

ACADEMIC FORUM FOR NUCLEAR AWARENESS

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US Standard for Radiation Protection Shelters

This is a digest, prepared by Dr. Y. Socol, AFNA. The language of the official FEMA TR-87 document was preserved wherever possible.

Protection

The minimum level of protection for public fallout shelters is PF 40[1]. This is achieved, e.g., by 30cm of concrete or 45cm of earth[2]. 30cm of concrete, covered by 45cm of earth, yield protection factor PF 1600.

Occupancy

Nothing in this standard shall be construed as preventing the dual use or multiple use of normal occupancy space as fallout shelter space, providing the minimum requirements for each are met.

Space allowances for use as a fallout shelter shall be as follows.

(a) Floor Area. A minimum of 1 m² (10 sq. ft.) of net floor area shall be provided per shelter occupant.

(b) Head Room. A minimum head room of 2m (6.5 ft.) shall be provided.

Ventilation and Temperature

Fresh Air. A minimum of 5m³ per hour (3 cu. ft. of fresh air per minute) per fallout shelter occupant shall be provided to prevent oxygen depletion and carbon dioxide buildup in the fallout shelter.

Effective Temperature. The fallout shelter shall have a ventilation rate sufficient to maintain a daily average effective temperature of not more than 28°C (82°F).

Ventilation Systems. Ventilation systems for public fallout shelters shall be designed to provide the ventilation rates required above during periods when

electric power may not be available from public service utilities. Emergency electrical generators or positive natural ventilation flow for fallout shelters may be used to meet this requirement.

Air Intake. Ventilation systems shall be designed so that the outside air intake opening is positioned not less than 60cm (2-ft.) above any surface on which radioactive fallout could be deposited. The air intake opening shall be hooded or positioned to prevent deposits of radioactive fallout on the intake face.

Filters. Special filters are not required. No filters are required for fallout shelter ventilation equipment if the face velocity at the outside air intake is less than 0.75m/s (150 ft. per minute).

Access and Egress

Public fallout shelters shall have no fewer than two widely separated means of access and egress leading to other spaces of the building or directly to the outdoors.

Emergency-type hatchways may be used as a means of access and egress, provided that at least one means of access and egress for the fallout shelter is a standard opening conforming to the requirements of the local building codes. Hatchways, if used, shall be a minimum size of 60x90cm (24-in. x 36-in.).

Sanitation

Toilets, either flush-type operating from the normal water supply system, or chemical or other types, shall be provided on the basis of one toilet per 50 fallout shelter occupants. Toilets may be outside the fallout shelter in other portions of the building provided that they may be reached by occupants of the fallout shelter without exposure to direct fallout radiation. Austere provisions, such as empty water containers, for disposal of waste may be considered as fulfilling this requirement.

Drinking Water

A minimum of 13.5 liters (3.5 gallons) of potable water shall be available for each fallout shelter occupant. This would be sufficient for drinking and basic cleanliness during 5-6 days[2].

Supplies and Storage

Consideration shall be given to fallout shelter supplies and their storage, including radiation-measuring instruments, but provision of such supplies is not required.

Full-Protection Nuclear Shelters

In the USA (and other countries also) there are standards for two types of shelters: nuclear shelters and fallout shelters. Nuclear shelters are to provide protection from nuclear blast (shock wave, penetrating radiation etc.) and from the subsequent fallout radiation. Fallout shelters are to provide protection from the after-blast fallout radiation only. The above standard deals with fallout shelters only, and FEMA did not publish a concise standard for nuclear shelters.

There is no reasonable protection from direct hit of a nuclear device; such hit, however, is greatly improbable. However, if exploded at optimal height (600m for Hiroshima-yield device, e.g.), the nuclear blast over-pressure reaches 3-5 atm. For nuclear shelters, semi-official instructions of the US Oak Ridge National Lab[3] recommend 1 atm (15 psi) blast protection (constructions defined as "seismic" readily meet this demand). For comparison, Soviet standard[4] demands the same 1 atm blast protection and additional radiation protection PF 1000 – both demands can be readily met by proper design and construction.

References

1. Federal Emergency Management Agency TR-87. Standards for Fallout Shelters. 1977.
2. Domestic Nuclear Shelters (A Home Office Guide). Sackville Press (Billericay) Ltd. for HMSO, 1981.
3. Cresson H. Kearny. Nuclear War Survival Skills. Oak Ridge National Lab, 1977.
4. Technical Arrangements of Civil Defense, SNiP 2.01.51-90. Moscow, 1990 (in Russian).