DEFENSE CIVIL PREPAREDNESS AGENCY
WASHINGTON, D.C. 20301

Technical Memorandum 72-1
(Supersedes TM 69-1)
November, 1972

TECHNICAL STANDARDS FOR FALLOUT SHELTER DESIGN

I. Purpose

This memorandum establishes the technical architectural and environmental standards for fallout shelter design.

II. General

These technical standards are viewed as objectives in the design of shelter in new buildings or buildings which will undergo major remodelings or additions. If all of the desired features of a shelter cannot be provided in the original construction, primary attention should be given to providing shielding only, and the addition of other features should be planned at a later time. Every building, to some extent, provides a natural shield against fallout radiation, and any shielded space could be important in protecting people in an emergency. The architectural and engineering professions are urged, if they cannot meet the standards fully because of financial or technical constraints, to conform as closely as possible to the standards. On the other hand, if it is feasible to exceed these standards within financial or technical constraints, architects are urged to do so.

These standards are not intended to establish expensive requirements for shielding or habitability which are not justified or required by the intended normal use of the structure. Where added design features are required to meet protection standards, emphasis should be on no-cost or low-cost solutions which make fullest use of design techniques to optimize shelter capability. For example, where added capability in ventilation or temperature control is required, use should be made of such natural ventilation as may be available and auxiliary air-moving devices.

Maximizing the number of shelter spaces is a desirable design objective. However, the shelter areas should at least accommodate the normal occupants of the building.

III. Shelter Standards

A. Protection Factor: The minimum recommended level of protection for the design of public fallout shelters is PF 40. A protection factor (PF) expresses the relation between the amount of fallout gamma radiation that would be received by a person in an unprotected location and the amount that he would receive if protected in the same location. For

example, an occupant of a shelter with PF 40 would be exposed to a gamma radiation dose rate only 1/40th (or 2.5 percent) of that to which he would be exposed if he were unprotected in the same location. Computations of PF's shall be made in accordance with methods approved by the Defense Civil Preparedness Agency (see TR-20, Vol. 1, available to Department of Defense Certified Fallout Shelter Analysts). The PF should be computed for the least protected area in the shelter. In addition to the above manual methods of computation, DCPA has available a program for computer evaluation of buildings in the design process. Assistance for utilizing this computerized procedure may be obtained through the Professional Advisory Service Centers (contact DCPA Regional Offices) or the Corps of Engineers (CE) and Naval Facilities Engineering Command (NAVFAC) field offices.

B. Floor Space: 10 square feet of usable space per person with a minimum headroom of 6½ feet.

C. Volume: 65 cubic feet per person.

D. Electric Power: Commercial electric power may or may not be available during the shelter period. For shelter design purposes, assume commercial electric power will not be available. Provision of emergency power should be considered. If emergency power is available, it should be tied into the lighting, ventilation, and other minimum essential operational loads of the shelter area(s). Simplified instructions should be posted to permit shelter occupants to activate the emergency power system if necessary. Sufficient fuel to last for at least 7 days should also be provided if emergency generators are used. Protection of electrical components and generators from the electromagnetic pulse should be considered in accordance with DCPA publication TR 61-B, EMP Protective Systems.

E. Lighting: No special lighting is required in shelter areas which receive natural light. Windowless areas, above or below ground, should be provided with low-cost permanent or improvised lighting at least sufficient to silhouette people and objects to maintain safety and minimize confusion. If emergency electric power is not available, battery operated lights (installed to designate means of egress for firecode requirements) should be collected and used for shelter purposes. Appropriate disconnects or switches should be provided to permit intermittent use.

F. Ventilation: The shelter should have a ventilation rate sufficient to maintain a daily average effective temperature (ET) of not more than 82° F. for at least 90 percent of the days of the year. Effective Temperature (ET) is an empirical index which combines, in a single number, the effects of temperature, humidity, and air movement on the sensation of warmth or cold felt by the human body. The zones of equal ventilation rates in cfm per person are shown in Figure 1. (See TR-20, Vol. 3) To prevent oxygen depletion and carbon dioxide buildup, the minimum rate of fresh air supply should be 3 cubic feet per minute per shelter occupant.

However, the maximum daily average of 82° ET for 90 percent of the days is an overriding requirement. The minimum recommended shelter temperature to be maintained during the occupancy period is 50° F. To achieve desired ventilation rates in shelter areas when emergency electric power is not available, consideration should be given to improving the natural ventilation flow and by providing expedient manually operated air moving devices.

Special filters are not required for ventilation systems. Filters designed for normal ventilation requirements should be adequate for use in emergencies under fallout conditions. No filters are required if the normal face velocity at the intake is less than 150 feet per minute.

G. Structural: Compliance with local codes.

H. Fire Resistance: Compliance with local codes for normal occupancy.

I. Hazards: Hazardous utility lines such as steam, gas, oil, etc., should not be located in or near the shelter unless provision is made to control such hazards by valving or other means.

J. Access and Egress: Comply with local codes for normal-use building occupancy. As a minimum, buildings with shelter should have no less than two widely separated means of access and egress, the space required for free travel of one column of people. In no case shall a single passage width be less than 24 inches. Emergency-type hatchways may be used as means of access or egress. They should be designed so that any normal size adult can readily enter or leave the shelter.

K. Depreciation: The shelter features should be designed for the useful life of the facility.

IV. Shelter Supplies

A. Drinking Water: A minimum of 3½ gallons of potable water is recommended for each shelter occupant. If reasonable assurance cannot be provided by local officials that the public water system will be operable in a fallout environment, consideration should be given to other means of meeting the requirement. A portion of the water requirement can be obtained from the trapped potable water supply in the hot water heaters, storage tanks, and supply mains and piping by suitable valving. Consideration should also be given to the use of an auxiliary water well serving the building if it would be operable.

B. Sanitation: Toilets should be provided on the basis of one per 50 occupants. Toilets may be outside the shelter area in other parts of the building, provided they are readily accessible without hazardous exposure to fallout gamma radiation. If reasonable assurance cannot be provided by local officials that normal facilities will be operable in a fallout environment, other austere provisions should be made for the disposal of waste. Consideration should be given to using chemical toilets.

C. Radiation Instruments: Radiation-measuring instruments are furnished by the Federal Government. Consideration should be given to providing a secure storage space for these instruments.

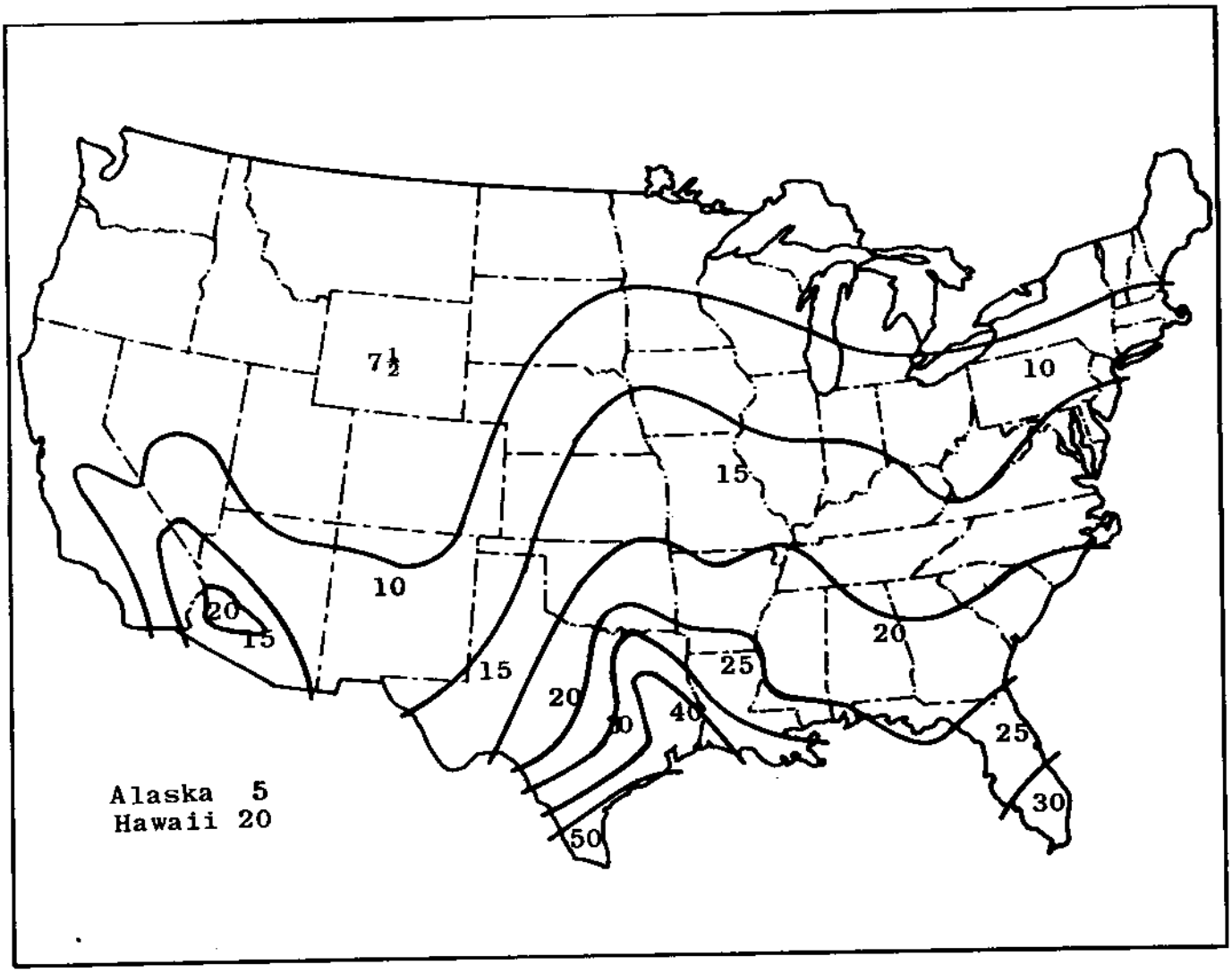

FIGURE 1.-- ZONES OF EQUAL VENTILATION RATES IN CFM PER PERSON

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Architects and Engineers Qualified in Fallout Shelter Analysis
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