



Hurricane Evacuation Shelter Selection Standards

Disaster Cycle Services Job Tools Respond Program

Purpose

To help ensure safe shelter for an evacuating public, an interagency group comprised of the Federal Emergency Management Agency (FEMA), the U.S. Army Corps of Engineers, the Environmental Protection Agency (EPA), and Clemson University supported the development of the 1992 hurricane evacuation shelter selection standards. These standards reflect the application of technical data compiled from hurricane evacuation studies, other hazard information, and research findings related to wind loads and structural problems. The American Red Cross continues to coordinate with scientific sources to maintain and update these standards as new information becomes available. The standards are supplemental to information contained in the following Red Cross doctrine concerning shelter selection:

- [Operating a Shelter Job Tool](#)
- [Sheltering Standards and Procedures](#)
- [Facility Management Standards and Procedures](#)
- [Shelter Facility Survey](#)
- [Disaster Facility Requirements Checklist](#)
- [Facility Use Agreement](#)

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

With the vast amount of technical knowledge that exists today, in advance of any hurricane threat, the Red Cross will no longer support (with materials, people, or money) shelters that do not meet the minimum requirements stated in this job tool. The Red Cross vigorously supports all safe sheltering efforts within our capabilities.

Standards to Address Hazards Associated with Hurricanes

In the experience of the Red Cross, the majority of people evacuating due to 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 standards below address the risks associated with each of these hurricane-associated hazards.

Surge Inundation

In hurricane planning, 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), that are critical in determining the potential level of surge inundation for a given area. Steps to follow in ensuring shelters are safe from surge inundation include:

- Carefully review inundation maps to ensure that all hurricane evacuation shelters are located outside of Category 4 storm surge inundation zones, except for the coastline from Virginia to Maine where shelters must be located outside of Category 3 storm surge zones. This difference in surge vulnerability is based on current climatology science and the statistical improbability of a Category 5 hurricane occurring north of the NC/VA state line to align with hurricane evacuation and planning tools released by the National Hurricane Center (NHC).
- Due to the intricate nature of specific levees and mitigation systems and the uncertainty built into current modeling, any area that is listed as a “leveed area” without a surge value on inundation maps will be considered located in a **Category 1 Surge Zone/A Flood Zone**. In order for shelters to be located behind a leveed area, actual surge and flood vulnerability for the area must be shared with Red Cross and reviewed by national headquarters to ensure all parameters of safe sheltering have been met.
- Avoid buildings subject to isolation by surge inundation in favor of equally suitable buildings not subject to isolation. Confirm the accuracy of base flood elevations for all potential shelter facilities and access routes obtained from topographic maps.
- Do not locate hurricane evacuation shelters on barrier islands.

Rainfall Flooding

Rainfall flooding must be considered in the hurricane evacuation shelter selection process. Flood Insurance Rate Maps (FIRMs), as prepared by the National Flood Insurance Program, should be reviewed, particularly for riverine inundation areas and for shelters in inland counties.

- Locate hurricane evacuation shelters outside the 100-year floodplain.
- While it is permissible to locate hurricane evacuation shelters within the 500-year floodplain, this tactic should be avoided if alternative facilities are available outside of the floodplain.
- Avoid selecting hurricane evacuation shelters in areas likely to be isolated due to riverine inundation of roadways.
- Ensure 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 Flood Insurance Rate Map area.
- Consider the proximity of shelters to any dams and reservoirs to assess flow upon failure of containment following hurricane-related flooding.
- All buildings with flat roofs must have a scheduled maintenance program to keep drains/scuppers free from debris buildup during the year.

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 high wind speeds.

- Ideally, select buildings that a structural engineer has certified as being capable of withstanding wind loads according to American Society of Engineers (ASCE) (7-10) or Safety Equipment Institute (SEI) / American National Standards Institute (ANSI) (7-05) structural design criteria. Ideally, these structures should meet Emergency Shelter Criteria in International Code Council - ICC-500 (2014) and accessibility requirements in ICC A117.1 (2009).
- Acceptable buildings must meet ASCE 7-98 or ANSI A58 (1982) structural design criteria.
- Buildings must be in compliance with all local building and fire codes.
- If a certification is not available (see first bullet above), request a structural engineer through local authorities 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 prefabricated) 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 with access routes that 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 resources can help determine the suitability of a potential hurricane evacuation shelter or determine precautionary zones (safe distances) for potential shelters near facilities 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 10-mile emergency planning zone (EPZ) of a nuclear power plant. Shelters must be located outside the one-mile emergency planning zone.
- Regions 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 pre-storm hazards (e.g., arrival of gale-force winds or flooding rains) work with local emergency managers to determine a notification procedure regarding when to move a shelter population to predetermined safer areas within a 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, unless the building meets engineered requirements mentioned in the [High Winds](#) section.
- 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 three-story and larger 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 the community.
- Avoid basement(s) if there is any chance of flooding.

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 taking into consideration evacuation and transportation route models.
- Complete a risk assessment on each viable site.
 - Gather all pertinent data from the Sea, Lake, and Overland Surges from Hurricanes and the Flood Insurance Rate Maps models.
 - Determine the facility's base flood elevation.
 - 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 American Society of Engineers (ASCE) 7-10 or Safety Equipment Institute (SEI)/ American National Standards Institute (ANSI) 7-05 structural design criteria. Ideally, these structures should meet Emergency Shelter Criteria in ICC-500 (2014) and accessibility requirements in ICC A117.1 (2009). As a next step, facilities that meet ASCE 7-98 or ANSI A58 (1982) may be considered. Other facilities not meeting the criteria mentioned above should only be considered after these have been reviewed.
- Inspect the facility and complete a *Red Cross Shelter Facility Survey* and other required paperwork, in accordance with Red Cross doctrine.
 - 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.

- Determine required time to resource shelters with food, blankets, and personnel prior to opening and share with local emergency management to help ensure decisions are made with enough time to correctly get the facility operational. On an annual basis, share capabilities with local emergency management to assist with overall evacuation planning.

Increasing Shelter Inventory

An annual review of all selected hurricane evacuation shelters is required. Facility improvements, additions, or deterioration may alter 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 these structures more useful as hurricane evacuation shelters. Finally, add any new shelters to the regional shelter plan, the National Shelter System (NSS), and disaster response plans. Share shelter information with local emergency planning partners.

Planned 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 or Category 3 storm surge inundation zones for the coastline from Virginia to Maine. Certain exceptions may be made when absolutely necessary and 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 topographical maps and Flood Insurance Rate Maps, one can determine if the shelter and major means of egress are in any danger of flooding.
 - No shelter should be located in V or A Zones.
 - Zones B, C, and D may allow some flexibility. Requiring a closer look at elevations to avoid unnecessary problems of flooding, ponding, or isolation.
- 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 an 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-foot per person calculation. On a long-term recovery basis, shelter space requirements should follow the guidelines established in Red Cross doctrine.