurricane conditions, on a short-term basis, shelter space requirements may be reduced. Ideally, this requirement should be determined using no less than 15 square feet per person. Adequate space must be set aside for registration, health services, and safety and fire considerations. Disaster Health Services areas should still be planned using a 40-square feet per person calculation. On a long-term recovery basis, shelter space requirements should follow guidelines established in ARC 3041, *Mass Care Preparedness and Operations*.

Hurricane Evacuation Shelter Selection Process

General procedures for investigating the suitability of a building or facility for use as a hurricane evacuation shelter are as follows:

- Identify viable sites. Evacuation and transportation route models must be considered.
- Complete a risk assessment on each viable site. Gather all pertinent data from SLOSH and/or SPLASH (storm surge), FIRM (flood hazard) models; determine the facility base elevation; and obtain hazardous materials information and previous studies concerning each building's suitability.
- Have a structural engineer evaluate the facility and rate its ability to withstand wind loads according to ASCE 7-98 or ANSI A58 (1982) structural design criteria.
- Inspect the facility and complete a *Red Cross Facility Survey* (ARC Form 6564) and a *Self-Inspection Work Sheet Off Premises Liability Checklist*, in accordance with ARC 3041. Note all potential liabilities and the type of construction. Consider the facility as a whole. One weak section may seriously jeopardize the integrity of the building.

Increasing Shelter Inventory

An annual review of all approved hurricane evacuation shelters is required. Facility improvements, additions, or deterioration may change the suitability of a selected facility as a hurricane evacuation shelter. Facility enhancements may also enable previously unacceptable facilities to be used as hurricane evacuation shelters.

Work with officials, facility managers, and school districts on mitigation opportunities. Continue to advocate that the building program for new public buildings, such as schools, should include provisions to make them more resilient to possible wind damage. Suggest minor modifications of municipal, community, or school buildings, such as the addition of hurricane shutters, while buildings are being planned. Such modifications will make them useful as hurricane evacuation shelters.

Finally, add any new shelters to chapter shelter system and disaster response plans. Share shelter information with local emergency planning partners and the state lead chapter for Disaster Services for inclusion in state disaster response plans.