



10 NOVEMBER 2005

COMDTPUB P16700.4
NVIC 8-93 Change - 1

NAVIGATION AND VESSEL INSPECTION CIRCULAR 08-93, CHANGE 1

Subj: CH-1, EQUIVALENT ALTERNATIVES TO 46 CFR SUBCHAPTER H
REQUIREMENTS RELATED TO MEANS OF ESCAPE, SAFE REFUGE AREAS,
AND MAIN VERTICAL ZONE LENGTH.

Ref: (a) COMDTPUB P16700.4, NVIC 8-93

1. PURPOSE. This document revises reference (a) by adding a new enclosure (4) to provide a methodology for the acceptance of equivalent alternatives to the 46 CFR Subchapter H requirements for means of escape and safe refuge areas onboard passenger vessels with a maximum enclosed width in excess of 40 m (131 ft.). 46 CFR 72.05 and 72.10 provide the design criteria for the onboard means of escape on traditional passenger vessels. However, these regulations were developed for vessel designs having a maximum enclosed width of 40 m (131 ft.). The alternatives in this enclosure are limited to vessels that:

- a. Do not operate on international voyages subject to SOLAS;
- b. Have no overnight passenger accommodations;
- c. Are primarily comprised of large public spaces;
- d. Operate on limited protected routes accepted by the cognizant Officer in Charge, Marine Inspection; and
- e. Do not carry cargo or vehicles.

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NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 08-93, CH-1

2. **ACTION.** Officers in Charge, Marine Inspection are encouraged to bring this NVIC to the attention of appropriate individuals in the marine industry within their zones. Vessel owners electing to employ the alternatives outlined in this NVIC must do so in all areas. The Coast Guard will also consider other design alternatives which are shown to provide an equivalent level of protection. This NVIC is available on the World Wide Web at www.uscg.mil/hq/g-m/nvic/. Within the Coast Guard, it will be distributed by electronic means only.
3. **DIRECTIVES AFFECTED.** “Equivalent Alternatives to 46 CFR Subchapter H Requirements Related to Means of Escape, Safe Refuge Areas, and Main Vertical Zones,” COMDTPUB P16700.4, NVIC 8-93, is amended by inserting the enclosure of this document as a new enclosure (4).
4. **BACKGROUND.**
 - a. The provisions for onboard means of escape and structural fire protection in Subchapter H and NVIC 8-93 are based on vessel designs with a maximum enclosed width of 40 meters (131 ft.). This enclosure has been prepared to supplement the existing guidance by providing a means to evaluate the fire protection and life safety issues on vessels of greater enclosed width, and includes consideration of dockside evacuations.
 - b. Both NVIC 8-93 and Subchapter H are based on the premise that main vertical zone bulkheads are provided every 40 meters (131 ft.) to subdivide the vessel into discrete fire areas. The main vertical zone bulkheads are required to extend for the entire enclosed width of the vessel. In response to industry requests, enclosures (1) and (2) of NVIC 8-93 were developed to provide a method for evaluating equivalent life safety arrangements for vessels designed with main vertical zone bulkheads spaced more than 40 meters (131 ft.) apart longitudinally. However, the alternative provisions in enclosures (1) and (2) were not intended to apply to vessels with an enclosed width in excess of 40 m (131 ft.).
 - c. Vessels with an enclosed width in excess of 40 m (131 ft.) could have very large public spaces with a significantly higher passenger capacity than vessels previously envisioned during the development of Subchapter H or NVIC 8-93. If these vessels periodically carry passengers while dockside as well as underway, the means of escape provisions must be arranged to ensure an orderly, prompt evacuation in either configuration. The prescriptive means of escape provisions in Subchapter H and NVIC 8-93 do not account for this. The alternatives in enclosure (4) have been selected to ensure that a comprehensive evaluation of the evacuation system is performed at the design stage to eliminate localized congestion and to ensure that the means of escape are adequate to allow efficient movement of all of the occupants from the public spaces to dedicated areas of refuge or to protected dockside exits before untenable conditions occur, assuming worst case fire scenarios.
 - d. Enclosure (4) recognizes performance-based fire protection engineering methods using computer fire models as evaluation tools for this purpose.
5. **DISCLAIMER.** While the guidance contained in this document may assist the industry, the public, the Coast Guard, and other federal and state regulators in applying statutory and

NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 08-93, CH-1

regulatory requirements, this guidance is not a substitute for applicable legal requirements, nor is it in itself a rule. Thus, it is not intended to nor does it impose legally binding requirements on any party, including the Coast Guard, other federal agencies, the states, or the regulated community.



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Encl: (1) Equivalent Alternatives to 46 CFR 72.05 for Wide Main Vertical Zones

ENCLOSURE 4

**Equivalent Alternatives to 46 CFR 72.05 for
Wide Main Vertical Zones**

General

1. Enclosures (1) and (2) provide equivalent alternatives to the fire protection requirements for the onboard means of escape, number of passengers carried, and main vertical zone (MVZ) length listed in 46 CFR Subchapter H. These alternatives were developed for vessels with main vertical zones that do not exceed 40 meters (131 ft) in width. Vessels of greater width present fire protection and life safety issues that are not fully addressed by the guidance in enclosures (1) and (2).
2. This enclosure provides technical guidance for the additional fire protection and life safety features considered necessary for vessels with MVZs or LMVZs that exceed 40 meters (131 ft.) in width and that may periodically operate dockside. Throughout this enclosure, wide main vertical zones are referred to as WMVZs. The Coast Guard has determined that WMVZ vessels operating on certain protected service routes and subject to the additional guidance in this enclosure can be accepted as equivalent to the Subchapter H requirements for General Fire Safety. This enclosure is applicable only to vessels that:
 - a. Do not operate on international voyages subject to SOLAS;
 - b. Have no overnight passenger accommodations;
 - c. Are primarily comprised of large public spaces;
 - d. Operate on limited protected routes accepted by the cognizant Officer in Charge, Marine Inspection; and
 - e. Do not carry cargo or vehicles.
3. WMVZ vessels will be accepted if they comply with enclosures (1) and (2) as modified by this enclosure, including the following additional fire protection and life safety measures:
 - a. Submittal of an acceptable performance-based tenability analysis using selected design fire scenarios to show that safe conditions will be maintained in public spaces

and along all required escape paths for the total time needed to safely evacuate all passengers and crew to the onboard refuge areas and to dockside exits (if applicable);

- b. Provision of dedicated onboard refuge areas sized for 100% of the occupants, and if the vessel operates dockside, provision of an exit system sized for 100% of the occupants that provides access to the dockside exit discharge facilities. The refuge areas or exits may be horizontally located on all four sides of the WMVZ;
- c. The use of a performance-based exit system design that is determined by a tenability analysis performed for each project, instead of a prescriptive exit system design where the number and location of stairtowers and maximum travel distances are specified. For WMVZs, exit system design features such as 100% horizontal evacuation through multiple exit doors to promote rapid evacuation and limit queuing may be considered by the analysis;
- d. The use of materials with restricted surface flammability on the exposed surfaces in the WMVZ to limit flame spread and smoke production;
- e. The use of permanently marked exit access aisles in public spaces to permit unobstructed access to the exits; and
- f. The use of clearly marked illuminated exit pathways and illuminated exit signs connected to the vessel's emergency power supply.

Detailed explanation of each of these considerations is provided in the following paragraphs.

Background

4. Enclosures (1) and (2) are based on the concept of providing qualified onboard refuge areas for LMVZ vessels where the passengers can relocate in the event of a fire. The assumption is made that only one fire will occur at a time while underway and thus only one main vertical zone will require evacuation. The onboard refuge areas provide a protected location where the passengers can relocate until the fire is extinguished or until the vessel needs to be evacuated.
5. The location of the onboard qualified refuge areas depends on the spacing of the main vertical zone bulkheads. On vessels with main vertical zones that do not exceed 61 m (200 ft) in length, qualified refuge areas may be located within the fire affected zone. If the main vertical zone spacing is greater, the qualified refuge areas must be located in another zone, either fore or aft of the affected main vertical zone. The outboard passageways on LMVZ vessels are accepted only as exit discharge areas (EDA) which are used as a means of access to the out of zone qualified refuge areas. Thus, on a LMVZ vessel, the qualified refuge areas can only be located fore and aft of the LMVZ bulkhead.
6. Enclosures (1) and (2) specify a number of more conservative safety measures for the onboard means of escape in exchange for the longer spacing of the MVZ bulkheads. The

guidance in enclosures (1) and (2) specifies that at least one stairtower should be located within each main vertical zone, the maximum travel distance from all areas to an exit is limited to 22 m (72 ft.), and the cumulative width of the exit doors in MVZ bulkheads is limited to 25% of the total width of the bulkhead. For WMVZ vessels, the design of the evacuation system and the location and number of exit doors will be specifically determined for each vessel by a performance-based tenability analysis. Moreover, to promote rapid evacuation and limit queuing, qualified refuge areas or exits may be horizontally located on all four sides of the WMVZ if they are separated by A-class divisions.

Tenability analysis

7. The means of escape arrangements on WMVZ vessels should provide ready access to protected onboard refuge areas. For vessels that may also operate dockside, the means of escape should include both onboard qualified refuge areas and a protected exit system that leads to dockside exit discharge facilities. Both means of escape should be sized to accommodate 100% of the passengers and crew. The location and arrangement of the refuge areas and the necessary provisions for dockside evacuation are specific to the intended operation of each project. Therefore, submitters are encouraged to meet with the Coast Guard (cognizant OCMI and the Marine Safety Center) early in the design process to discuss the proposed design and tenability analysis.
8. A performance-based tenability analysis must be performed for all WMVZ vessels to demonstrate that there is sufficient time available for the passengers and crew to safely evacuate to the refuge areas before heat and smoke from agreed upon design fire scenarios could result in unsafe conditions. Key input parameters of the tenability analysis (including the required travel path configuration, the total travel distance, the minimum design fire scenarios and required safety margins) are specific to each project and are established in conjunction with the Coast Guard prior to performing the tenability analysis. For vessels that are required to have a dockside means of escape, the tenability analysis must be performed for both the onboard and dockside evacuation scenarios.
9. A recognized performance-based fire protection engineering approach should be used for the tenability analysis. Currently, two approaches accepted by the Coast Guard are the *SFPE Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings*, Society of Fire Protection Engineers and National Fire Protection Association, 2000, and the International Maritime Organization MSC/Circ. 1002 *Guidelines on Alternative Design and Arrangements for Fire Safety*.
10. Design fire scenarios with a range of typical fuel loads representative of the expected operating conditions are used to model the expected heat and smoke production for the actual room geometry of the protected space. With this information, the predicted effects of the fires are compared against the required evacuation time calculations to confirm that sufficient time is available for evacuation before unacceptable levels of heat, toxic gases or reduced visibility occur. The fuel packages selected for the analysis should be

representative of the maximum fuel loading expected during operation of the vessel. The use of a conservative approach should be clearly demonstrated in all calculations.

11. Calculation of the required evacuation time should be based on a recognized performance-based fire protection engineering approach. The required evacuation time includes the initial detection time, the time to notify occupants, passenger awareness and reaction time, the walking time needed to reach the exits, and a calculation of the time needed to pass through the exit doors, accounting for queuing time. International Maritime Organization MSC/Circ. 1033, *Interim Guidelines for Evacuation Analyses for New and Existing Passenger Ships* uses a passenger awareness and reaction time of at least 5 minutes, which considers a portion of the passengers to be elderly or otherwise mobility impaired. Other approaches adopted or recognized by the National Fire Protection Association (NFPA) or Society of Fire Protection Engineers (SFPE), will be considered if they are applicable to public spaces such as casinos, and are shown to be equally conservative as the guidance in MSC/Circ. 1033.
12. The tenability analysis must include an uncertainty analysis to evaluate the accuracy of the conclusions. An uncertainty analysis consists of multiple computer iterations with varied input data and design fire scenarios. A sufficient number of design fire scenarios and possible obstructions to the means of escape should be considered to clearly illustrate how different fire scenarios could impact the margin of safety between the required and the available evacuation times.
13. The ceiling height of a space is critical to the amount of time available for safe evacuation. High ceilings provide a plenum for the accumulation of smoke and combustion gases, and can provide longer tenability times. For vessel designs where a high ceiling is not feasible, an engineered smoke management system could be used as an alternative approach. However, since a smoke management system is an active system, a failure modes and effects analysis (FMEA) or similar methodology must be used to demonstrate the reliability of the active components. Smoke management systems do not need to be separate fire protection systems, if the normal ventilation system can be designed for this purpose through the use of heat resistant components that direct the exhaust to the atmosphere away from all refuge areas. NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas* provides further guidance on the design of smoke management systems.

Refuge area and exit system criteria

14. The dedicated onboard refuge areas and exit system should be separated from the public area by A-60 divisions. The HVAC system for the refuge areas or exit system must not serve the public space, thus ductwork should not penetrate the separating divisions.
15. Subchapter H permits interior finish materials in public spaces over 47 square meters (500 ft²) with combustible furnishings (type 7 spaces) to include a 2/28 inch veneer of combustible materials. The regulations do not restrict the surface flammability of the finishes used in large public spaces. The use of unrestricted surface finishes could adversely impact evacuation if there is rapid flame spread across interior surfaces that

impedes the means of escape. Thus, all interior finish materials applied to bulkheads and ceilings and floor coverings should be low flame spread materials. Ceiling and bulkhead finishes must be USCG type approved under 46 CFR 164.012. Carpeting in public spaces must either have a flame spread of 75 or less and a smoke developed rating of 100 or less when tested to ASTM E-84, or alternatively, a critical radiant flux of not less than 0.8 watts/cm² with a specific optical density not to exceed 450 in both flaming and non-flaming modes when tested to ASTM E-648 and ASTM E-662, respectively. Low flame spread materials approved under type approval series 164.112 or 164.117 that meet parts 2 and 5 of Annex 1 of the International Maritime Organization Fire Test Procedures Code will also be accepted as meeting these criteria.

Exit access aisles

16. Large public spaces such as casinos and restaurants are typically arranged to maximize the number of gaming machines, tables and fixtures located throughout the space, creating circuitous means of escape paths that do not lead directly to the exit doors. Such arrangements can slow the evacuation from the area because of localized congestion. To avoid this, the arrangement of the public spaces onboard WMVZ vessels must be arranged with clearly defined permanent access aisles of at least 44 inches in clear width leading directly to the exit doors.
17. It is important that the exit access aisles be kept clear at all times and the configuration of the public space should not be changed in any manner that would restrict the clear width of the travel paths. The access aisles should be clearly marked and illuminated with exit pathway lighting as well as directional exit markings, such as illuminated floor level exit signs or low-location lighting systems, designed to ensure that the passengers can easily follow the exit path in the event of reduced visibility inside the public space. The pathway lighting and directional exit markings should be powered from the emergency power supply. Additionally, the directional exit markings should be a type that is readily distinguishable from the normal space décor.