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INTEGRATED GUIDANCE FOR SHELTER MANAGEMENT

VOLUME II

PLANNING A GROUP SHELTER

A Planning Guide

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OCD REVIEW NOTICE

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INTEGRATED GUIDANCE FOR SHELTER MANAGEMENT

This document is one in a series of three volumes designed to aid the shelter manager in meeting his responsibilities in peacetime and, should the need occur, under emergency conditions.

What binds these documents into a unified package is a concept of shelter management. This concept holds that every shelter manager must prepare himself, through training, and must prepare his shelter facility, through planning, to meet any situation requiring the use of the shelter. In addition, the concept holds that the in-shelter performance of the manager will improve if he is provided with guidance materials to support his decision making, no matter how well trained he may be.

Training, planning, and in-shelter guidance, therefore, are viewed as three key features of a shelter management program, and each is represented by a separate volume in the Integrated Guidance for Shelter Management series.

Each document in the set stands as a complete work that can be read and applied independently of the others. However, each volume contains technical information that will not be found in the others. For example, the subject of food is treated in a different fashion in each volume. The training document discusses background factors and management considerations in shelter feeding. The planning guide emphasizes pre-occupancy procedures for establishing a feeding capability in the shelter. The guide for in-shelter use presents a priority-ordered listing of management actions pertaining to shelter feeding. This illustration suggests that, for a shelter manager to derive maximum benefit from the guidance materials, he should consider the document as an integrated package. When the reader approaches the documents as a unified set, the volume numbers reflect the optimum order in which they should be read.

Volume I, Introduction to Shelter Management, has been designed as a training text. It provides an

overview of the scope and nature of the shelter manager's duties and responsibilities. The text emphasizes general management principles and considerations, rather than specific operational procedures. This enhances its utility as an introduction to the topic of shelter management.

Volume II in this set of documents is entitled Planning a Group Shelter. It deals with the peacetime responsibilities of the shelter manager which focus upon the achievement and maintenance of a state of operational readiness of a shelter facility. The planning guide discusses the principal factors that must be considered in planning and developing a group shelter. It also identifies methods for meeting the requirements associated with these factors, and presents specific information that would permit the shelter manager to select methods appropriate to his needs.

The Shelter Manager's Guide, the last volume in the series, has been developed for use during the period of shelter occupancy. This means that the content, as well as its organization and presentation, has been designed for optimum usefulness under emergency conditions. The Guide lists priority-ordered management actions and decisions, arranged according to the phases of a shelter stay.

The selection and recruitment of shelter managers is another key aspect of the shelter management program. Guidance in this area is more appropriately used by those responsible for obtaining shelter managers than by the managers themselves. For this reason, a fourth published guide entitled Selection and Recruitment of Shelter Managers, has not been included in this unified package. The Selection and Recruitment Guide, however, is available through the same channels through which the other guidance documents have been obtained.

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I. INTRODUCTION

THE SHELTER PLAN

The current national shelter program calls for the designation of adequate shelter areas in existing buildings and the stocking of these areas with food, water, medical and sanitation supplies, and radiological monitoring equipment. A great variety of additional resources are available within these structures which may be applied to the task of shelter living. The effective use of all available resources, however, depends upon careful shelter planning prior to an attack. This planning should result in a written statement regarding the anticipated way of accomplishing each shelter function. The statement should include the physical resources to be utilized for each method, the procedures for the use of these resources, and the personnel requirements involved.

A topical outline for a possible shelter plan is presented in Table L. In most cases, a chapter should be allocated to each shelter function. A number of factors must be considered within each function to assure adequate shelter planning. These factors comprise the basic units of shelter planning, and usually will warrant treatment as major headings within each chapter of the plan.

Usually, a variety of methods are available for dealing with each factor in shelter planning. To identify and evaluate those methods in terms of their apparent utility under the constraints imposed by a particular planning situation is a primary task in the development of a shelter plan. Even where funds are limited or non-existent, adequate planning can lead to very good use of available resources. For almost every factor involved in shelter planning, a number of possible methods are available which will satisfy the requirements through the use of existing facilities. These available resources include:

1. The general structure in which a shelter may be housed.

Table I

Topical Outline for a Shelter Plan

- I. Introduction**
 - A. General Description of Shelter Area**
 - B. Floor Plan of Shelter Area**
- II. Shelter Management**
 - A. Organization Chart**
 - B. Management Area**
 - C. Management Facilities**
- III. Radiological Protection**
 - A. Assessment of Available Shielding**
 - B. Provision of Additional Shielding**
 - C. Radiological Monitoring**
 - D. Decontamination**
- IV. Auxiliary Power**
 - A. Types of Equipment**
 - B. Procurement**
- V. Maintenance**
 - A. Requirements**
 - B. Facilities**
 - C. Personnel**
- VI. Temperature and Atmosphere Control**
 - A. Air Exchange**
 - B. Control of Air Temperature**
 - C. Air Purification**
- VII. Water Supply**
 - A. Amount**
 - B. Provision and Storage**
 - C. Purification**
 - D. Distribution**
- VIII. Food**
 - A. Procurement**
 - B. Storage**
 - C. Preparation**
 - D. Distribution**
 - E. Provision of Eating Facilities**

Table I (continued)

- IX. Lighting
 - A. General Shelter Lighting
 - B. High Intensity Lighting
 - C. Back-Up Lighting
- X. Fire Protection
 - A. Prevention
 - B. Detection
 - C. Suppression
- XI. Medical
 - A. General Medical Area
 - B. Medical Facilities
- XII. Sanitation
 - A. Human Waste Disposal
 - B. Garbage and Trash Disposal
 - C. General Shelter Cleanliness
 - D. Personal Hygiene
 - E. Body Disposal
- XIII. Communications
 - A. Communication Area
 - B. Equipment
- XIV. Security
 - A. Security Area
 - B. Security Facilities
- XV. Sleeping Facilities
 - A. General Strategy
 - B. Provision of Sleeping Facilities
- XVI. Warning and Shelter Entry
 - A. Warning Systems
 - B. Access Routes
 - C. Shelter Entrances
 - D. Shelter Loading
- XVII. Non-Operational Activities
 - A. Training and Education
 - B. Shelter Service Activities
 - C. Physical Fitness Activities
 - D. Religious Activities
 - E. Recreation

2. The equipment, tools, and other "hardware" available within or near the structure.
3. Food, water, medical supplies, and other provisions available within or near the structure.

Certain Government-supplied resources also are available at little or no cost. The Federal Marking and Stocking Program is, of course, the prime example of such Government aid. Other Federally-provided resources include both technical consultation and training programs for shelter managers and radiological monitors.

A number of methods for meeting the requirements associated with a particular planning factor may be feasible within the scope of available resources. The key step in shelter planning is to decide upon a specific method for dealing with each factor. In addition to the effective use of resources, this decision should be based on the extent to which a method will meet shelter requirements and the ease with which it may be implemented to bring the shelter system into operational readiness. An initial statement of the apparent "best method" for dealing with each shelter planning factor should first be presented in a Basic Shelter Plan. Two samples of such a basic shelter plan are included as Appendices A and B of this document. Appendix A was developed by the American Institutes for Research to serve as an example of a basic shelter plan. Appendix B is a basic shelter plan developed by a local civil defense director for a real shelter. Editorial changes have been made in the actual plan to correct grammatical and stylistic errors. Whenever possible, the authors' words were used and the content was never changed. In addition to the editorial changes, sections dealing with shelter management, non-operational activities, lighting, security, and shelter maintenance were added to the plan.

Once the basic shelter plan has been prepared, the planner may begin to implement each method, thereby bringing his shelter to a state of operational readiness. This implementation may include the modification and/or construction of facilities, the

procurement and installation of supplies and equipment, the specification of operation and maintenance procedures, and the selection, recruitment, and training of necessary personnel. At times it may be necessary to alter, or even abandon, a particular method because it is found that certain resources are not available, personnel cannot be trained, etc. Such instances should be rare if the basic shelter plan is well thought out. If they occur, however, another method must be selected and implemented. As each method is implemented and the shelter approaches a state of operational readiness, the basic shelter plan should be revised accordingly. The final version of the plan, which might then be termed an operational plan, will reflect a state of actual readiness as opposed to planned readiness.

PURPOSE OF THE GUIDE

The purpose of this planning guide is:

1. To specify the principal factors which must be considered in planning and developing a shelter area within an existing structure.
2. To identify possible methods for meeting the various requirements associated with each of these factors.
3. To present sufficient information to permit the selection of specific methods for meeting each shelter requirement according to the needs and opportunities of a particular situation.

The implications of both implementation and shelter use of a particular method are presented where appropriate for use in basic planning. In certain cases, however, the actual implementation or use of a method may require technical guidance beyond the information contained in this document. Other documents, referenced in this report, are available as a source of such guidance. Thus, the guide, Planning a Group Shelter, should serve as the primary reference for the preparation of a basic shelter plan and as a useful secondary reference for the implementation of the plan.

NATURE OF THE GUIDE

Chapter II of this document deals with the organization of shelter management. This subject is discussed early in the planning guide because it is important to every shelter function and because the shelter management staff has a potential role in planning for the shelter.

Each of the remaining chapters of the guide deals with a general shelter function. Each chapter first provides information concerning the origin of the problems within a given area and the implications which they pose for shelter operations. The balance of each chapter identifies the major planning factors within each area and specifies the requirements for each planning factor. Specific methods are then presented for dealing with the planning factor under consideration. The information provided to facilitate decisions on the best method for a particular shelter situation includes:

1. The required equipment and facilities, including a description, the relative cost, and peacetime uses.
2. The conversion procedures, including the procurement and installation or modification.
3. The maintenance requirements.
4. The personnel and training requirements.
5. The general effectiveness of the method.
6. The potential user-acceptance and necessary orientation.
7. The technical references.

Some of this information may apply to all of the methods dealing with a particular factor. For example, specific training requirements exist for radiological monitors, regardless of the method used. In such cases, this information is presented as general information prior to the presentation of specific methods.

Finally, the peacetime or Government-supplied facilities will not always be available to meet every shelter need. This guide, therefore, discusses some methods involving equipment that can be bought or constructed specifically for use in the shelter. Provided also are recommendations and references regarding the available information about the selection and procurement of these items.

USE OF THE GUIDE

The development of a basic shelter plan should be initiated as soon as possible following the designation of a particular area as a fallout shelter. A shelter manager, of course, should be selected as soon as a structure is marked and possibly even before it is stocked with OCD supplies. The preparation of an operational plan should be the responsibility of this shelter manager. Shelter management training is strongly recommended as a prerequisite for the use of the planning guide. The training document, Introduction to Shelter Management (Bend & Collins, 1965), provides the necessary background material for shelter planning.

In small shelters a basic shelter plan probably can be prepared by the shelter manager, possibly with the help of his immediate deputy. Planning for large shelters, however, may be quite complex. In this case it may be desirable for the service deputies, and perhaps even some team heads (i.e., food, medical, radiological, etc.), to participate in shelter planning for their particular area of responsibility (See Chapter II). In any case, if the shelter cadre is selected prior to shelter entry, as is recommended for large shelters, it would be advisable to at least make the basic shelter plan available to them for their comments.

The importance of a written plan cannot be overstressed. This offers the following advantages:

1. It assures that all aspects of shelter planning are considered.

2. It provides an opportunity for interested parties to review each method.
3. It assures the continuity of shelter management by providing a permanent record of the shelter plan.
4. It establishes confidence on the part of the public who may use the shelter by reassuring them that there is a plan for their survival.

II. SHELTER MANAGEMENT

SELECTION OF A MANAGEMENT CADRE

The need for shelter management as an essential part of any shelter system has been emphasized in a number of documents concerning the National shelter program (OCD, 1963; Bend & Collins, 1965). The complexity of the shelter management job is evident to those who have received training in this area.

The selection of a management cadre is desirable as an early step in shelter planning for two principal reasons. First, the effective use of shelter facilities will require decisive and active management of the shelter from the very outset of any emergency. This management will be available only if key individuals are selected and trained prior to an attack. Secondly, it may be desirable for those who will be responsible for shelter operation during an emergency to participate in shelter planning. This fact has already been stressed in the discussion on how to use this guide.

The selection and recruitment of the management cadre can be a complex task. Guidance for this process can be found in the document, Selection and Recruitment of Shelter Managers (Smith & Jeffreys, 1965). Shelter management training should be available through your local civil defense organization.

DEVELOPING THE MANAGEMENT ORGANIZATION

The nature of a shelter management organization is discussed in manager training documents (Bend & Collins, 1965) and in guidance materials for in-shelter management (Brandegge & Bend, 1964). The specific structure of the community organization may vary in both the size and number of units according to such factors as the size and configuration of the shelter, the potential number of shelterees, and the probable characteristics of the shelter population (Bend, et al., 1963). A sample organization chart for 300 people

is presented in Figure 1 and one for 5,000 people is presented in Figure 2.

As in any organization chart, an attempt is always made to define each block of responsibility according to functional similarity. Thus, the deputy for operational services, for example, is responsible for medicine and sanitation, two functionally related areas, rather than medicine and communications, which involve entirely different skills and knowledges. When the planner considers the specific people who are available to him, as well as the particular characteristics of his shelter, he may wish to modify the sample organization. For example, if a highly qualified M.D. is available as a member of the shelter staff, it might be appropriate to create the position of deputy for health services to which the medical and sanitation teams are responsible, while retaining a deputy for operational services who is responsible for food, water, and security. By the same token, a shelter with outstanding mechanical facilities such as auxiliary power, ventilation, and air-conditioning may create a need to place equipment operation and maintenance at the deputy rather than team level in the organizational chart. The important factor is to see that all of the jobs which are necessary to meet the objectives of a shelter system are accounted for.

RESPONSIBILITIES OF THE SHELTER PLANNER

It is the responsibility of the shelter planner to assure that:

1. The management staff is organized in the manner most compatible with the needs of his particular shelter.
2. All management personnel receive the proper training.
3. In-shelter duties are clearly defined for his particular shelter.
4. Full use is made of available management personnel during shelter planning.

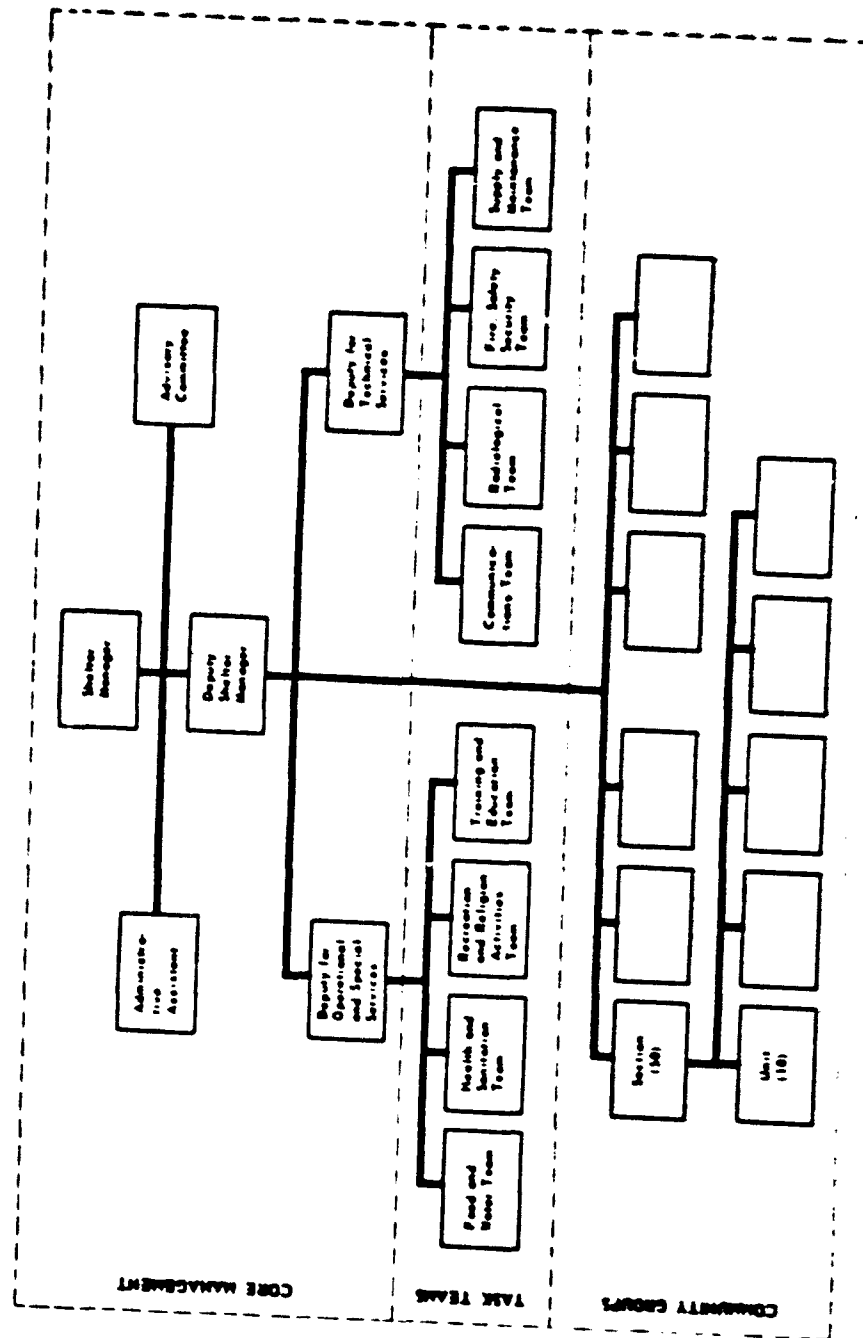


Figure 1. Sample Organization of a 300-Person Shelter

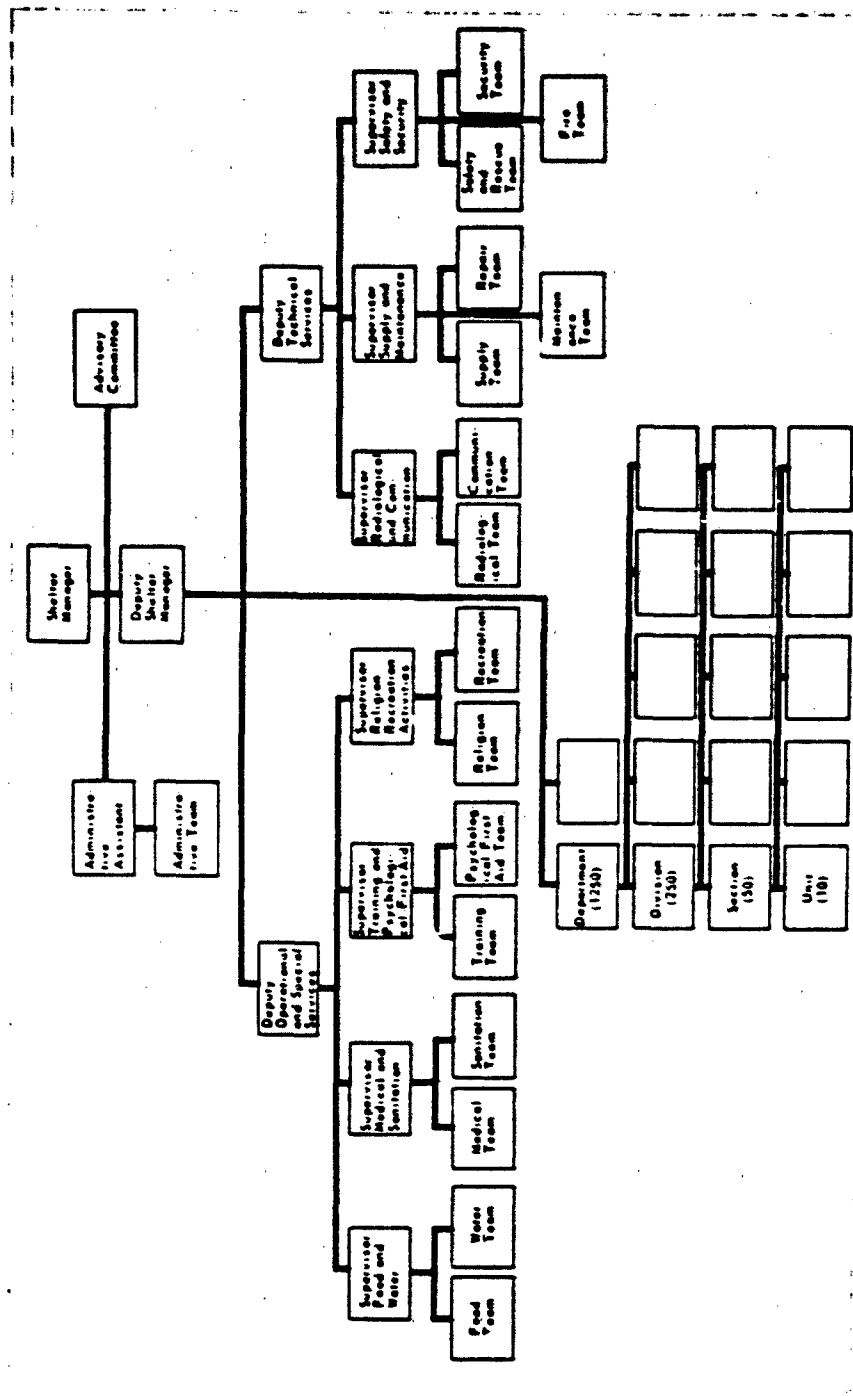


Figure 2. Sample Organization of a 5,000-Person Shelter

MANAGEMENT AREA

All shelters should have an area set aside for the use of the management staff. This area should be used for meetings of the shelter management staff and the advisory committee.

The shelter management area should be located near to the communication area and the security area. This will greatly facilitate control of the shelter organization. The area should be as isolated as possible from the rest of the shelter to insure that the shelter staff will not be continuously interrupted while carrying out their duties.

MANAGEMENT FACILITIES

Facilities for the management area should include paper and pens; desks or writing tables; chairs; and filing cabinets, drawers or something similar which can be used for storing shelter records. These resources are usually part of the existing facilities in any structure housing a shelter. At least one copy of the shelter's operational plan should also be stored in the management area.

Management has to have the necessary information about the shelterees with which to organize the shelter efficiently. Also, a permanent record may be needed of each shelteree to pass along to the appropriate authorities after shelter exit.

A Shelteree Registration Form serves these functions. It provides management with data on the manpower resources within the shelter, by indicating the distribution of skills and talents. Secondly, it identifies immediate or special problems of particular shelterees, such as illnesses requiring sustaining drugs. It provides information which can be used as a basis for assigning shelterees to shelter community groups. Finally, it serves as an aid in such recovery operations as location of lost family members, return of personal property, and population census.

A 5" x 8" index card is the ideal size and material for the form. A sample registration card is presented in Figure 3.

Plans should be made to locate the management area in a place where these facilities are stored or in use during peacetime. If this is not possible, the shelter planner should see that these facilities are moved to the shelter area upon receipt of an attack warning.

REGISTRATION FORM

Shelter: _____
Registration Number: _____

Name: _____

Address: _____

Age: _____ Sex: _____ Social Security No.: _____

Occupation: _____

Military Service Dates: _____ Rank: _____ Military Job: _____

Civil Defense Training: Yes _____ No _____ Which Ring? _____

Check the following activities in which you are skilled. Also circle any activities that are part of your normal occupation.

Administrator/Supervisor _____	Engineering _____	Police/Security _____
Air Conditioning and _____	Equipment Maintenance _____	Psychiatry/ _____
Ventilation Repair _____	and Repair _____	Psychology _____
Appliance Repair _____	Fire Fighting _____	Radio Operating _____
Building Custodian _____	First Aid Training _____	Radiological Training _____
Carpentry _____	Food Preparation _____	Safety Engineering _____
Child Care _____	Medicine _____	Science _____
Clergy _____	Military Police _____	Science Teaching _____
Construction _____	Nursing _____	Secretarial _____
Counseling _____	Office Management _____	Social Work _____
(Youth, Vocational) _____	Pharmacy _____	Store Managing _____
Dentistry _____	Plant Maintenance _____	Supply or Parts _____
Electrical Repair _____	Plant Safety _____	Distribution _____
Electronic Technician _____	Plumbing _____	Teaching _____
Warehouse Management _____	X-Ray Technician _____	Veterinary Medicine _____
Other: _____		

Education: (Circle last year of school completed)

Grade School: 1 2 3 4 5 6 7 8 High School: 1 2 3 4 College: 1 2 3 4

Other: (Specify) _____

Medical Problems requiring immediate or special attention: _____

Initial Assignment: _____ Permanent Assignment: _____

Other Members of Immediate Family:

Name	Relation	Age	Check if with you	Elsewhere—indicate where if known

Religious Preference: _____

List Hobbies, Talents, Skills not already mentioned: _____

DO NOT WRITE BELOW THIS LINE

Group Assignment: _____ Task Assignments: _____

Personal Property: Items Items Items

In-Shelter Medical Problems: _____

Other: _____

Figure 3. Registration Form

CHAPTER III. RADIOLOGICAL PROTECTION

GENERAL INFORMATION

A primary purpose of a fallout shelter program is to provide protection against radiological hazards. Radiological protection is therefore fundamental to shelter planning. Without the assurance of such protection, the other areas of shelter development are of little practical value.

Types of Shielding

Barrier Shielding

Gamma rays can travel many feet through air and can be most effectively reduced in intensity by placing enough mass between the source of radioactive fallout and the person being shielded to absorb the rays. Generally, the more dense the shielding material, the greater the protection offered. When radiation strikes a barrier, it may be absorbed and reduced in intensity. However, if the barrier is not sufficient to absorb it all, radiation may pass through the barrier in the same direction or be scattered in other directions. Consequently, to be protected from the threat of radiation by barrier shielding, a person must be surrounded by that shielding. The degree of protection depends upon total mass, which is determined by thickness and density of the shield. For example, 20 inches of concrete will provide shielding equivalent to 30 inches of earth.

Geometric Shielding

Another type of natural protection is provided by distance, or geometric shielding. Exposure is decreased with an increased distance between the fallout and the individual. If a person were standing on a smooth, evenly contaminated test plane, about 50 per cent of the fallout radiation reaching him would come from a radius within 50 feet of him, and 90 per cent from within 500 feet. A real surface, such as a street or lawn, has some degree of roughness which would reduce the contribution from sources at the greater distances and, thus, provide some additional shielding.

Protection Factor

The detailed and systematic appraisal of all such relevant variables will permit computation of the minimum protection factor afforded by a potential shelter area. This term expresses the relative reduction in the amount of radiation that would be received by a person in an unprotected location, compared to the amount he would receive if he were protected. For example, a completely unprotected person would be exposed to 40 times more radiation than a person inside a shelter with a fallout protection factor of 40 (Office of Civil Defense, 1965, p. 11).

Eight categories of protection factors have been used in the designation of shelter protection. They are shown in Figure 3.

The Federal Government is presently stocking shelters rated two through eight. Within a single OCD marked facility, there may be shelter spaces of varying protection categories.

	Category							
	1	2	3	4	5	6	7	8
Protection Factor	0-39	40-69	70-99	100-149	150-249	250-499	500-1,000	Over 1,000

Figure 4. Categories of Protection Factors

MAJOR PLANNING FACTORS

Three major factors which should be considered in planning for radiological protection are:

1. Assessment of the shielding already available in the dual-purpose structure.
2. Provision of additional shielding as necessary or desired.
3. Provision of radiological monitoring capability within the shelter.

Assessment of Available Shielding

Nature of Available Protection

The concept of dual-purpose shelters is based upon the fact that existing structures usually provide some radiation shielding as an inherent part of their construction. The degree of protection may greatly vary from one part of the structure to another. This variation, and the specific level of protection afforded at any point in the building, will depend on such things as:

1. Basement areas and/or heavy walls and ceilings of sufficient density to provide barriers shielding against direct penetration of radiation from fallout outside the structure.
2. A structural configuration which would provide geometric shielding by placing the shelterees in an area distant from the source of radiation. This type of protection is often afforded by high-rise structures.

In many cases, the existing shelter will have been assessed under the Federal Marking and Stocking Program. If this has not been done, the shelter planner should provide for assessment of the shelter area prior to planning for other major functions.

In situations where the main shelter area has already been assessed, the planner may wish to provide for additional assessment of areas with lower protection factors near to the shelter which might be useful for such shelter needs as the storage of used waste containers, etc.

Approaches to Assessment

The complexity involved in computation of a protection factor, and the importance of this factor in shelter planning, necessitate a careful and, if possible, professional assessment of available protection. When several potential shelter areas are available, shelter planners may wish to roughly appraise the protection afforded by each of these areas in order to determine whether a more formal survey and other steps toward development of a shelter are appropriate.

With the use of guidance materials available through local, state, or Federal civil defense organizations, individuals with some training in engineering or architectural design should be able to estimate the radiation protection available within an existing structure. Such estimates cannot be expected to be as accurate as those by professionally trained individuals. However, they can be useful at least in determining general shielding potential and whether or not a structure should be surveyed more formally as a possible dual-purpose shelter.

Professional assessment of available radiation protection may be obtained through request for participation in the National survey, use of professional consultants, and participation in formal training.

Requests for Participation in the National Survey. Shelter planners who feel that a particular structure will qualify for the National Marking and Stocking Program may request that it be surveyed as part of the Fallout Shelter Updating Program. This program will assess the protection of structures missed during the initial survey, or those which have been newly constructed or modified since that time. Requests for consideration in this program should be directed to local civil defense officials. The survey, conducted by Government-trained architects and engineers, will indicate the following:

1. Those areas within the dual-purpose structure which provide adequate radiation protection. (A protection factor of at least 40 is being used as a basis for designating shelter areas in the current Federal program).
2. The capacity of the designated shelter areas.
3. Steps which can be taken to provide adequate protection in other parts of the structure.

Those who request the Government survey should, of course, be prepared to sign a license permitting public marking and stocking of all adequately protected shelter areas with a capacity of more than 50 persons.

Use of Professional Consultants. An increasing number of architect/engineering firms through

participation in Government-sponsored courses and in the shelter-marking program are becoming familiar with techniques for assessing radiation shielding. These organizations may be available on a consulting basis for the development of private structures. Many of these firms were involved in the Federal marking program, and may be contacted through the local civil defense office. Colleges and universities also are good sources of qualified individual consultants. In all cases, care should be taken to assure that the consultant is trained and, preferably, experienced in the specific and unique problems associated with radiation shielding. A reliable firm or individual consultant should produce an appraisal of existing, or potential, radiation shielding equivalent to that provided by participation in the Federal Marking and Stocking Program.

Participation in Formal Training. Those responsible for shelter planning may send architect/engineering personnel to Government-sponsored courses and develop their own capability for the assessment of radiation protection. The availability of such courses should be determined through the local civil defense office. Identification of shelter areas in this matter does not necessarily involve participation in the marking and stocking program, but the assessment of radiation protection should be quite accurate.

Providing Additional Protection

Need:

If adequate radiation shielding is not available in the potential shelter area, it is very important to provide additional protection to an extent which raises the protection factor to a satisfactory level.

A protection factor of much more than 40 will be necessary for shelters in a geographical area for which particularly large amounts of high radioactive fallout may be anticipated, such as areas downwind of, and relatively close to, potential targets. Except for "hardened" shelters constructed to withstand blast effects in areas which also may be extremely "hot"

in terms of radiation, protection factors probably need not exceed 1,000.

Methods:

In some cases, entire walls may have to be constructed to provide adequate shielding. Most potential dual-purpose structures, however, will require additional shielding only at certain points around the shelter area. Windows, doors, and other openings may reduce the protection factor of an area which is otherwise well protected by the thickness of its walls and ceiling. Such openings must be blocked or baffled with concrete or other dense materials to provide adequate shielding.

These steps for providing additional protection may be taken long before an attack by constructing permanent baffle walls or by solidly blocking up wall openings. Another approach is to prepare to quickly form the additional shielding following an attack warning by using blocks or other building materials which have been set aside for that purpose, or which are always available for some peacetime use.

Inside the shelter, shelterees should be directed to shield doors, windows, and other exposed areas with sandbags or earth. If sandbags or earth are not available, any material which is dense can be used; for example, bookcases with books on shelves, file cabinets, and heavy equipment. Elevator shafts can be blocked by stopping elevators on the floor above the shelter.

The first approach, that of permanent modification in advance of an attack warning, has many advantages. As was pointed out earlier, adequate radiation shielding is fundamental to shelter effectiveness. This protection must be available when fallout first descends following an attack. The construction of protective barriers following an attack warning could be quite time consuming due to:

1. The substantial weight of building materials dense enough to provide adequate shielding.

2. The congestion of personnel which can be anticipated in and around the shelter following an attack warning.

The need for haste following a warning usually will necessitate "dry wall" construction of the barriers; that is, placing the building materials side-by-side and on top of one another without the use of mortar or other adhesive substances. The inherent instability of such construction makes the erection of free-standing walls over four feet high extremely difficult. Such barriers also would be susceptible to collapse in a crowded shelter. In contrast, shielding provided during peacetime can be sturdily constructed by professional contractors, and the protection factor of the shelter area formally reassessed when the modifications are complete.

In most dual-purpose structures, certain wall openings must be retained to meet ventilation requirements or permit personnel movement. In such cases, baffles can be constructed which permit personnel and air movement but effectively block radiation. This principle is illustrated in Figure 5.

Peacetime users of a dual-purpose structure may object to having windows and other openings blocked or even baffled prior to an attack. Attractive murals of outdoor scenes can be used to meet this problem in windowless shelter areas. If such an alternative is not possible or acceptable, post-warning shielding may be used. Techniques for facilitating this approach include the following:

1. Use of floor markings, which can be decorative in nature, to indicate where barriers should be erected.
2. Installation of "L" beams at window sills to support shielding material (Suggs, 1962). These braces can be used to support window boxes during peacetime. Figure 6 illustrates this technique.

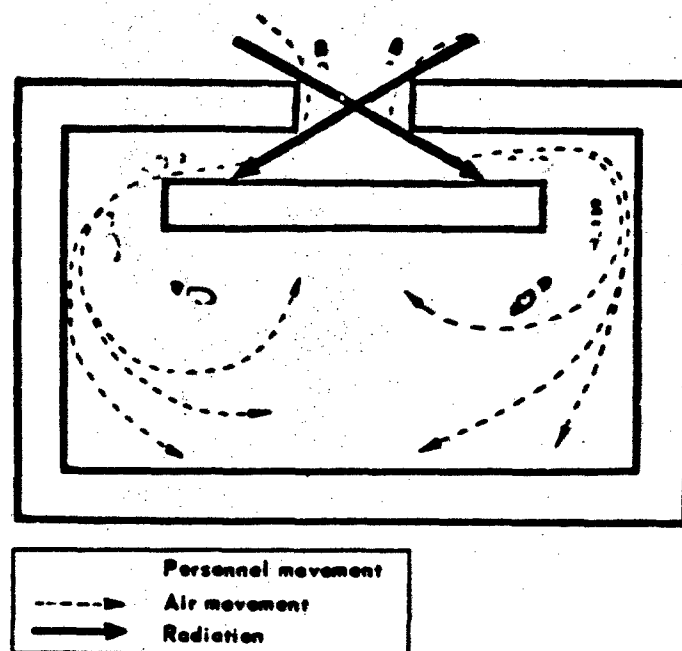


Figure 5. Baffle Shielding

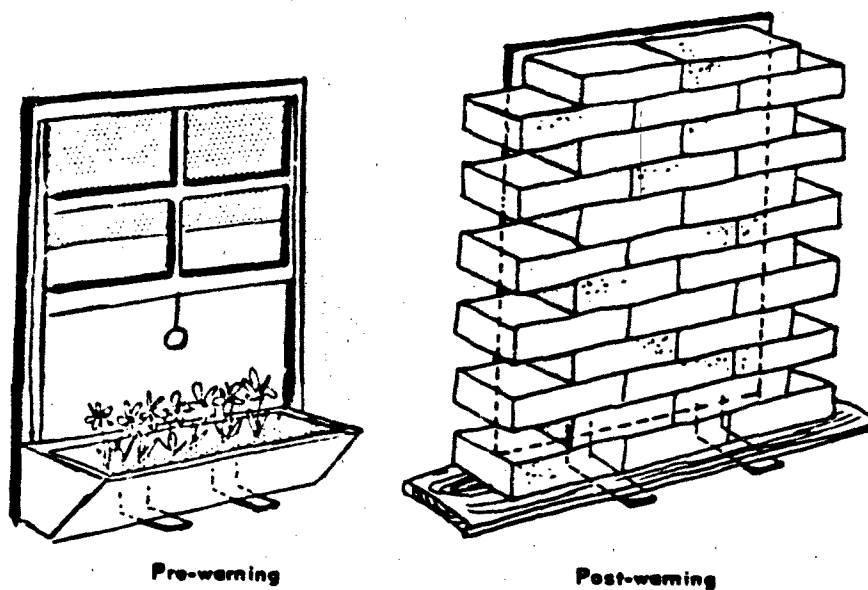


Figure 6. Post-Warning Window Shielding

RADIOLOGICAL MONITORING

Due to the critical nature of their tasks, radiological monitoring instruments should be both accurate and reliable and should be operable after storage for several years. Remember also that these instruments could be needed during the reconstruction stage following an attack, as well as during the shelter stay. For this reason, they should perform reliably through many weeks of continuous use. Ratemeters with a range of 0-500 R/hr, such as the CD V-715 instrument provided by the Federal Government, are quite adequate for shelter use. Dosimeters should have a reading range of 0-200 Roentgens in order to provide information within the range which is critical to man's health and safety.

Procurement of Instruments

Radiological instruments for shelter use will have to be obtained from the Government or purchased on the open market. Structures which qualify for the National Marking and Stocking Program will be provided with a community shelter radiation kit (CD V-777-1) in addition to the rest of their shelter provisions. Some dual-purpose shelters may qualify for appointment as Federal, state, or local monitoring stations. At least two trained monitors are required and four are recommended for each site. Specified communications facilities and a protection factor of 100 are also required. Each monitoring station is provided with a radiological defense monitoring set (CD V-777) suitable for general monitoring and shelter use.

A number of radiological monitoring instruments are available commercially. A complete kit, including at least one ratemeter, dosimeter, and battery-operated charger, has been purchasable for as little as \$25.00. Local civil defense authorities should be consulted to confirm the adequacy of any instruments with which the shelter planner is unfamiliar.

Personnel Requirements

Shelter planners must take into consideration the importance of the qualified personnel as well as adequate equipment needed for radiological monitoring.

Unlike certain other shelter equipment, radiological monitoring instruments should be used by pre-trained operators to assure maximum effectiveness in the shelter situation. Current OCD plans call for three radiological monitors in each shelter of 50-100 spaces, and five monitors in larger shelters (DOD, 1962).

Shelter monitors should participate in radiological monitoring courses which are now given in many communities. The local civil defense organization should be contacted to determine when a course may be available. In large shelters optimum training would involve at least one person's participation in the two-week course for Radiological Defense Officers, and subsequent training (four to five hours) of additional radiological monitors by the RDO. It is important that at least one monitor be assigned to each existing shelter.

Decontamination

Required Facilities

There should be little need for extensive decontamination within most dual-purpose shelters. When decontamination seems appropriate, simple "dry" procedures may be employed for personnel decontamination. The only facilities required are combs or brushes which usually are readily available in any shelter area. "Core" shelters which plan to expand following an attack may require larger brushes or brooms. Such materials which are available for peacetime use should be stored in or near the shelter area.

The shelter planner also should take into consideration the need for a decontamination area. If possible, this area should be separate from the main shelter in order to avoid disruption of routine shelter activities.

Personnel Requirements

Persons selected as decontamination personnel for the shelter should, if possible, receive instruction in decontamination procedures by a Radiological Defense Officer or other qualified individuals.

IV. AUXILIARY POWER

GENERAL INFORMATION

Certain shelter equipment may require the support of some power source. It is almost never reasonable to assume that municipal power serving a dual-purpose structure will remain intact following a nuclear attack. All essential equipment can be operated on self-contained batteries or powered manually to meet minimum shelter needs. The effectiveness of many shelter systems can be significantly increased, however, by the support of a relatively large central power supply.

A major advantage of auxiliary power is the increase in shelter capacity which can be achieved through the use of electrically-powered forced ventilation, or even air-conditioning systems. Another use of auxiliary power is for shelter lighting. It also may be used for support of communications and, if necessary, water pumping. In addition, auxiliary power may be useful for heating elements used in the preparation of food, or even refrigeration for food preservation. Waste disposal facilities, such as a sump-pump, also may use auxiliary power. Where completely adequate power facilities are available, this power may serve other uses, such as support of special medical facilities or consoles used in radiological monitoring.

MAJOR PLANNING FACTORS

Type of Equipment

Motor-Driven Generators

For those having them, diesel or gasoline engine-driven generators offer the greatest emergency power capability. However, there are many possible sources of difficulty that must be taken into account in operating a motor-driven generator in or near the shelter. Those include:

Exhaust. If the exhaust system is faulty, the presence of carbon monoxide from the engine becomes a real danger. Engine exhaust should be vented, in a closed system, through pipes or ducts leading outside the shelter building. Even small leaks in the vent system could cause serious contamination of the atmosphere.

Heat. Internal combustion engines generate large amounts of heat, especially when in continuous operation. Engines located within the shelter area may have negative effects on temperature and humidity as well as the water consumption rate of the shelterees.

Fuel. Fuel, in or near the shelter, constitutes a continual fire hazard. Extreme caution must be exercised in all operations involving fuel, and with smoking in the equipment or fuel storage area. The hazards associated with storage of fuel for power equipment give rise to legal, as well as technical, problems which must be considered during shelter planning.

Location. In addition to problems of exhaust and heat, the location of the generator engine has important implications for maintenance and repair during shelter use. Frequently, existing engines will be located in radio-active "hot" areas, creating problems of access by repair personnel in the event of equipment trouble.

Noise. While not directly related to survival, the shelter noise level can have important psychological effects. Generator engines and auxiliary equipment may contribute heavily to the general shelter noise level. Machinery could be especially disturbing during sleeping hours.

Battery Power

Large, dry cells which are used for emergency lanterns, portable radios, and other low-power equipment are an important source of power for emergency lighting and communication equipment. In addition, these batteries are small enough that a large number could be supplied without sacrifice of vital shelter space.

Some of the limitations of battery power are:

Limited power. Batteries could not be used for total emergency power on a continuous basis because extended current drains render them ineffective. Both storage batteries and dry cells require frequent recovery periods during which some, but never all, of the expended energy is reacquired. Batteries can be returned to full strength only by recharging from another source. Since recharging facilities will not be generally available, conservative battery use will be necessary.

Machinery operations. Most machinery that could be used for shelter purposes is designed for operation on normal commercial power, i.e., 100-120 volts a.c. Unless large high-current storage batteries and battery-adapted machinery are available, the use of batteries for machinery operation will probably not be possible.

Lighting. Lights, too, will require special adaption for operation from normal 6 to 12 volt storage batteries. Either special bulbs or transformed current will be necessary to provide minimal shelter lighting from storage batteries.

Manual Generators and Equipment

Although this type of capability can offer little more than battery-strength power, manually-operated equipment has few of the drawbacks that are inherent in more comprehensive and powerful machinery. Even if other equipment is available, the back-up capability offered by manual equipment should not be overlooked. Bicycle-type generators, for example, could supply low-level lighting almost indefinitely. A similar arrangement for the mechanical operation of exhaust fans could also be valuable should the primary system fail.

PROCUREMENT

Auxiliary power may be provided through use of existing facilities or by direct purchase of power equipment. Many buildings have auxiliary power

units for use during peacetime emergencies. In this case, shelter planners should see that this equipment is located within a shielded area and within access of the shelterers. In addition, this equipment must be tied into the shelter system. Some firms which use large vehicles have spare batteries which provide a limited source of auxiliary power. Under other circumstances, it may be appropriate to purchase power equipment. In this case, an engineering expert usually should be consulted because of: (1) the key role which auxiliary power may play in shelter operations, (2) complexity of most auxiliary power systems, and (3) the unique needs of any particular shelter.

PERSONNEL REQUIREMENTS

In most cases, the use of auxiliary power equipment will require that skilled personnel be appointed prior to shelter entry to assure adequate operation of this machinery during the shelter stay. These people should also be assigned to the duty of periodic maintenance checks on this equipment during peacetime. This should be done to insure immediate readiness of the equipment in the event of an emergency.

V. MAINTENANCE

GENERAL INFORMATION

Some group fallout shelters will contain equipment which requires maintenance support. Much of the equipment which may be provided, such as ventilation systems, must perform adequately during the entire shelter stay to assure the health, and often the survival, of the shelter inhabitants. At the same time, under conditions of a nuclear attack, the resources commonly available to maintain and repair many critical items will not be available on casual demand. Thus, shelter planners should provide some capability for essential in-shelter maintenance and repair.

A primary concern in shelter planning, of course, will be to achieve the highest possible degree of reliability in shelter equipment and, thus, keep the need for maintenance and repair to a minimum. Many equipment items, however, require some preventive maintenance, such as oiling, adjusting, etc., in order to keep them functioning properly. In addition, even the most reliable equipment is subject to some chance of failure, particularly when operated continuously for as long as two weeks following a storage period of perhaps several years. Finally, all shelter facilities run the risk of being damaged, either by weapon effects or accidents within the shelter, itself. Shelter planners must take all three of these possibilities into consideration when developing some capability for in-shelter maintenance and repair.

MAJOR PLANNING FACTORS

Identification of Specific Maintenance Requirements

The variety of tools, test equipment, and other items available for various maintenance tasks is virtually endless. Planning for a general and somewhat nebulous shelter maintenance need would be expensive and inefficient. Shelter planners should

carefully identify the maintenance requirements associated with each item of shelter equipment. These data should be used not only in deciding upon the procurement of various shelter facilities, but also to identify the specific maintenance support required for each shelter item. Shelter planners may also wish to provide some capability for general repair and rescue in the event of blast damage to their dual-purpose structure. The materials which should be provided for such operations are discussed in Rescue Skills and Techniques (OCDM, 1959).

Stocking Essential Tools

The tools needed for shelter maintenance should be procured and stored in a safe location within the shelter. Many of the necessary tools may be available among the maintenance resources of the dual-purpose structure housing the shelter. The everyday use of many of these tools, however, may make it advisable to stock extra items especially for shelter use. This will be particularly true if only a small number of relatively inexpensive tools are required.

Stocking and Posting Maintenance Instructions

Clear instructions for both preventive and corrective maintenance should be provided for shelter use. Basic operating and maintenance instructions should be posted in plain view on or near the associate equipment. Diagrams, charts, and other aids should be provided to reduce the probability of error on the part of maintenance personnel (Altman, Marchese, & Marchiando, 1961).

Personnel Requirements

In a few cases, the use of complex shelter equipment will require that skilled personnel be appointed prior to shelter entry to assure adequate performance of in-shelter maintenance. Shelter planners must identify this need and see that it is met.

VI. TEMPERATURE AND ATMOSPHERE CONTROL

GENERAL INFORMATION

Control of the shelter temperature and atmospheric composition can be as vital to survival as protection from weapon effects. Lack of adequate control could result in objectionable or dangerous changes in shelter temperature or atmospheric quality.

A dangerously high effective temperature is probably the biggest environmental threat posed by crowded conditions of shelter living. Effective temperature relates dry-bulb temperature, humidity, and air movement to physiological comfort or discomfort. Effective temperatures from 68° in cold weather to 78° in warm weather cover the range of relative comfort (National Research Council, 1960). Effective temperatures within the range of 78° to 85°F can be tolerated by most people for long periods of time. With effective temperatures higher than 85°F, heat stress reactions become progressively more intense and tolerance time is markedly decreased.

Shelter planning should assure that the oxygen level of shelter air can be maintained at a minimum of 19 per cent, and that the carbon dioxide level can be kept below two per cent. No amount of detectable carbon monoxide should be tolerated in the shelter air (National Research Council, 1960).

MAJOR PLANNING FACTORS

The atmospheric composition and temperature within a shelter may be controlled by one or more of the following:

1. Air exchange, which usually can be quite effective in controlling both the atmospheric composition and the temperature in the shelter.
2. Control of air temperature and humidity, which can keep the effective temperature of shelter air at a safe level.

3. Air purification, which can be effective for controlling composition of the shelter air.

Careful management of certain shelter activities may also contribute to the control of temperature and atmospheric composition. Consideration should be given to each of these factors during shelter planning.

Air Exchange

The removal of stale air from the shelter and introduction of fresh air from the outside is a fundamental technique for control of both effective temperature and atmospheric composition. Generally speaking, air exchange may be accomplished through: (1) natural ventilation and (2) forced ventilation.

Natural Ventilation

Natural draft ventilation relies solely on air circulating through open doors and windows, cracks, and other natural openings in the shelter. The extent and effectiveness of natural ventilation in any particular structure will be a function of many things, such as structural characteristics of the building, prevailing winds, and even orientation of the structure in relation to the sun's most direct rays (National Safety Council, 1955). Natural ventilation is, of course, much more effective in the upper stories of a building than a closed basement. A ventilation specialist probably should be consulted to determine the potential natural ventilation of any dual-purpose shelter. Shelter planning might include procedures such as opening doors and windows for enhancing the natural ventilation of a structure following an attack warning. These procedures, however, must be compatible with other shelter requirements, such as protection from fallout.

The exclusive use of natural ventilation will greatly limit the number of shelterees that can be adequately provided for in a shelter. In general, naturally-ventilated, above-ground shelter areas should allow 500 cubic feet of space per person in planning shelter capacity, to provide for satisfactory atmospheric

composition during the shelter stay (OCD, 1962). This principle, however, assumes the availability of completely adequate natural ventilation. If there were no air replacement, 500 cubic feet of space per person would provide only for about one day of shelter occupancy.

Forced Ventilation

Basement shelters and above-ground facilities which wish to approach the ten square feet per person standard for shelter capacity (OCD, 1962) probably will have to employ some mechanical equipment, such as fans or blowers, to provide adequate air exchange. In planning for forced ventilation of a shelter, consideration should be given to: (1) the required rate of air exchange, (2) the need for an auxiliary power source, and (3) specific methods for providing forced ventilation.

Rate of air exchange. An air exchange rate of three cubic feet per minute per person has been suggested as a minimum requirement for maintaining the atmospheric composition of the shelter (OCD, 1962). It is important to note, however, that in most climate conditions this rate of air replacement would prove inadequate for the control of effective temperature in the shelter during a major portion of the year, unless ventilation is supplemented by other substantial cooling effects. Figure 7 indicates the rate of air exchange required to maintain a safe effective temperature under various conditions of outside air temperature and humidity.

Other factors, such as the temperature of the earth around the shelter, also are related to the required rate of air exchange. The complexity of this problem will, in most cases, require consultation with a ventilation specialist to determine the rate of air exchange and/or capacity of a particular shelter.

Need for auxiliary power. Forced ventilation systems can be powered by hand cranks, "bicycle" chain drives, and other manual means. Large, fairly crowded shelters, and other situations requiring the rapid exchange of large volumes of air, may require the support of an auxiliary power source. The power

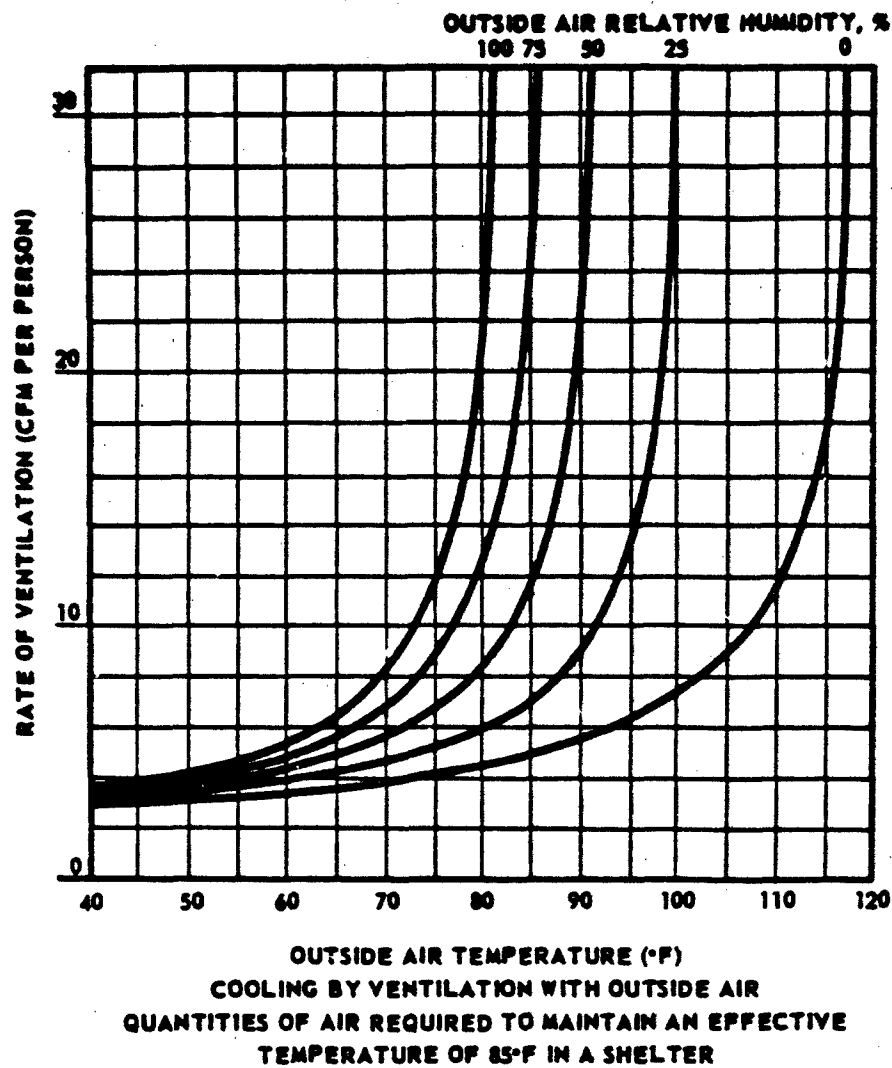


Figure 7. Required Rates of Air Exchange*

*Allen, E. C. From Mechanical equipment requirements. In Symposium on survival shelters. Miami Beach, Florida: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 25-27 June 1962. Reproduced with permission of the author.

requirements of the ventilating equipment must be carefully assessed in relation to other demands which might be made upon the shelter's electrical system. Consideration may be given to the use of blowers (fans) with alternative manual/motor drives. Then, if the power fails, the blower can be hand operated.

Methods for providing forced ventilation. Again, professional specialists probably should be consulted to determine the particular method for forced ventilation of a shelter, as well as the power requirements for support of that method.

In some cases, available peacetime facilities may be useful for shelter ventilation. Portable fans or air-conditioning units may be installed at pre-designated openings of the shelter upon receipt of an attack warning and plugged into an auxiliary power source. Also, permanent ventilation systems in large dual-purpose structures may be modified to permit operation on auxiliary power and the by-pass of non-shelter areas, with a resulting high-volume air flow to the shelter facilities.

Such uses of peacetime facilities could reduce shelter costs, but may prove to be inefficient or inadequate. In dual-purpose structures which inherently provide an adequate amount of radiation shielding, the installation of ventilation facilities often may be the most fruitful way to spend a large portion of any funds which are available for shelter development. These facilities could be useful during peacetime for the ventilation of offices, laboratories, storage rooms, or other dual-purpose areas.

More complete information on requirements for shelter ventilation or cooling is being developed by the Office of Civil Defense and other agencies (Allen, 1962). Ventilation specialists serving as consultants to shelter planning should make every effort to become familiar with the latest requirements.

Control of Air Temperature

Air exchange can usually be very effective in maintaining acceptable low temperatures when sufficiently large volumes of air can be circulated through the shelter. However, as indicated in Figure 7, the rate of air exchange required for temperature control becomes exorbitantly high under certain conditions of outside temperature and/or humidity. Plans for reducing the temperature of incoming air may, therefore, pose a more expedient solution to the control of temperature in shelters located in normally warm climates.

A number of methods for shelter temperature control involves use of materials available in dual-purpose structures, thereby increasing the feasibility of their use in the shelter system. Of major importance in shelter planning, however, are the relationships of various techniques for temperature control to air exchange and shelter humidity, along with the requirements for auxiliary power associated with many of these methods. All of these factors should be taken into consideration, probably by a professional consultant, during shelter planning.

Air may be cooled by the use of conventional air-conditioning units, which also may be used to facilitate air exchange (page 37). An adequate power supply must be available if this method is to be used. Another technique which could be applied is to pass air through cool water by means of an air washer. The air is cooled and also cleaned by this method, but the humidity will be increased.

Since the temperature of well water in most parts of the country usually is relatively low (45° - 55°F.), it may be used for cooling the air in shelters where a well is available. This could be done by passing air around a surface coil through which well water is being pumped. Ground or shallow well water temperatures in the South may be as high as 75°F., but even water at this temperature can be helpful if plentiful, and a high volume of air flow and large coil surface areas are available. However, an increase in humidity could also be a problem with this method.

If some provision for heating the shelter is desired, conventional heaters may be used where power is available. If diesel or gasoline engines are used in the shelter, waste heat may be drawn from this machinery and used to heat water for coil heaters. This would not involve use of any electric power.

Purification

Need

Shelter facilities which control air temperature through air-conditioning, or those located in relatively cool climates, may be naturally ventilated or may utilize forced ventilation at a rate of less than three cfm of fresh air per person. These shelters could require some means of purifying the shelter atmosphere. Shelters which are capable of being sealed for fire protection also may require facilities for air purification.

Facilities for Purification

Maintenance of a safe shelter atmosphere may be accomplished through filtration, absorption and/or oxygen regeneration.

Filtration. The purpose of filtration is to remove dangerous particulates from shelter air. Commercial air filters may serve the purpose of removing particulates, but will require a forced ventilation system to overcome the resistance which incoming air will meet from the filter. Filters which are already installed in good ventilating systems for peacetime use are usually adequate for removing particulate matter such as fallout. Filters will need to be shielded against damage from blast and thermal radiation and should be kept from moisture. If filters are clean at the start of occupancy, they probably will not require servicing or replacement during the anticipated stay time. Since the material accumulated by the filters may be radioactive, it should be shielded from the general shelter area to protect the shelterees (Department of the Army, 1958).

Sand or gravel filters may also be used for air purification. This type of filter will remove heat and

most particulate matter from the air, but is not capable of removing such toxic elements as carbon monoxide. In most cases, sand or gravel filters will not be available in existing structures, and will need to be specially constructed. These filters are quite large and heavy, and will require a high-powered fan in order to pull the air through and into the shelter (National Safety Council, 1955).

Absorption. The purpose of absorption is to remove toxic or noxious elements from incoming air. This may be done by using charcoal filters and charcoal elements or such absorbents as lime. Charcoal elements are especially good for removing foul odors and smoke from the shelter air. Charcoal should be kept from moisture to maintain its absorbancy. If charcoal filters are not located in the shelter, they should be located in a shielded area to protect both maintenance personnel and the general shelter population.

Such elements as soda lime, baralime, and lithium hydroxide are capable of removing carbon dioxide from shelter air. These materials will produce a chemical burn in contact with the skin, and are highly irritating to the lungs and eyes, so care must be taken in their use. Lime also must be kept dry to be useful.

Oxygen regeneration. The purpose of oxygen regeneration is to periodically replace oxygen in the air. Oxygen regeneration can be accomplished by bleeding oxygen from large tanks into the shelter. Trained personnel will probably be needed to operate such equipment. Also, precautions must be taken against possible fire hazards. Chlorate candles, which give off oxygen when burned, may be used as a possible method for oxygen regeneration. This method is generally not desirable, since it may cause the shelter temperature to rise considerably. This method also requires special facilities in its use, and is quite expensive. Precautions also must be taken here to protect against fire hazards.

Most of the techniques for air purification involve a certain amount of technical complexity and some

inherent danger. In addition, there may be some question as to the actual need of purification facilities as opposed to such alternatives as: (1) increasing the volume of air exchange, if the source of contamination comes from within the shelter; or (2) sealing the shelter against contamination in the outside air. Both the need for air purification and the specific techniques for meeting this need should be considered by a trained ventilation specialist. Such specialists should be aware of the unique problems associated with shelter design, and familiar with the latest literature in this area (e.g., National Research Council, 1960).

Management of Activities

Management of shelter activities which might affect shelter temperature and atmospheric composition should be considered in shelter planning. Some of these considerations include:

1. Physical activity on the part of the shelterees.
2. Utilization of heat- and exhaust-producing equipment.
3. Use of open flames for cooking, which gives off heat and carbon monoxide.
4. Excess humidity and/or foul odors produced by uncovered water containers, wet garbage, human waste, etc.

The latest studies on management of shelter activities should be consulted for further information (Bend, et al., 1963; Siroky & Eninger, 1963).

Personnel Requirements

In those cases where complex equipment is available for temperature or atmospheric control, trained personnel should be provided for operation of these facilities. In any case, a competent technical supervisor and crew should handle repair and maintenance

aspects of this equipment. If trained personnel are not in the shelter, a temporary team should be selected from incoming shelterees with relevant experience.

To operate all mechanical equipment and facilities in the shelter, technical manuals on operations, maintenance, and repair for each of these should be located in a convenient place.

VII. WATER SUPPLY

GENERAL INFORMATION

Although a human being may survive for two weeks with no food, it will not be possible to survive in the shelter for more than a few days without water or liquids. In addition, water may be useful for other shelter functions such as fire suppression, decontamination, and sanitation.

MAJOR PLANNING FACTORS

Planning for a shelter water supply should consider the following major factors:

1. Amount.
2. Provision and storage.
3. Purification.
4. Distribution.

Methods for the distribution and use of water for non-drinking purposes are discussed in other chapters of this report. The following pages deal with amount, procurement, and storage of the entire water supply, and possible techniques for the purification and distribution of drinking water.

Amount

The Federal Government is stocking all licensed shelters with water containers holding 17.5 gallons of water, which provide 3.5 gallons for each shelter space.

The amount of drinking water required to maintain human efficiency in a shelter, however, will depend upon the shelter temperature, the length of the shelter stay, the nature of the shelter diet, and other factors. High shelter temperatures, particularly, will greatly

increase the amount of water required by the shelters. With low shelter temperatures people might survive at one quart per day for fourteen days. However, at high temperatures this allotment would lead to serious consequences, including fatalities, if extended for that length of time (Taylor, 1962).

The amount of water required for purposes other than human consumption depends primarily on the other provisions which are available for meeting these requirements. If water is to be the sole means of meeting requirements such as fire suppression and decontamination, the amount required for each function should be carefully assessed. For example, the use of showers for decontamination may require large quantities of water.

Provision and Storage

Basic Approach

The three basic approaches to provision and storage of water for shelter use are:

1. Stocking of water containers.
2. Use of storage tanks.
3. Use of wells.

Sufficient water for a dual-purpose shelter also may be available in the structure's water system. Uncontaminated water may be trapped in the piping system, boiler, and storage tanks, sprinkler system, and non-operable heating and air-conditioning system, by shutting off all valves leading to and from the building's water system. Shelter planners should obtain a professional appraisal of the capacity of this building's water system before designating this resource as a primary source of shelter water. Attention should be given to the correct procedures for tapping this source in the event of an emergency, and to the possible need for purification of the water (Bend, et al., 1963).

There are several other ways of providing water for the shelter. Some of these include use of: water from flush tanks of toilets; liquid from water-packed foods such as canned fruit; ice from undamaged refrigerators; and water collected in bathtubs, sinks, buckets, wastebaskets, and other containers. Such approaches should be utilized as auxiliary sources, however, and rarely considered within the shelter plan as a primary source of water.

The three basic approaches to provision and storage of the shelter water supply should be considered in terms of their availability in a particular planning situation and the extent to which water purity is maintained.

Containers

Availability. If water filled containers are to be used to store the shelter water supply, the shelter planner should decide whether they will be commercially filled (i.e., hermetically sealed cans) or self-filled (i.e., containers filled with tap water just prior to being placed in the shelter). Commercially filled containers are generally more costly because of the cost of the filling and sealing operation and because water is heavy and bulky, and shipping cost will be high. Containers which can be self-filled may be procured in one of three ways: (1) through the Federal Marking and Stocking Program, (2) containers already available in existing structures, or (3) by direct purchase.

Maintenance of purity. Containers which are to be self-filled should preferably be those which have tight-fitting covers, such as the containers provided by the Federal Marking and Stocking Program. At the time of storage, containers should be marked with the date. A periodic inspection should be made of the water supply to determine its purity and any damage which might cause leaks and would necessitate replacement. Water in hermetically-sealed containers should maintain its purity for at least five years and often much longer. Self-filled containers with a good seal, such as those provided by OCD, also provide long storage life.

The area in which containers are stored is also important in shelter planning. This area should be away from latrines and the sick bay. It should be dry and cool, but caution should be taken to see that the water is not stored in a place where it might freeze.

Tanks

Availability. Storage tanks may be appropriate for storing water in relatively large shelters, particularly where a tank is available to meet fire suppression and other peacetime needs within the existing structure. If it is desired, a storage tank may be bought and installed especially for shelter use, but this would be quite expensive. In any case, storage tanks should be located as near to the shelter as possible. Also, precautions should be taken against possible flooding of the shelter if a tank ruptures due to blast damage during an attack.

Other types of tanks which may be considered for provision of a primary water supply are available furnace boilers or hot water tanks. However, these tanks would probably not provide enough water for the whole shelter population.

Maintenance of purity. Water stored in tanks will need to be tested periodically for purity. The tank itself should be inspected regularly for leaks, rusting, or other damage. If possible, to assure purity the peacetime water supply may be circulated through the storage tanks. If furnace boilers or hot water tanks are to be used as part of the primary water supply, they should be flushed every three months until the tank runs clean to keep it free from rust and sediment.

Wells

Availability. If a well is available, it will be a good means of providing a water supply. An existing well may be used, or a well may be sunk especially for shelter use. It should be located as near to the shelter as possible.

The deeper wells require a pumping system to be operated. If public power fails, auxiliary power

generators will be necessary to keep the pumps working. Under extreme conditions, however, it may be possible to operate the pumps manually.

Maintenance of purity. Water stored in wells should be checked periodically for purity. The well also should be checked for standing capacity and flow. A regular maintenance check of the well's pumping system should be made for possible damage or deterioration.

Purification

Purification of the primary shelter water supply should almost never be necessary while in shelter since this water should be checked and possibly rotated periodically during peacetime. However, some situations such as damage to the primary water supply, an extended shelter stay, or environmental conditions such as high temperatures, may create a need to use auxiliary water sources which require purification.

Generally, the three types of contaminants to be considered are:

1. Toxics.
2. Bacteria.
3. Foreign bodies.

The likelihood of encountering toxic elements in the shelter water supply will be small. Bacteria may be combated with water purification tablets, which are provided in Federally stocked shelters. Several drops of chlorine household bleach or tincture of iodine added to each quart of water also can be quite effective, as will boiling the water hard for at least one minute (OCDM, 1961; Cannel, 1962).

Foreign bodies may be removed by filtering the water through filter paper, gauze, fiberglass, or finely woven fabric; or by allowing the water to stand until the sediment settles, and pouring off the "clean" water.

Distribution

Two main considerations which hinge on the procedure used for water distribution are equitableness and waste. Wasteful or inequitable water distribution could result in generally poor morale, hostility and resentment toward shelter management, hoarding, and possibly even overt aggression among the shelterees.

Methods of Distribution

Water may be distributed to the shelterees either by having them come to a fixed-point of distribution or by taking it to them (moving-point distribution). Methods for distribution of water will depend on the size of the shelter, its configuration, and the type of available equipment.

Fixed-point distribution. In small shelters or in shelters where crowding is not anticipated, a fixed-distribution point is desirable. The advantages of this method include:

1. Facilitating management supervision of the distribution process.
2. Optimizing equitable distribution.
3. Minimizing waste.

Techniques for dispensing water at fixed-distribution points include:

1. Water fountains.
2. Regular water spigots.
3. Hoses.
4. Dipping from water containers.

Moving-point distribution. Water stored in containers can be transported to areas throughout a large shelter through use of various carts, trays, wagons, and other vehicles available in existing structures.

These carts may also be used for food distribution and movement of other heavy objects.

This type of distribution should be used only in large shelters where a traffic problem or a ventilation problem might arise from many people moving around the shelter area. This method will limit movement to a few people responsible for distribution.

If this method is to be part of a shelter plan, the shelter layout must provide room for the movement of these carts. Again, the risk of spillage is so great when using this method, that it should be employed only when no other feasible alternatives are available.

Combination. These two general approaches may be combined in planning for a very large shelter. Water may be taken from the shelter source and moved to several locations for fixed-point distribution. This water may be moved to fixed points by using equipment discussed under moving-point distribution. The water supply may also be piped to various parts of the shelter for distribution. Two ways in which this can be done are:

1. Use existing plumbing in the shelter by installing a bypass which permits disconnection from the municipal system and a tie-in with the shelter water supply.
2. Install a special plumbing system throughout the shelter. This may be done with standard plumbing equipment, or simply by running a flexible hose from the water supply to various points in the shelter, even following an attack warning.

Drinking Containers

Regardless of the distribution approach used, in most cases, each shelter inhabitant will require a container to hold his water ration. Each shelteree should have his own container to reduce the threat of contagious disease in the shelter. Federally stocked shelters contain plastic cups as part of their provisions. Many existing facilities have cup dispensers located at the water fountains throughout the building.

Extra supplies of these paper cups can be stored in or near shelter areas for use in an emergency. In other cases, shelter planners can ask peacetime users of a structure to bring the cups which they retain for use during "coffee break" to the shelter following an attack warning. When cups are purchased especially for shelter use, they should be of a durable and easily cleaned material which does not shatter to sharp edges if broken. Plastic picnic utensils may be appropriate for this purpose.

VIII. FOOD

GENERAL INFORMATION

The food provided as part of shelter provisions need not be elaborate. Indeed, most of the relatively inactive shelter population could survive for two weeks with no food. Nevertheless, shelterees receiving too little food may become preoccupied and uncooperative, and lack of food may have a detrimental effect on the ability of shelterees to perform critical shelter tasks.

MAJOR PLANNING FACTORS

Planning for a shelter food program should center around five major factors:

1. Procurement.
2. Storage.
3. Preparation.
4. Distribution.
5. Provision of an Eating Area.

An important consideration in planning for each of these factors is the general type of food selected for shelter use. The shelter menu may be comprised primarily of survival rations, such as biscuits, crackers, and a carbohydrate (hard candy) supplement, or it may utilize relatively standard foods, ranging from basic canned dishes such as chili or stew to complete meals. A third approach is the use of survival rations augmented by different "toppings" (jelly, spaghetti sauce, etc.) or by a supplemental supply of standard foods, ranging from candy bars to provisions sufficient for an occasional complete meal. The implications, such as cost, space requirements, water requirements, etc., posed by use of a particular type of food will be pointed out, where appropriate, for each factor involved in food planning.

Procurement

Relationship of Food to Drinking Water

Any plan to provide food to shelterees must consider the relationship of food requirements to the provisions which have been made for drinking water. Food which provokes thirst, high protein diets, and vitamin supplements which require large quantities of drinking water should be kept to a minimum in shelters where the water supply is limited. Foods which require an abundance of water in their preparation should also be avoided in order to conserve the shelter water supply.

Calories and Nutrients

Two primary considerations in the procurement of a shelter food supply are the number of calories desired for each shelteree, and the vitamins, minerals, and other nutritional characteristics which are appropriate.

The Federal Government, in its Marking and Stocking Program, is providing 10,000 calories of food per shelter space (DOD, 1962). Planning of food procurement for use in any particular shelter should consider the characteristics of the shelter population. Additional amounts or kinds of foods may be desirable if a great many infants, young children, adolescents, the sick and aged, or pregnant or lactating women are expected in the shelter (Wells, 1962).

Also, stocking amounts of food beyond caloric minimums may help to offset feeding problems created by possible overloading, and alleviate low morale and other problems associated with reduced food intake.

Survival of the shelter population depends more on an adequate supply of calories than on an adequate balance of nutrients. Primarily, foods that provide an adequate supply of calories and provisions for some variety should be stocked in the shelter. Foods which are particularly high in protein content generally should be avoided since they create a need for a large supply of drinking water. It is desirable to include in diets for infants and pregnant or lactating women, and other special cases, more protein (along with more

water), as well as vitamin C, calcium, and other nutrients.

Methods of Procurement

Three primary approaches may be followed in the procurement of a shelter food supply:

Federal stocking of emergency rations will be available to shelter areas which qualify for and accept licensing under the Federal Marking and Stocking Program. The general implications of participation in the Federal Program are discussed earlier in this document. A cereal ration and carbohydrate supplement totaling 10,000 calories per shelter space will be provided according to the government-designated capacity of the shelter. These rations are expected to be usable for at least five years and will be replaced periodically by fresh supplies when determined not to be usable any longer.

Back-stocking and rotation of foods used during peacetime may be a useful way to stock shelters in buildings which normally distribute food through vending machines, snack bars, cafeterias or restaurants. Depending upon the nature and volume of foods normally used in the building, storage of extra quantities of rotation through the peacetime facilities could provide an augmented or complete shelter menu. Such back-stocks, of course, must be stored within the shelter area for access following an attack. Candy bars and other snack foods will be very useful in supplementing basic shelter foods. Plans for utilizing large back-stocks of meats and fresh vegetables normally available for restaurant or cafeteria use must take into consideration the refrigeration and cooking facilities required for preserving and preparing these foods during the shelter stay. An initial outlay of funds will be necessary to acquire the necessary backlog of provisions. Replacement of rotated foods would, of course, cost no more than that normally required to support the peacetime food distribution facilities. There may be some additional cost for storage and the administrative tasks associated with maintenance and surveillance of the larger food supply.

Direct purchase may be an appropriate method for obtaining survival rations, supplemental foods, or a relatively standard shelter menu. Emergency rations, identical or similar to those distributed by OCD, may be purchased from private manufacturers, their distributors or dealers. Although specific prices vary considerably, the per-person cost of such rations, particularly when purchased in large lots, is relatively low (Approximately \$1.25 to \$6.00 per person for a 10 to 14 day food supply).^{*} Adjuncts to these or Federally provided rations can be purchased for just a few cents per person (Shepherd, Nury, Ferrel, & Hale, 1962). The purpose of these adjuncts is to increase the palatability, raise the caloric content, minimize the diet monotony, and improve the nutritional balance of the survival ration. Canned foods, including stews, soups, fruits, and vegetables can be purchased either to augment survival rations or as a complete shelter menu. If funds are available for an elaborate food supply, a professional dietician should be consulted to plan their purchase.

Two additional ways of obtaining food for a shelter are to request individuals to bring provisions to the shelter with them and/or to utilize the inventories of retail food stores near the shelter as soon as it is safe to venture from the shelter for short periods of time. While both of these approaches may be useful for supplementing a shelter food supply, they rarely should be relied upon as the sole source of shelter food. Provisioning by individuals prior to an attack assumes that those who will occupy the shelter can be identified and that they can be contacted and convinced to bring certain specific provisions to the shelter. Plans for bringing food to the shelter following an attack warning pose similar problems and, in addition, must assume that individuals will have time to acquire the food and bring it to the shelter after a warning is received. A recent government survey (Callahan, Rosenblum, & Coombe, 1961) indicated that more than ten days supply of food was available in retail food store inventories. The accessibility of such supplies under the radiation hazards following

^{*}Based upon experiences in stocking actual shelter systems of various sizes.

an attack is very unpredictable, however, and these provisions may be valuable during the post-shelter recovery phase.

Storage

Plans for storage of the shelter food supply should aim toward:

1. Maximizing the shelf life of the provisions.
2. Assuring the security of food stocks.
3. Placing the provisions as close as possible to food processing areas.
4. Meeting safety requirements.

Planning to achieve these goals should consider packaging, environmental control, physical location, provision of special facilities, and inventory and marking.

Packaging

Shelter planners may have little to say about the way in which food provisions are packaged. Survival rations usually will be adequately packaged in moisture-proof, and often airtight containers. Problems may be encountered with use of standard foods, since most containers in present commercial use are not fully insect-proof, with the exception of tin cans and steel drums, which are susceptible to rust if the humidity is much above 45 per cent (Tressler, 1959). If shelter planners have the opportunity to package their own shelter foods, civil defense officials or professional consultants should be contacted to determine the best techniques which have been developed through recent research.

Environmental Control

Environmental control of the food storage area can do much to increase the shelf life of foods packaged in a variety of ways. For example, the lower the temperature in the storage area, the longer metal containers will remain free from corrosion, and the

more slowly they will corrode. Further, if food is held below 45°F. it will not be attacked by insects, nor will insects grow in it (Tressler, 1959). On the other hand, care must be taken to see that food stocks are not damaged by freezing. The relative humidity in the food storage area should be kept below 60-70 per cent to eliminate external corrosion of metal containers (Olson, Ferrel, Juilly, Kaufman, & Taylor, 1960). Shelter food supplies also should be stored in an area free from moisture, and one which provides good air circulation to reduce the danger of mold growth on fiberboard or paperboard packages.

Location

In addition to storing food within the general shelter area, an effort should be made to locate these provisions close to anticipated food preparation and distribution areas. Other considerations in planning the location of shelter food stocks include:

1. Dispersion of provisions in large dual-purpose shelters which anticipate possible blast damage in some areas.
2. Stacking of large containers to form partitions between various functional areas of the shelter.
3. Arrangement of food stocks to permit effective movement of personnel from one part of the shelter to another.
4. Dispersion of provisions to prevent weight overloads on upper floors of dual-purpose structures.

Special Facilities

The simplest way to store shelter food supplies is to pile the containers up, one on top of the other. The use of storage shelves, however, will keep food cartons away from damp floors, provide a safer technique than simply stacking large containers, and improve the accessibility of individual items. The use of large cabinets or bins will provide even more secure storage facilities. Storage cabinets, or at least the general storage area, should be capable of being locked.

Other special facilities, such as ladders for access to provisions stacked or shelved in high locations, should be utilized if available in dual-purpose structures, or should be purchased if essential to the storage system.

Inventory and Marking

Shelter foods should be marked with the date and shelf life at their time of storage. An inventory of these foods should be taken periodically to determine any additional needs as well as what foods should be rotated or replaced.

Preparation

Deciding Upon the Extent of Preparation

A plan for shelter food preparation may involve one or more of the following tasks:

1. Unpackaging.
2. Mixing.
3. Heating.
4. Cooking.
5. Special treatments.

As the extent of food preparation proceeds for the simple unpackaging of rations to heating or even cooking elaborate meals, the palatability of the menu will increase; but shelter planning must meet correspondingly increasing demands upon power and environmental control systems, and provide substantial support in both equipment and personnel. Factors which must be considered in planning for the provision of these facilities include:

Shelter temperature control, which will have to be highly sophisticated to keep the temperature at a reasonably low level if heating units are used to cook or warm food in the shelter.

Auxiliary power requirements, which will be increased tremendously by the use of electrical heating elements to warm or cook food.

Fire and other hazards, which may be associated with the use of open flames and combustible fuels to heat or cook food.

Increased water requirements, associated with many methods of food preparation.

Support equipment, such as the pots and pans and other utensils required for cooking and other relatively elaborate food preparation.

Personnel required, for any extensive food preparation. A number of well-trained individuals should be available for any elaborate food preparation in large shelters in order to minimize waste and maintain general efficiency.

The most straightforward and economical approach to shelter food preparation appears to be simply unpacking the provisions, and perhaps after some mixing, readying the proper locations for distribution. If at all possible, however, some provisions should be made for at least heating certain shelter foods, particularly for infants or the infirm. Facilities for such food preparation are available from a number of sources.

Kinds of Preparation Facilities

Generally speaking, facilities useful in food preparation include (1) containers and other utensils, and (2) heating units.

Utensils useful in food preparation, such as knives, spoons, can-openers, and pans are often available in structures serving as dual-purpose shelters. In many cases such items are kept available for "coffee breaks" or other social functions. Some buildings contain complete kitchen units. In any dual-purpose structure where utensils useful for food preparation are available, these materials should be stored in the shelter area, or plans made for their removal to the shelter in the event of an attack warning. Certain

special items or entire sets of utensils may be purchased especially for shelter use at relatively little cost. Care should be taken to procure utensils which are compatible with the heating or cooking facilities which will be available in the shelter.

Heating or cooking facilities also are available in many dual-purpose shelter structures. Heat generated by certain equipment items in the shelter also can be utilized for warming foods or beverages. Small, low-cost heating units can, of course, be purchased especially for shelter use. A number of techniques for heating or cooking food in the shelter are presented in Table II. Except for their use in large kitchen units, flame burners are not recommended for shelter use because of the hazards involved.

Planning the Food Preparation Area

Regardless of the extent of food preparation, a specific area or areas in the shelter should be designated as the location for this critical function. Major considerations in planning these areas will be their size and configuration, number, and location within the shelter.

Size and configuration. The size and specific configuration of these areas will depend to a large extent upon the nature of the food preparation. A relatively small area is required for unpackaging food rations. Some counter space is necessary for mixing and other more extensive preparation. Areas used for heating or cooking probably will require facilities for temperature control and for removal of grease and odors.

The number of preparation areas. In general it will be best to confine food preparation to a single area in the shelter. Such an approach will:

1. Optimize rationing control.
2. Minimize waste.
3. Facilitate the organization and management of complex food preparation procedures.

Table II
Techniques for Heating and Cooking of Shelter Food

TECHNIQUE	CONSIDERATIONS
Hot plates and small immersion units	Often are available in dual-purpose structures. Hot plates may be purchased for approximately \$20-\$40. Can heat small amounts of food at any one time with each unit. Each heating coil will draw approximately 8 watts of electric power.
Large coffee urns	Often are available in dual-purpose structures. May be purchased for approximately \$30-\$50. Can heat large quantities of liquid (6-8 gal.) and cans of food immersed in this liquid in a short period of time. Will draw approximately 10 watts of power.
Hot water from cooling system of diesel engines or other machinery	Can warm various quantities of food depending upon amount and temperature of the water. Assumes the availability of a diesel engine or other machinery in the shelter, but heating the water for warming food does not require additional power.
Vending machines which heat canned foods	Probably should be used only if already available within the dual-purpose structure. Can heat moderate quantities of canned foods (200 cans simultaneously). Will draw approximately 10 watts of electric power.
Stoves, ovens, and other large kitchen units	Occasionally available in dual-purpose structures. Purchase would be quite expensive. Can cook moderate to large quantities of food, depending on the size of the unit. Will require at least 50 watts of electric power or a source of natural gas.

4. Minimize the need for both support equipment and personnel.
5. Restrict the need for extra temperature control and ventilation to a single area in the shelter.

A single preparation area is generally recommended under one of the following conditions:

1. If a population is under 300.
2. If a shelter consists of a single, relatively manageable area.
3. If shelter space may be at a premium.
4. If the food is packaged in large bulk quantities.
5. If equipment and utensils will be available for only one kitchen.
6. If the food needs to be heated, and ventilation is limited.

In especially large shelters, or when the shelter consists of a number of separate areas, several food preparation facilities may be more appropriate.

Location of the preparation area(s). Preparation facilities should be within easy reach of food storage areas, and as far away as possible from the sick-bay and toilet areas. If there are exhaust fans in the shelter, heating or cooking facilities should be located next to one of them. Also, this area should be physically separated from the rest of the shelter with a barrier, if possible, in order to permit sanitary and efficient food preparation.

Distribution

Major Goals

Once prepared, each shelter meal must be transferred from the preparation area to each individual shelteree in the most effective manner possible. This

effectiveness is largely a function of the speed and equality of distribution, and the minimization of waste.

General Approach

Food may be distributed to the shelterees either by taking it to them (moving-point distribution), or by serving from a single, fixed-point distribution area.

Moving-point distribution. The chief advantage of taking food to the shelterees is that it reduces traffic problems in the shelter by limiting necessary movement to the few people responsible for distribution. In planning an approach to food distribution, then, both the size of the shelter and anticipated crowding should be carefully considered. A plan to take food to the shelterees may be advantageous when:

1. The shelter is large and many of the shelterees will be a significant distance from the food preparation area.
2. Ventilation and other factors will permit fairly high-density crowding, and the resulting limited movement of large numbers of people within the shelter.

Fixed-point distribution. In small or moderately sized shelters, and where extreme crowding is not anticipated, a fixed-point approach to food distribution seems most advantageous. The advantages include:

1. Facilitating management supervision of the distribution process.
2. Optimizing equitable distribution.
3. Minimizing waste.
4. Controlling sanitary conditions.
5. Minimizing the need for support equipment and personnel.

All of these factors assume greater importance when the shelter diet is in the form of standard bulk foods

or other items which require serving utensils, individual plates, and other materials for their distribution.

These two general approaches may, of course, be combined in planning for a very large shelter, when food is taken from a central preparation area and moved to several locations for fixed-point distribution.

Support Equipment

Support equipment will be needed in order to distribute the food with minimum waste and in the shortest time possible. Generally, the two major considerations when deciding on support equipment for distribution are:

1. The elaborateness of the food which is to be served.
2. The method of distribution.

In situations where the shelterees will come to a fixed distribution point, the necessary equipment might include such things as counters or trays.

In shelters where the food is to be taken to the shelterees, support equipment for distribution is also needed. This equipment may include:

1. Existing facilities in the building such as trays, baskets, and service carts.
2. Facilities improvised from large cans and lids, bushel baskets, boxes, or any table with wheels such as typewriter tables or those used in libraries or mailrooms.
3. Facilities especially purchased for distribution.

Provision of Eating Facilities

Eating Area

In order to maintain sanitary conditions within the shelter and reduce the movement of personnel carrying hot or easily-spilled foods, an eating area should be designed within the shelter. This is particularly

true if food is to be distributed at a single fixed-point in the shelter. The eating area, of course, should be as close to the distribution point as possible, and away from the latrines and sick-bay. Providing such an area should increase management efficiency as well as making the shelterees more comfortable both physically and psychologically. This area will serve to prevent garbage and food spillage from being spread throughout the shelter. Tables and chairs or benches should be provided for this area. If regular furniture is not provided, tables may be improvised from large boxes or cans as well as collapsible bunks which can be moved easily. When not in use for eating purposes, this area might be used for other things such as shelter meetings or recreation. In deciding whether a formal eating area should be provided, shelter planners should take into consideration the many other potential uses of such an area and its facilities.

Eating Utensils

Eating utensils such as dishes, knives, forks, etc., should be provided when anything more than simple survival rations, which may be eaten from their own containers, are stocked. Some of these utensils may be part of an existing supply kept for "coffee breaks" or other social functions. Regular dishes may be purchased or paper plates and plastic knives, forks and spoons may be stocked. In deciding on the eating utensils to be provided, the shelter planner should:

1. Assess what utensils will be needed for the diet stocked in the shelter.
2. Determine what methods of sanitation will be available to keep these utensils clean or what method of disposal will be available if paper plates, etc., are used.

IX. LIGHTING

GENERAL INFORMATION

Minimum lighting is essential to shelter operation. Peacetime lighting facilities which rely upon municipal power may not be operable during or following a nuclear attack. Well-organized procedures for shelter organization and management will be of little use if sufficient lighting is not provided for putting them into operation.

MAJOR PLANNING FACTORS

Types of Shelter Lighting

Three types of shelter lighting should be considered in shelter planning.

General Shelter Lighting

A general lighting system, which is independent of commercial power, should be installed in the shelter to provide sufficient light for the performance of general shelter tasks, reading, and movement about in the shelter. It should be possible to dim at least some portion of the general lighting system sufficiently to permit sleeping by the shelter occupants.

High-Intensity Spot Lighting

The general level of illumination within a shelter may be inadequate for certain critical tasks, such as medical treatment, reading of instruments, and equipment maintenance. To meet these needs, facilities should be available to provide relatively high-intensity lighting within at least a limited area of the shelter. Such lighting facilities should be portable, if possible, to provide the necessary illumination wherever it may be needed in the shelter.

Back-Up Lighting

The primary lighting system within a shelter will be subject to failure, through blast damage, loss of auxiliary power, or other factors. Such failures may be partial or total; temporary or permanent. A back-

up lighting system should be available to provide illumination in any of these instances. This lighting may be minimal, but sufficient to support repair work, and it should be available to all areas of the shelter.

Methods

Three general methods are available for providing lighting in dual-purpose shelters. Some may meet the requirements of both general and high-intensity lighting. Others are sufficient for back-up and/or high-intensity lighting.

Use of Existing Lights

When connected to an auxiliary power source, all or part of the existing lights in a dual-purpose shelter area may be utilized for general shelter lighting. This method should provide adequate over-all coverage in the shelter, and may even meet the requirements for high-intensity lighting in some areas. To make the most effective use of the auxiliary power system, a planner may wish to connect only part of the peacetime lighting system to it in some areas.

Supplementary Facilities

Extra lights may be installed in potential shelter areas not covered by the normal lighting system. Additional lights also may be installed in the shelter medical areas, and other areas requiring high illumination.

Use of Portable, Battery-powered Lights

Battery-powered lights which may be moved around the shelter are an excellent source of high-intensity lighting. Such equipment also would provide back-up facilities in the event of a failure of the general shelter lighting. Portable lighting equipment includes large emergency floodlights, and smaller lighting units such as flashlights. Fuel-fed lamps or lanterns are not recommended because of the hazards which are involved in their use, such as burns and fires, oxygen depletion, and carbon dioxide and possible carbon monoxide generation.

Other Considerations

Facilities available for any of the general methods discussed above may be evaluated according to several factors. The level of illumination is, of course, a major consideration. Excessive glare also can be a disadvantage to shelter living, causing discomfort and inefficiency. The type of fixture used in a lighting system also is important. This characteristic may influence the shelter heat level, demands upon the shelter power supply, and other factors.

Level of Illumination

As indicated earlier, illumination level requirements vary with different activities. Normal lighting recommendations as reported by Murray (Disaster Research Group, 1960) are:

- | | |
|----------------------|--|
| 1 - 5 ft. candles* | Sufficient for seeing larger objects, illuminating hallways and stairs. |
| 5 - 10 ft. candles | Needed for casual visual work that is not continuous. |
| 10 - 15 ft. candles | Needed for reading large size print. |
| 15 - 20 ft. candles | Should be used where handwriting and moderately fine details must be discriminated - satisfactory for general office work, mail rooms, and file rooms. |
| 20 - 50 ft. candles | Are needed for various kinds of visual tasks including reading and drafting. |
| 50 - 100 ft. candles | And more, are needed for severe visual tasks such as stitching on black cloth. |

* Ft. candle - a unit of illumination, being the direct illumination on a surface everywhere one foot from a uniform point source of one international candle.

Similarly, studies of shelter lighting specify different levels for different areas. For example, Panero specifies two to three foot candles in the bunking areas and ten to 25 foot candles elsewhere. Ferguson specifies 25 foot candles for work and medical areas and five to ten foot candles elsewhere. The Office of Civil Defense's Minimum Technical Requirements for Group Shelters (OCD, 1962) mentions two foot candles for sleeping areas, five foot candles for activity areas, and 20 foot candles for administrative and medical areas.

Table III summarizes the latest recommendations for illumination of major shelter areas.

Table III
General Recommendations for Shelter Illumination

SHELTER AREA	RECOMMENDED ILLUMINATION
Bunking area	2 - 5 foot candles
Corridors for personnel movement	5 foot candles
General activity areas, including eating, recreation, training, etc.	5 - 10 foot candles
Administrative and general work areas	20 foot candles
Close work areas, including medical and decontamination areas, equipment maintenance, etc.	20 - 25 foot candles

Light Fixtures

When auxiliary power is available, the shelter planner may have the opportunity of choosing between incandescent and fluorescent fixtures for shelter lighting. There are advantages and disadvantages to each type of fixture. These are presented in Table IV. The type of fixture which is most appropriate usually will depend upon the particular shelter situation. Smith and Wendel (1963) report that fluorescent lighting is most acceptable for large shelters from the cost-effectiveness standpoint.

Table IV
Incandescent versus Fluorescent Shelter Lighting

TYPE OF FIXTURE	ADVANTAGES	DISADVANTAGES
INCANDESCENT	1. Cheaper installation 2. Less sensitive to voltage fluctuation and more rapid recovery from temporary power failures 3. Subject to rheostat dimming	1. More expensive operation 2. More heat generated 3. Higher burnout rate 4. Uneven illumination and glare 5. More power required for same light level
FLUORESCENT	1. Much lower power required for same light level 2. Lower heat generation 3. Less expensive to operate 4. Reduced glare and shadows	1. Odd quality of light 2. Not subject to rheostat dimming 3. Possible health hazards from broken tubes 4. More complex (starters, etc., required)

Control of Illumination

Control of lighting in all areas can be accomplished by one of two methods. The first involves differential switching where different switches control different lights. When, however, one switch controls all the lights of the shelter, it will be necessary to manipulate light levels and control power usage by loosening or tightening bulbs in their sockets.

X. FIRE PROTECTION

GENERAL INFORMATION

A number of fire hazards such as smoking, operation of electrical equipment, etc., may exist within crowded group shelters.

Although thermal weapon effects are unlikely to start fires within shelters beyond the range of major devastation, spot fires may be started elsewhere in the building.

A general picture of the fire problem in relation to civil defense is available in the OCD TR-25 (Strope & Christian, 1964).

The shelter planner should consider a fire protection program for two major reasons:

1. There is a real need for protection, because of the fire hazards present in shelter living and the serious effects which an outbreak of fire may cause.
2. It is important for individuals confined to a shelter to have the assurance of a fire protection program.

MAJOR PLANNING FACTORS

A fire protection program should include plans for:

1. Prevention.
2. Detection.
3. Suppression.

Prevention

A major aspect of fire protection is prevention. Steps taken prior to an attack should prevent the outbreak of fire during peacetime as well as after shelter occupancy. In general, the recommendations of the National Fire Protection Association (Tyron, 1962) and The National Safety Council for peacetime fire safety provide suitable guidance. These steps will involve the practice of general fire safety measures as part of:

Storage of fuel and other materials in or near the shelter. Shelter planners should see that all combustibles, such as paper and wood, are stored at safe distances from possible ignition sources. Fuel storage tanks should be checked periodically for leaks and other damage. Other volatile material, such as medical supplies, should be stored in air-tight containers.

Installation of vital equipment. Electric equipment should always be installed by authorized persons, since electrical defects are often a source of fires. Also, where electrical equipment is exposed to flammable vapors, dusts or gases, it must be of a special type to prevent explosions (National Safety Council, 1955).

General design of the shelter. Precautionary measures may be taken in the shelter to prevent the outbreak and/or spread of fires. Such measures include painting with non-flammable paint as well as avoiding the use of combustible wall boards, acoustical ceilings, etc. (National Safety Council, 1955).

Peacetime uses of the shelter. If possible, the shelter should not be used in peacetime for any work which might entail the use of flammable goods such as dry cleaning fluid or some industrial materials. Also, peacetime materials such as gasoline, paints, and varnishes should not be stored in the shelter area.

In-shelter methods for fire prevention are primarily procedural, and can be found in general safety manuals such as those published by the National Fire

Protection Association. Those specific to shelter living can be found in reports on shelter management (Bend, et al., 1963; American National Red Cross, 1950). Because of this procedural emphasis, management and training are particularly important to fire prevention in the shelter.

Detection

Fire detection is important in limiting damage both in shelters and around the shelter area. Quick detection will also facilitate preservation of available fire suppression resources.

Approaches

Personal observation. A very practical plan for fire detection in shelters is the use of personal observation. Shelters are relatively confined, and fires may be spotted almost immediately by alert personnel. Fire watches should be planned to assure that someone is awake at all times in all areas of the shelter. Shelterees may also be sent elsewhere in a structure prior to the occurrence of fallout to detect spot fires.

Use of instruments. A number of special instruments are available for fire detection in unprotected areas or remote locations in the shelter (Tyron, 1962). These instruments include:

1. Gas analyzers.
2. Smoke detectors.
3. Heat sensors.

In some instances, fire detection instruments will be available in existing structures. In most cases, however, it will be necessary to procure such instruments when they are desired for shelter use. The potentially high cost of these instruments makes it desirable to plan for other methods of detection, where possible.

Suppression

Criteria

Facilities used for shelter fire suppression must be able to effectively extinguish many different types of fires. Because water is essential to survival of the shelterees, fire-fighting equipment should use a minimum amount of this shelter resource. Fire-fighting facilities must also be safe. It is particularly important that shelter facilities and personnel are not adversely affected by such things as toxic fumes from chemical extinguishers, or extensive water damage to vital shelter stocks.

Facilities, Personnel, and Procedures

Almost all buildings contain some type of fire-fighting equipment. Shelter fire-fighting facilities may be increased by moving some of the portable equipment available in other parts of the structure to the shelter following an attack warning. Peacetime facilities not ordinarily used for fire fighting should also be considered in planning. Some of these facilities include sand and buckets or other containers which may be filled with water. Remember, any kind of water--even waste water--can put out fires.

In some cases, it may be necessary to purchase fire-fighting equipment, such as fire extinguishers, especially for shelter use. In addition, automatic sprinklers, hydrants, or other devices for fire suppression may be installed in the dual-purpose shelter area. This would be practical, of course, only when ample water from either an undamaged municipal water system or a special tank is available to the sprinkler system in the event of an attack. Before buying this equipment, shelter planners should consult with a local fire department or fire protection engineering consultant. Planners should be sure, however, to make the individuals who are consulted aware of the problems which are unique to shelter fire suppression.

A fire-fighting team, trained prior to shelter entry, should be considered in planning for fire suppression. Plans should also be made to orient all shelterees, following shelter entry, concerning fire-fighting

procedures. This will not only aid in extinguishing fires, but may also reduce excessive fear reactions to fire.

Table V
Common Fire-Fighting Materials

TYPE OF FIRE	POSSIBLE EXTINGUISHING MATERIALS	COMMENTS
Wood, paper, cloth or rubbish	Water, sand, earth, brooms, blankets, etc., may be used to suffocate the fire.	Water is likely to be essential for drinking purposes and will probably not be available for fire fighting. Waste water or contaminated water can be used. Sand will be needed in large quantities, although it is difficult to use on irregular surfaces. Brooms, thick coats, blankets, rugs, particularly if dampened, can be used to smother small fires.
Oil, gas, or grease	Dry chemicals, CO ₂ , sand or water in a fog or fine spray.	May be difficult to breathe if dry chemicals or CO₂ are used in a small room. A heavy stream of water may spread the fire.
Electrical fires	Dry chemicals or CO ₂ . Sand if not in danger of damaging machinery. As a last resort - and be sure to <u>first</u> turn off electrical current - water.	Until the power is turned off, there is the danger of electrocution if water is used - also, water will probably damage the machinery.

XI. MEDICAL

GENERAL INFORMATION

The variety of medical problems which could arise in a shelter may have important implications for shelter functioning.

Due to the isolation of the shelter group from peacetime medical facilities after an attack, even minor ailments could become problems in the shelter environment. Therefore, shelter planners should be prepared to cope with minor ailments, as well as more complicated illnesses.

The primary objectives in planning for medical treatment in the shelter are:

To effectively treat the symptoms of illnesses or injuries. In many cases, it will be virtually impossible to stock drugs to cure illnesses and injuries. Thus, effective symptomatic treatment should be a major consideration in medical planning. For example, as in the case of radiation sickness, a person can live or die, depending on the treatment of symptoms. Other ailments for which symptomatic treatment should be emphasized include skin ailments, psychological problems, gastro-intestinal illnesses, first-degree burns, shock, puncture wounds, and infectious diseases.

To reduce pain. It is important to have pain-killing drugs on hand to reduce the suffering of the patients and to prevent other shelterers from becoming demoralized. The need to reduce pain may arise in such situations as terminal cases of radiation sickness, serious first-degree burns, and complex illnesses which the shelter medical supply is not capable of handling.

To prevent contagion. The control of communicable disease is of particular importance in a confined and crowded shelter environment with limited medical resources. Much can be achieved toward this goal through well-planned shelter sanitation (See Chapter

XII). When communicable disease becomes a threat in the shelter, however, medical planning should provide procedures and materials for control of feeding and medical operations, and, if necessary, for isolation of infected individuals.

MAJOR PLANNING FACTORS

The major factors to consider in planning for shelter medicine are the development of the medical area and procurement and storage of medical facilities.

Medical Areas

In shelter planning, some consideration should be given to medical areas. Plans for medical areas should be considered and the diagnosis and treatment center for the sick bay.

Diagnosis and Treatment Center

All shelters should have at least one area set aside for the use of the medical team personnel for the diagnosis and treatment of illness and injury. This area should resemble a doctor's office as closely as possible under shelter conditions. Some of the important considerations in locating a diagnosis and treatment area are:

1. Illumination. The diagnosis and treatment center should be located so to receive as much light as possible to allow for diagnosis and treatment.
2. Privacy. A separate room is ideal for the diagnosis and treatment center. If this is impossible, improvised partitions of blankets, drapes, furniture, and the like should be erected to provide as much privacy as possible.
3. Absence of disturbing stimuli. It is desirable to establish this medical area in as comfortable a location as possible away from extremes of noise and heat.

4. Relation to other shelter activities. If possible, a sanitation area should be set up near the medical area: (a) to allow for the disposal of medical wastes, and (b) under the assumption that the sick and injured will have more extensive need of sanitation facilities. The diagnosis and treatment area should be situated away from the food preparation area. As indicated above, it should be located as far as possible from noise and heat-producing activities.

Some of the important factors in the determination of the number and size of diagnosis and treatment areas are:

1. The number of sick and injured. The greater the number of casualties and the incidence of illness, the larger will be the number and/or size of diagnosis and treatment centers.
2. Configuration of the shelter. A shelter composed of widely separated areas will require more medical areas than a shelter consisting of a single area.
3. Amount of medical equipment and supplies. The size or number of the medical areas is influenced by the extent of supplies and equipment. The more supplies, the larger the number and/or size of medical areas.

The time at which a treatment area should be put into operation depends upon the medical strategy selected in a particular shelter. For example, if the sick and injured are going to be sorted at shelter entry, the diagnosis and treatment area will have to be set up immediately.

In large shelters, a sign of some sort should be erected to indicate the location of the medical area.

Sick Bay

The sick bay refers to an area in the shelter that has been set up to accommodate persons with communicable diseases, serious ailments, or injuries, requiring isolation from the rest of the shelter. The

sick bay is the shelter version of the hospital. There are three reasons for keeping the seriously sick and injured separated from the rest of the shelter. One is to provide a setting within which the non-ambulatory patient can be given the most effective treatment and care. The second reason is to reduce the possibility of the spread of contagious disease in shelter, and thirdly, to control the potentially demoralizing effects that the appearance and behavior of severely ill or injured persons may have on the shelter.

The sick bay should not be established automatically as a fixed area of constant size. Because of the scarcity of space in a shelter, the sick bay should be flexible - able to contract when the patient load is low, thereby making more space available for other activities, and conversely, able to expand rapidly in response to medical emergencies.

Finally, if the shelter contains only a few cots, beds, or items of bedding, these should be reserved for use in the sick bay. In a number of shelters, the sick bay will consist of space on the floor. Any improvised bedding that can increase patient comfort should be utilized (See Chapter XV).

Medical Facilities

Two major considerations in planning for medical facilities are (1) procurement, and (2) storage.

Procurement

Medical facilities may be procured through the use of existing facilities, Government-supplied facilities, or by direct purchase.

Use of existing facilities. A number of buildings contain dispensaries and other medical areas. Where it is possible, shelter planners should include these areas in the shelter during peacetime use.

If these facilities are not already stored in the shelter area, plans should be made to identify existing facilities and see that they are transported to the shelter upon receipt of an attack warning. Preferably,

these materials should be stored in the shelter and possibly rotated through dispensaries used in peacetime. Medical supplies in pharmacies located in existing structures also should be utilized. This may be done by rotating pharmaceutical supplies with those stored in the shelter, or providing for the transportation of these supplies to the shelter immediately after an attack warning.

Government-supplied facilities. Shelter medical supplies may be procured through participation in the Federal Marking and Stocking Program. The supplies and equipment in the medical care pamphlets in the Federally provided medical kit are intended for the treatment of minor ailments and injuries. They do not provide a capability to deal with major medical problems. Table VI lists the items available in these kits.

Also, some large shelters which meet specific requirements may qualify for Federal contributions toward a 200-bed hospital unit (OCDM, 1959).

Direct purchase. Medical facilities may also be procured for shelter use by direct purchase. These facilities include medications, bandages, and other consumables; as well as stretchers, flashlights, and such medical instruments as thermometers. The following list of medical supplies provided by the Federal Government (See Table VI) may serve as a checklist for those planners desiring to purchase special facilities. If possible, professional medical personnel familiar with possible shelter medical problems and the characteristics of the potential shelter population should participate in this planning effort.

Some people may require special medicines necessary to sustain their own life or health. Some critically needed drugs, such as insulin, are extremely difficult to store in proper quantities for extended periods of time. As a general rule, the responsibility for the preservation and use of such medication in shelter must rest with the individual. Few shelters will contain the proper refrigeration facilities for storing insulin or other drugs that require refrigeration.

Table VI

Government-Supplied Medical Facilities*

MEDICATION
Acetylsalicylic Acid Tablets, USP Cascara Sagrada Ext. Tablets (Laxative) N.F. Eugenol, USP Eye, Nose (and Ear) Drops Isopropyl Alcohol, N.F. Kaolin and Pectin Penicillin G, Tablets, USP Petrolatum White, USP Phenobarbital Tablets, USP Soap, Surgical Sodium Bicarbonate Sodium Chloride, USP Sulfadiazine Tablets Tablets, Water Purification
DRESSINGS
Bandage, Gauze, Roller Bandage, Muslin, Triangular Cotton, Purified Pads, Gauze, Surgical
OTHER
Applicator, Wood, Cotton, Tipped End Depressor, Tongue, Wood Forceps, Splinter, Tweezer Pin, Safety Scissors, Pocket, Straight Syringe, Fountain, Plastic and Attachment Thermometer, Human, Clinical Oral, Stubby Bulb, with Case

*Derived from: Department of Defense, Office of Civil Defense. Federal civil defense guide: Part D, Chapter 2, Appendix 1. Washington: Author, January 1965.

If rotation of such drugs is not economically feasible, individuals who require such drugs should be informed that they should bring an adequate supply with them to the shelter in the event of an attack warning. Refrigeration for perishable drugs should be provided if at all possible.

Storage

Two major requirements for the storage of medical facilities are preservation and protection.

Preservation. Medical supplies stored for shelter use should not be packaged in glass containers, due to the danger of breakage from blast tremors. The area in which medical supplies are stored should be dry, cool, and free from rodents and other pests. Due to the nature of these supplies, this area should also be as aseptic as possible. Good air circulation is also necessary to reduce the danger of mold growth in containers or boxes. Refrigeration may be required for preservation of some medical supplies.

Protection. Protection of vital drugs and other medical supplies is of major importance in shelter planning. This may even present a greater problem than protection of shelter food. Protection from theft from sources outside the shelter should be provided for these supplies in peacetime as well as during the shelter stay. This may be accomplished by providing locked cabinets for supplies. A monitor may also be required for these supplies during the shelter stay.

Medical Personnel

It will be extremely desirable to have trained medical personnel in the shelter. The practice of medicine is one of the few shelter activities for which extensive previous training is a prerequisite. Planners may want to contact local medical people concerning their availability to serve as part of the shelter medical staff. Unfortunately, many shelters will not have people with the ideal training - that of a physician. However, a shelter is likely to have one or more persons with some medical training.

Medical supplies should coincide with the level of medical personnel expected in the shelter. For example, there will be no need to stock elaborate surgical equipment if qualified medical people are not available.

XII. SANITATION

GENERAL INFORMATION

Sanitation may become a problem in the shelter due to the lack of facilities ordinarily taken for granted in peacetime. A limited water supply will also contribute to this problem. This situation may also become magnified in the shelter setting due to personnel concentration and confinement.

MAJOR PLANNING FACTORS

Planning for shelter sanitation must focus on five major factors:

1. Human waste disposal.
2. Garbage and trash disposal.
3. General shelter cleanliness.
4. Personal hygiene.
5. Body disposal.

Human Waste Disposal

Methods of Waste Disposal

Waste may be disposed of by removal from the shelter or storage in the shelter.

Removal. Waste may be pumped out of the shelter by means of the sewage system. However, shelter planners usually cannot assume that this system will remain operable following an attack. Waste also might be pumped out of the shelter to a nearby storage tank. Grinding up the waste through the use of a grinding mill might be considered for increasing the capacity of such a storage tank (Dorsey, 1962).

Liquid waste may be disposed of by channeling it through pipes to foundation drains outside of the shelter (Department of the Army, 1959).

Planners must remember that the use of facilities other than the public sewer system for waste disposal in peacetime is restricted by law. Installation of these systems is also very expensive.

Storage. A variety of methods are available for storing human waste in the shelter. Human waste should not be disposed of in the same container as garbage and other trash. Mixture of these materials increases the generation of gas (Vernon, 1959).

Sanitary kits consisting of a 17.5 gallon drum, polyethylene liner, toilet seat, toilet paper, and commode chemicals may be obtained through participation in the Federal Marking and Stocking Program (DOD, 1962). This method allows the storage of waste in the same container used as a toilet. This eliminates the transfer of waste from one container to another.

Existing facilities may be used which also eliminate the need for transferring waste for disposal. Large garbage cans or metal drums fitted with toilet seats may be adequate. Wastebaskets or other such containers may be used as make-shift toilets (Federal Civil Defense Administration, 1956). However, waste will probably have to be transferred from these smaller containers for disposal.

All containers used for storing waste should be equipped with tight-fitting lids. Disinfectant should also be stocked for application to waste containers. If adequate funds are available, chemical toilets may be stocked for the collection and storage of human waste. Individual toilet units are expensive. However, several seats may be installed on large storage tanks to which chemicals for waste treatment have been added.

Location of Toilet Facilities

Facilities should be located away from the living area. In a shelter that consists of a single space, commodes may be placed at either end of the shelter. This limits shelteree contact with the toilet area and facilitates segregation of the sexes. It also reduces odors in the living area and enhances whatever toilet privacy is practicable.

Toilets should be as far away from the food storage and handling area as possible to prevent possible contamination of the food supply.

Although the sanitation drums are portable and can be placed wherever desired, the drums will be inconvenient to move when filled. The distance to the shelter exit, or to another area where the filled drums can be emptied or stored, is another consideration in locating the toilet facilities.

Toilets should be shielded from public view. The physical layout of the shelter may make it possible to locate toilet facilities in areas that are closed to general view.

Toilet facilities should be located near the ventilation exhaust, if one exists in-shelter, in order to keep odors and fumes from the toilet area to a minimum.

Garbage and Trash Disposal

The degree to which trash and garbage will be an in-shelter problem depends upon the amount and type of food stores and other types of supplies and materials available. Wasted food probably will be kept to a minimum in shelters where food preparation and distribution are carefully organized. The amount of garbage resulting from OCD stocks should be minimal, since there will probably be little waste of the survival rations.

All shelters should contain some equipment for collecting, disposing of, or, if necessary, storing trash and garbage. The primary piece of equipment is the container in which to place refuse. Planners should consider using some of the large empty food containers for storing garbage and trash. These cans should be covered, preferably with tight-fitting lids. If the number of large food containers is limited, large garbage cans may be provided for other garbage and trash in the shelter, such as used tissues and paper towels. Disinfectant should be provided for application to stored garbage and trash.

General Shelter Cleanliness

Dirt and filth can breed disease and depress shelter personnel. This may affect the health and attitude of the shelterees, and could increase medical problems. Planners may enhance shelter cleanliness by emphasizing cleaning procedures and by providing cleaning equipment.

With exception of the disinfectant and waterless hand cleaner, cleaning materials are not currently supplied in OCD sanitation kits. However, equipment necessary for cleaning the shelter is usually available in most buildings. If possible, this equipment should be stored in the shelter during peacetime. Cleaning equipment should include brushes, brooms, rags, mops (if water is available), dust pans, and buckets.

Cleaning agents should also be provided. These include soap powder, cleanser, and disinfectant.

If the floor of the shelter is constructed from concrete or another porous material, it should be painted or sealed. This will prevent the absorption of spilled food and other waste which could cause the growth of bacteria. A smooth surface will also prevent production of dust and facilitate cleaning.

Personal Hygiene

Personal cleanliness, like shelter cleanliness, is important in preventing the spread of disease. It also may enhance a feeling of well being.

OCD personal hygiene supplies will be extremely limited in nature and in amount. They consist primarily of toilet paper, sanitary napkins, and waterless hand cleaner. These items will be supplied for the rated capacity of the shelter. If there is to be tooth-brushing, use of toilets for disposal will be most unpleasant. A separate receptacle, therefore, should be provided.

Also, there are a number of other methods available for personal cleanliness in the shelter. Where water is available, standard methods involving the use of soap and other common materials may be used. Waterless hand cleaners may be used when the water supply is limited. Chemically treated towelettes, such as "Wash 'n Drys," are commercially available. These may be substituted for soap and water, and can be used for washing both hands and face (Altman, et al., 1960).

Body powder should also be stocked in the shelters. This is especially important for babies. It will also help to reduce rashes in warm and humid shelters.

Supplies which are stocked for rest rooms in most buildings can be utilized in the shelter. A sizable backlogging of these supplies will be required, however, since large quantities will be needed for shelter use. If possible, these supplies should be stored in the shelter during peacetime.

Two other important aspects of personal hygiene are: (1) use of toilet facilities, and (2) feminine hygiene. Adequate facilities for coping with these problems are essential for both health and cleanliness in the shelter. Inadequate planning in this area also could create serious morale problems among the shelterees.

Almost all structures which house dual-purpose fallout shelters will contain a limited supply of both toilet tissue and sanitary napkins for use in rest rooms. Only rarely, however, will these peacetime resources be adequate to meet the shelter needs for large numbers of people for a two-week period.

OCD shelter stocks contain a minimum quantity of both toilet tissue and sanitary napkins. In shelters which are not part of the Federal Marking and Stocking Program, shelter planners should assure an adequate supply of these items by:

1. Carefully assessing the probable needs of the shelter situation.

2. Procuring and storing an adequate supply of these materials, which can be rotated through the peacetime facilities. The extra items should, of course, be stored in the shelter area, if possible.

Because sanitary napkins can be used as medical dressings, shelter planners may wish to stock an extra supply of these items to augment other medical facilities.

Body Disposal

Planning for body disposal is important to assure that this operation is carried out smoothly during shelter occupancy. Shelter inhabitants will be extremely sensitive about the disposal of bodies. For this reason, plans should be made to meet cultural standards commensurate with health and sanitation requirements necessary for body disposal. Religious materials for memorial services for all faiths, or at least for a single, non-denominational service should be provided in the shelter. (See Chapter XVII).

Shovels and other items required for burial procedures also should be included in the shelter stocks. In addition, room should be designated for the retention of bodies until burial or removal from the shelter is possible. This room should be located as far from the shelter living area as possible. Most dual-purpose structures should have such a room available. This room need not be shielded as well as the general shelter area, but shielding should be adequate enough to permit occasional access by personnel. Preferably, this room should be in the coolest part of the structure and as close to the medical area as possible. The area should be sealed as adequately as possible from the rest of the shelter to prevent odors and gases from leaking into the rest of the shelter. An exhaust vent should also be provided.

Bodies retained in the shelter area may be placed in large plastic bags, or the body orifices closed with cotton or some other material to stop the escape of fluids. Medical or mortuary personnel should be

consulted for further information concerning the procedures and equipment needed to support body disposal.

Records should be kept of all deaths in the shelter. The vital information can be entered on or attached to the registration form. Identification, in the form of a tab or other device, should be attached to the body before it is stored. The following information should be ascertained:

1. Name and address.
2. Date of death.
3. Cause of death, if known.
4. Names of immediate survivors.
5. List of personal effects found on the body.
6. Last will, if expressed.

The planner should see that these identification forms are prepared and stored in the shelter area.

XIII. COMMUNICATIONS

GENERAL INFORMATION

Shelter planners should consider facilities for both in-shelter and beyond-shelter communications. A reliable system for in-shelter communication is important to assure effective shelter operation. Beyond shelter communication also is desirable at least in order to receive messages from the Emergency Broadcasting System (EBS). This system will keep the public informed on such matters as radiation levels, post-attack conditions, directions from emergency control centers, state of the Government and potential dangers in the area. Two-way communication to the outside from the shelter will be valuable for reporting emergencies and requesting aid or advice from other sources such as civil defense communication centers.

MAJOR PLANNING FACTORS

Communication Area

Communication equipment should be located in a relatively quiet area of the shelter. This will aid communications personnel in hearing incoming messages as well as in transmitting information. These facilities also should be located so as not to disturb those outside the communications area. This area should be lighted well enough to permit messages to be written and read. Locating this area adjacent to shelter management will be helpful. Access to communication facilities should be controlled to prevent unauthorized personnel who may disrupt communications from entering the area.

Equipment

In-Shelter

Communications facilities for the shelter may simply consist of runners who operate from the communications center where messages originate (Jones and Laughlin Steel Corporation, 1960). Also, loud speakers may be mounted in one or two central areas of the shelter. Battery-powered telephones or walkie-talkies also may be useful. However, these are not usually available within existing structures, and probably will have to be purchased for use in the shelter. When auxiliary power is available, standard telephone lines, within structures containing their own switchboards, can be used for in-shelter communications.

When choosing facilities for the shelter, planners may consider a combination of two or more methods. For example, messages may be transmitted by telephone to members of the shelter staff and relayed to other personnel by means of runners. Similarly, walkie-talkies may be used for both in-shelter and beyond-shelter communications.

Beyond Shelter

Planners should provide for placement of a standard radio receiver, such as a portable radio, in the shelter. If this is not possible, planners should assign someone to bring a radio used in the building during peacetime to the shelter upon attack warning. This radio is important in assuring that shelter personnel will receive messages from the Emergency Broadcasting System (EBS). A planner also may wish to have other radio receivers for use in obtaining information from civil defense organizations (Jones and Laughlin Steel Corporation, 1960).

Shelter planners may desire two-way communication facilities for the shelter. This may be done through the use of two-way radio or by wire.

The expense of radios for the shelter will depend on range, number of frequencies, and the general complexity of the equipment. Depending on these

factors, some equipment may be purchased for as little as 100 to 150 dollars.

Planners probably should not rely on the use of city telephones because of blast damage, unless there are protected underground telephone lines available for this purpose.

General Requirements

Shielding, which is effective in impeding radiation, also will inhibit the passage of radio waves. For this reason, shelters planning to use radio communication systems should consider the need for an outside antenna to support this equipment. Protection from blast damage should be assured by use of "whip" antennas or stabilization with guy lines. For short-range communication, a simple ground wire may suffice.

In cases where the auxiliary power supply is limited, or stand-by power is desired for communications equipment, batteries should be stocked in the shelter. These batteries should be checked periodically to see that they are in proper working condition. They should also be rotated if they can be used in peacetime.

Complex communications equipment will probably require skilled operators. Planners who have such equipment should consider ham operators or identify qualified radio operators among their potential shelter population. The Radio Amateur Civil Emergency Service (RACES), which was set up for providing communications in all types of disasters, may also be contacted for this purpose (Gautney & Jones, 1962).

XIV. SECURITY

GENERAL INFORMATION

Security plays an important role in shelter planning. It will be especially useful during shelter entry and organization of shelter functions. Security is also important for keeping disturbing influences within the shelter to a minimum.

MAJOR PLANNING FACTORS

The major factors to consider in planning for shelter security are the development of the security area, procurement and storage of security facilities, and personnel requirements.

Security Area

All shelters should have an area set aside for the use of security team personnel.

Use

This area should be designated for the following uses:

1. Marshalling area for security personnel.
2. Restraining shelterees who are psychologically disturbed or who are in some way disturbing the operation of the shelter.
3. Storage of equipment necessary for use in controlling the shelter.

Characteristics

That part of the security area which may be used to confine individuals dangerous to themselves or others should be separated as much as possible from the general living area of the shelter. The confinement area should not contain vital shelter facilities or equipment which might be damaged or destroyed,

and entrance and exit to the area should be easily controlled by a few individuals.

Security Facilities

Two important factors in planning for security facilities are (1) procurement, and (2) storage.

Procurement

Security facilities include such things as night sticks, handcuffs, whistles, and flashlights for crowd control both during shelter entry and shelter habitation. Other facilities should be procured for restraint of those people who are disturbing influences in the shelter. These supplies include such things as straight jackets, and possibly tranquilizers. These supplies may be procured from facilities already in use by a peacetime security force in the building housing the shelter. In cases where these supplies are not part of the existing facilities, they should be procured through direct purchase.

Storage

Security supplies necessary for control of the general shelter area, and which are not in use during peacetime should be stored inside the shelter and as near to the entrance of the shelter area as possible. This will aid security personnel in taking their posts as quickly as possible at the time of shelter entry. All facilities necessary for confinement or restraint should be stored in or near the designated security area.

Provision should be made for the protection of these supplies from theft. This is especially true when drugs or weapons are included as part of the security facilities. This may readily be accomplished by providing locked cabinets for supplies.

Security Personnel

It would be desirable to have trained security personnel in the shelter. This part of the shelter staff may consist of those already on a peacetime security staff within the existing structure. If no such staff is available, personnel within the building who have related experience to some type of security work, such as military or auxiliary police, should be contacted.

XV. SLEEPING FACILITIES

GENERAL INFORMATION

Provision for sleeping in the shelter should receive careful planning since it will take up more time and space than any other activity. The amount of space required for sleeping will influence the physical organization of the shelter, and the time required for sleeping will affect the scheduling of other activities.

MAJOR PLANNING FACTOR

Planning for shelter sleeping facilities involves two major considerations. These are (1) the general strategy of shelter sleeping arrangements, and (2) the provision of sleeping facilities.

General Strategy

There are several basic decisions that shelter planners must make concerning shelter sleeping arrangements that will greatly affect shelter operation. One such decision is whether plans should be made to have all shelterees sleep at once, or in two or more shifts. Another important consideration involves locating the sleeping area in the shelter. In order to optimize social control, shelter planners also should make preliminary decisions regarding the grouping and relative positioning of sleepers.

Simultaneous vs. Shift Sleeping

If adequate space is available, it is better to plan to sleep the entire shelter population at one time, rather than in shifts. Simultaneous sleeping offers fewer problems in such areas as noise control, shelter movement within the shelter, and scheduling of activities.

Also, from the health and sanitation point of view, it is desirable that only one person use a particular sleeping space. "Hot bunking" (assigning more than

one person to the same sleeping space in shifts) increases the possibility of transmission of infectious diseases.

Finally, if only one person occupies a bunk which does not have to be dismantled daily, the bunk becomes a place of relative shelter privacy, where an individual can relax during the day and store his non-valuable personal effects.

Sleep space, of course, is the major consideration involved in deciding upon simultaneous vs. shift bunking. If bunks are available, there must be enough space to house them in the shelter. Sleeping facilities which can be dismantled during the day will greatly enhance the possibility of simultaneous bunking. When no bunks are available, general sleeping space must be considered in deciding upon a sleeping arrangement. Table VII indicates the adequacy of various sleeping areas. Aisle space, which was not taken into account in the Table, should be allotted wherever possible. A two-foot aisle around the perimeter of the sleeping area, plus at least one aisle and preferably more within the sleeping area, will make entry and egress in the sleep area easier, and thereby increase management control during sleep hours.

The major advantage of shift sleeping is that it saves space, which is a very important consideration in shelter. However, the uses to which this space can be put might be limited by the requirement to lower noise and illumination levels, so as not to disturb those on the sleep shift.

It is recommended that the number of sleeping shifts be kept to two, if at all possible. This will permit a large period of time daily when all shelterees are awake for activities in which the entire shelter population should participate. Two-shift sleeping will also allow time for daytime naps and rest periods for children and others requiring them.

Table VII
On-the-Floor Sleep Space Required for 100 Sleepers

SQUARE FEET AVAILABLE	CONDITIONS FOR SLEEPING 100 SHELTEREES
650	1. All except children have to sleep with legs bent. 2. Situation may be uncomfortable enough to consider "shift sleeping."
900	1. Almost all shelterees will be able to sleep on their sides with legs extended. 2. Some will be able to sleep on their backs.
1500	1. Almost all shelterees will be able to sleep on their backs with legs extended. 2. There will be sufficient room to extend arms and move body slightly without interfering with other shelterees.

Location of the Sleeping Area

The principal considerations involved in locating the shelter sleeping area during shelter planning are:

Shelter size and layout. In a small single-area shelter, there will often be no choice in locating a sleeping area. The sleeping area will consist of all or most of the usable floor space, unless many-tiered bunks are available.

Ventilation. Sleeping areas, particularly those utilizing tiered bunking, probably will contain more people per cubic foot than any other area in the shelter. Particular attention should be paid to the ventilation facilities for this area to assure adequate temperature and atmospheric control. While in many shelters the problem will be one of excessive temperatures, due to high density occupancy, shelters in cold climates may have a requirement to provide some heat for the sleeping area.

Noise and Light. When shift sleeping is to be used, the sleeping area must be separated from the activity

area, either by a barrier or by physical distance. This has a two-fold purpose: to insure that sleepers are not affected by on-going activities in the day area, and that activities are not constrained by the requirement to keep light and noise at levels so that people can sleep. The quieter and darker the location, the greater the opportunity for sleep.

Toilet facilities. In a shift-sleeping shelter, relative location of the toilet facilities and the sleeping area should be such that those in the day area can use the facilities without disturbing sleepers.

Grouping and Positioning of Sleepers

Shelter planners should recommend that shelterees be separated in the sleeping area on the basis of sex, age, and marital status. The most effective plan for grouping is to use physically separate areas for a dormitory or dormitories for single men, and one or more for single women. Family groups should sleep together in a third location.

If the shelter consists of a single area, the grouping of sleepers will be largely a shelter management problem. Similarly, the relative positioning of sleepers to avoid the spread of respiratory ailments is the job of shelter management. It is recommended that shelterees and their neighbors sleep in a "head-to-foot" arrangement, as illustrated in Figure 8. Two small children may be fit into the floor space allocated for one adult.

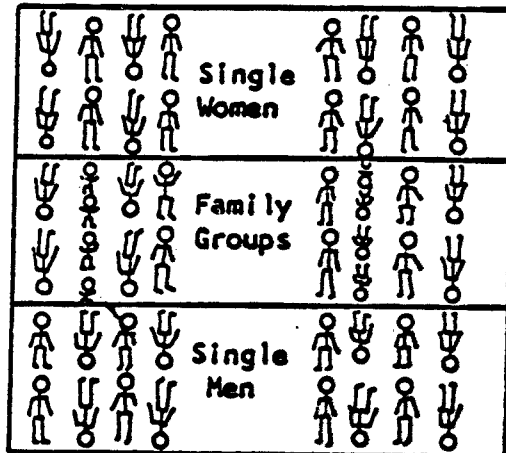


Figure 8. Grouping and Relative Placement of Sleeping Shelterees

Provision of Sleeping Facilities

Plans for shelter sleeping facilities can involve one of three basic approaches:

1. Improvising without major modification of existing facilities.
2. Improvising involving extensive modification of existing facilities.
3. Installation of a shelter bunking system.

In addition to the bunks themselves, various other items may be provided to enhance sleeping in the shelter.

Improvising Without Modification

If necessary, shelterees can sleep on the floor of the shelter with no particular ill effects. If shelter planning calls for such an approach to the sleep problem, any of the more comfortable facilities such as cots, or even tables and desks, probably should be set aside for special use (for example, in the sick bay). Pre-planning of this nature reduces conflict within the general shelter population.

Rugs available within dual-purpose structures can be laid in the sleeping area and rolled up during daylight hours. This should contribute to both the comfort and cleanliness of the sleeping area.

Some shelters will have special facilities that can be used without modification for sleep purposes. In a shelter with an auditorium, the auditorium seats can serve as sleeping facilities. In a filled parking garage, the cars may well provide sleeping facilities for many shelterees. If shelterees can sleep on the tops of desks, tables, etc., as well as under them, more sleepers can be accommodated at one time.

Improvising Through Modification

The most effective sleeping facilities for shelter use are tiered bunks. The capability of "stack" sleeping shelterees will greatly increase the amount of shelter floor space available for other purposes.

Many of the peacetime facilities available within dual-purpose structures can be modified to form tiered bunks for shelter use. The development of such sleeping facilities is largely a matter of individual ingenuity. One method which has been demonstrated as feasible is to fasten together six or seven multi-tiered, open-backed, metal bookcases or stock shelves. Depending upon the width of the shelves, one or two persons can sleep on each tier. Five tiers of sleepers will very often be possible, using normal metal bookcases or stock shelves. Another way of constructing a tiered sleeping arrangement is to carefully place tables on top of one another.

Plans for any such improvising of bunk facilities should be worked out in great detail by shelter planners prior to shelter entry to assure that:

1. Sufficient facilities are available to assure the planned sleeping arrangements.
2. The planned modification will provide tiers which are strong and sufficiently stable.
3. Higher tiers will be arranged in a manner which will reduce the probability of someone toppling from them while asleep.

The necessity for careful pre-planning cannot be overstressed. For example, while stacking tables atop of one another may seem quite simple, an actual attempt to stack only a few tables will quickly reveal the many factors which must be considered to meet the three basic requirements stated above.

Very adequate non-tiered bunks for infants and small children also may be made from cardboard cartons. If possible, the carton should be lined with a waterproof material. It should be recognized that waterproof materials, if not properly installed, may become a suffocation threat to infants. Children should be assigned to a specific cardboard bunk for the entire shelter stay, to the extent possible.

Installation of a Bunking System

When the planning budget permits, a complete bunking system can be installed in the shelter. Tiered bunks, of course, are highly recommended. Such sleeping facilities may be purchased from a number of commercial sources, including military surplus outlets and retailers of camping and dormitory equipment.

In some shelters, bunks will have to be dismantled and erected daily, for maximum use of shelter space. In such cases, the shelter planner should establish a set of procedures and a schedule for erecting and dismantling bunks.

Bunking systems may be designed to provide a variety of daytime uses. For example:

1. Bunks may be left in place for daytime naps.
2. Bunks may be used as chairs for eating, recreation, etc., To accomplish this, some modification is usually necessary, e.g., removing or raising the middle bunk on a tier.
3. Removable bunks may be used as tables or desks, when placed on water drums, cartons, camp stools, etc.

Sleep area partitions. Partitioning the sleep area serves two basic purposes. First, partitions serve to separate the sleeping area from the daytime area. This is a requirement for carrying out shift sleeping successfully. Secondly, partitions can be used to segregate the sexes during sleeping hours, which will help maintain social control in the shelter.

The natural configuration of the dual-purpose shelter can be used to provide separate sleeping areas. A natural partition is any structural feature of the structure that insulates one part from sight or sound of another. This includes separate rooms, walls, room dividers, etc. Finally, temporary partitions for separating sleeping areas can be erected from folding screens, portable blackboards, map racks, bulletin boards, and signs.

Additional Items

Other items which may be provided in planning for shelter sleeping facilities include:

Blankets. In the warm environment of many shelters, blankets will not be necessary as a covering. However, in all shelters, blankets may still be needed by the infirm and aged. In addition, blankets have a number of other uses. A blanket may be folded over as a mattress or a mattress cover, rolled up as a pillow, or hung up as a partition. Blankets which are quite adequate for shelter use can be purchased for as little as three to five dollars. However, those responsible for developing shelter sleeping facilities in dual-purpose structures can plan to use a variety of available items to serve this purpose. Blankets may be improvised, for example, from clothing (coats, jackets, shirts, sweaters); furniture (slip covers, drapes, curtains, rugs); towels, laundry bags, and newspaper or other paper.

If two or more shelterers share a common bunk, table top, or even spot on the floor, it would be advantageous if each had his own blanket to provide something between the sleeper and the sleep surface. From both a psychological and a medical point of view, an individual's own private blanket or other form of bedding would be valuable in overcoming some of the disadvantages of "hot bunking" (more than one person using the same bunk).

Mattresses and pillows. While there seems to be little justification for stocking such an item in any but the most elaborate shelter, sleeping on the floor, table, or shelf may be made more comfortable through the use of an improvised mattress. Even one layer of fiberboard between a sleeper and the sleeping surface may aid the shelterer's comfort. Shelter plans may specify the use of the cardboard containers of various shelter supplies for this purpose, if this seems desirable.

Pillows, while not a likely item for shelter stocking, may be improvised from articles of clothing, books, or other materials.

CHAPTER XVI. WARNING AND SHELTER ENTRY

GENERAL INFORMATION

The major shelter goals can only be achieved through getting the greatest number of potential shelterees to the shelter on time. This suggests that some form of in-house warning system be developed within dual-purpose structures which will overcome the danger of failure in hearing outside warnings. The actual loading of the shelter is another important planning consideration.

MAJOR PLANNING FACTORS

A shelter warning and entry program should include plans for:

1. Warning systems.
2. Opening the shelter.
3. Access routes.
4. Shelter closing.

Warning Systems

Requirements

Factors which must be considered in the design of an effective in-house warning system are coverage, clarity, and reliability.

1. Coverage. Provision must be made so that all persons within the building are able to hear the warning no matter what conditions of man or machine noise or architectural features such as soundproofing exist.

2. Clarity. The addition of one sound to others may lead to the individual's ignoring the warning. The warning must be clear, distinguishable, and understandable to all individuals. The signal should be used only for disaster warning.

3. Reliability. The system must have a one-hundred per cent guarantee of working when it is needed. This suggests that careful attention be paid to design features and that frequent tests of operability of the system be made.

Methods

There are several different types of warning systems which may be used for alerting personnel in dual-purpose structures of an imminent attack. Some of these include:

Public warning system. Warning sirens have been installed by many cities and states through the help of the Federal Government. These sirens are strategically placed throughout the area to provide widespread warning prior to an attack. Signals are transmitted by these sirens to indicate "attack warning" and "take cover". These general warning systems can notify much of the population of an impending attack. They do, however, have limitations for warning people inside buildings, as discussed on page 107.

Bell-and-light system. This warning system is available to the public through the Bell Telephone Company. The system can be installed through most switchboards, and located almost anywhere within a building. Warnings originating from Air Defense Control Centers are transmitted over private lines and telephone networks to Civil Air Defense Warning stations. Special dials are installed at these points and when the code is dialed, warnings are relayed simultaneously to "bell-and-light" stations.

MUZAK. In some communities, the MUZAK system, which is a commercial distribution system for wired music, is also utilized for sounding warning signals. This is done through a special amplifier unit which is located at the MUZAK control center (Gautney & Jones, 1962). Where this service is available, it is automatically provided with the music service. This may require installation of an auxiliary speaker in areas where a warning signal is desired.

All of the systems described on previous pages provide maximum warning time in the event of an impending attack. The installation of the bell-and-light, or other individual warning device, in every room of a structure beyond the range of public sirens could be expensive. Furthermore, it would not necessarily be disadvantageous for shelter management personnel to receive a warning through such devices slightly prior to the rest of the shelterees. For these reasons, it may be desirable to develop a general warning system within a structure which can be activated by shelter management personnel. In such a case, the individual warning device would be placed at strategic locations throughout a structure, so that responsible persons could always hear them.

In some cases, existing facilities may be used as warning systems. Some of these facilities include in-house fire alarms, public address systems, telephones, and signal bells or buzzers. Some planners may wish to install a special in-house warning system. This can be accomplished through the utilization of door-bell devices, sirens, whistles, or other relatively inexpensive equipment.

Opening the Shelter

The dual-purpose use of some shelter facilities may necessitate their being locked during peacetime. Shelter planners should assure that these buildings can be opened immediately upon receipt of an attack warning. A number of individuals should be given the responsibility of seeing that the shelter is opened and the necessary support equipment (lights, ventilation, etc.) be put into operation. Enough people should be designated to assure prompt response at any time of the day or night. The responsible individuals should be provided with keys and given the necessary instructions by those responsible for shelter planning.

Access Routes

Review of Available Routes

Every building has peculiar characteristics which make it necessary for planners to review these

features before the determination of desirable routes to the shelter. Such review would include consideration of: (1) widths of passages, (2) distance to shelter, (3) location of people. On the basis of review of available routes to the shelters, planners must determine the most desirable passageways.

Orientation of Potential Shelterees

It is necessary that planners devise some system of informing the potential shelterees of the routes they are expected to take to insure that they will be appropriately used. Whether to implement such orientation through meetings, personal contact, memos, or other methods is a decision which will ultimately depend on the particular situation. Such factors as size of building, number of diverse organizations, number of people in and around the building, and effectiveness of present communications systems would be important in the design of an orientation plan.

Route and Shelter Marking

Orientation efforts may not prove successful as a result of being ignored, forgotten, or passed off lightly. Also, individuals will probably be in the building as visitors and, therefore, not be familiar with the access plans of the particular building. This suggests that planners must consider some form of visible marking of both routes and shelters for each building. Such an approach is rather simple in both cost and effort but planners must consider possible objections to posted directions from peacetime users of the structure.

Establishing a System for Traffic Control

To effectively get all individuals to the shelter quickly and smoothly, it will be necessary for planners to establish a system of traffic control for the building. Required control points must be determined. The procedures of control must be established and personnel selected and trained to implement this control. Control personnel also would help to prevent confusion and panic once the shelterees were in the actual shelter. The planner may wish to select these people from an existing security force in the building (See Chapter XIV).

Shelter Closing

The physical act of closing entrance to a shelter area will provide minimal protection against radiation hazards. Such a gesture will be useful in defining the boundaries of the shelter area for those inside and in indicating to others that the shelter has been filled to capacity.

Provision should be made for protecting those people who are not able to enter the marked shelter area before closure. Planning for this situation can be done by determining the number of other qualified shelters in the immediate area to which these people can be directed. The planner can also identify additional areas in his own building which approach a protection factor of 40. Signs listing these additional shelter areas should be posted outside the shelter. Control personnel also may be stationed at the shelter entrances to provide directions to latecomers.

If these people are to remain inside the building, the planner may wish to provide supplies necessary for their survival. This can be done by stocking extra supplies in the shelter which can be dispensed to the unmarked shelter areas.

XVII. NON-OPERATIONAL ACTIVITIES

GENERAL INFORMATION

Non-operational activities are those which are not necessary to the maintenance of primary shelter functions such as food, water, sanitation, etc. These activities are important, however, both for the training and education of the shelterees and the morale of the group.

MAJOR PLANNING FACTORS

Planning for non-operational activities should consider the following major factors:

1. Training and education.
2. Shelter service activities.
3. Physical fitness activities.
4. Religious activities.
5. Recreation.

Training and Education

Training and education activities not only provide a realistic and useful way to absorb shelteree idle time, but also enlarge the capability of shelterees for in- and post-shelter living. It is, therefore, recommended that shelter activity planners give priority emphases to such activities.

The following kinds of training and educational activities are recommended.

1. Management staff personnel training.
2. Shelteree training for in-shelter living.
3. News and orientation sessions.

4. On-going education for children.
5. Training for post-shelter living.

Shelteree Service Activities

In-shelter service activities involve realistic, service-providing tasks which give people a sense of contributing to a common good of the shelter.

The principal service activities are:

1. Care of infants and children.
2. Non-medical care of ill and injured.
3. Medical support activities.
4. Psychological support activities.
5. Improvement of shelter appearance activities.

Physical Fitness Activities

Two types of specific physical fitness activities which appear to be appropriate in the shelter are:

1. Self-initiated calisthenics.
2. Group calisthenics.

There are arguments both for and against physical fitness activities in a shelter. The planner should develop such activities within the limits suggested by shelter conditions, e.g., temperature, food, water, etc.

Religious Activities

There is considerable evidence that normal reliance on religious beliefs and activities is greater under severe stress. For this reason religious activities should be included in a shelter activity program. Such activities help people control their fears and anxieties.

Depending upon circumstances, three kinds of religious activities seem appropriate for the shelter situation.

1. Non-denominational services.
2. Denominational services.
3. Self-initiated prayer and meditation.

Recreation

Four types of recreation which can be considered by shelter activity planners are:

1. Arts and crafts.
2. Social-recreational activities.
3. Spectator entertainments.
4. Free-time quiet activities.

Improvised arts and crafts activities are very good as tension reducers. For this reason, activity planners should consider adults as well as children when planning for arts and crafts.

Social-recreational activities are a distinct advantage in providing ready means for breaking down social barriers and inhibitions. The social-recreational activities suitable for the shelter are (1) small group games, (2) organized group discussions, and (3) informal group singing.

Spectator entertainments are recognized as having much morale value. For this reason, the activity planner should make good use of all talent available to him in the shelter. The activity planner would also do well to solicit volunteers to develop plays, skits, or chorus arrangements.

Free-time quiet activities are essential since people need to have relief from organized activities and each other in a shelter environment. Free-time

quiet activities include such things as reading and many arts and crafts activities.

PLANNING CONSIDERATIONS

Three major considerations in planning for non-operational shelter activities:

1. Advantages and disadvantages for different types of shelterees.
2. Requirements for trained personnel.
3. Requirements for equipment and facilities.

The advantages and disadvantages of various non-operational activities in certain situations have been discussed above. The personnel required for carrying on non-operational activities can usually be recruited from the shelter population, e.g., nurses' aids, camp counselors, etc. However, the shelter planner may wish to select a few people to develop the basic shelter plan.

The need for equipment facilities for non-operational activities is quite small. The shelter planner should, however, stock manuals and other instructional material necessary for training and education along with certain basic religious documents. Equipment and facilities for other non-operational activities can usually be improvised in the shelter.

The document, Planning and Organizing Shelter Non-Operational Activity Programs, may be consulted for detailed recommendations regarding non-operational shelter activities (Siroky & Eninger, 1963).

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APPENDIX A

Sample Basic Shelter Plan

SHELTER AREA

The main shelter area consists of the third level of an underground parking garage, located beneath an office building. This shelter has a capacity of 175 spaces with a protection factor of 1,000+. A floor plan of the general garage area is presented in Figure 1. In Figure 2, a floor plan of the garage is presented with each shelter area designated. During peacetime this garage houses the cars for the employees of this building. Entrance into this garage facility is by two large doors at street level. There is one elevator to this facility, as well as a stairway from the first floor which runs down through the three levels of this garage beside the elevator. For automobile use, the three levels of this garage are connected by continuous ramps which start at street level.

Immediately after an attack warning, five minutes will be allowed for those people who wish to go home to remove their automobiles from the garage. We will then proceed to remove all cars from the third level of the garage. These cars will either be driven out of the garage and parked in two lots adjacent to the building, or they will be parked in the aisles of the upper garage levels. Which of these procedures we use will depend on the amount of time which is available after an attack warning.

The protection factor of the second level of the garage is in excess of 40. Therefore, if enough cars can be removed from this level it will be utilized as auxiliary shelter space. The balance of this plan, however, is based on the assumption that only the third level will be available for shelter use.

SHELTER MANAGEMENT

Selection of Management Cadre

Notes:

Because the shelter is relatively small, only one person was required to write the plan. For this reason, the management staff is not yet selected.

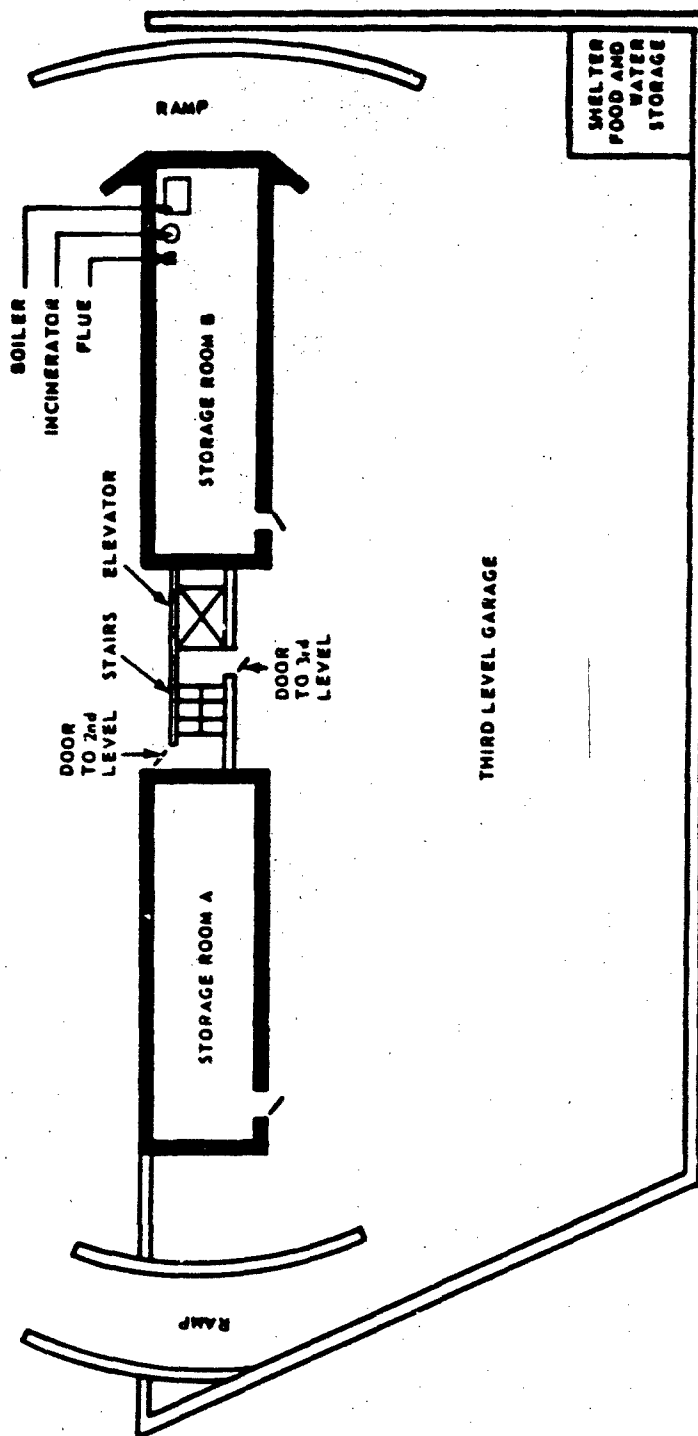


Figure 1. General Garage Area

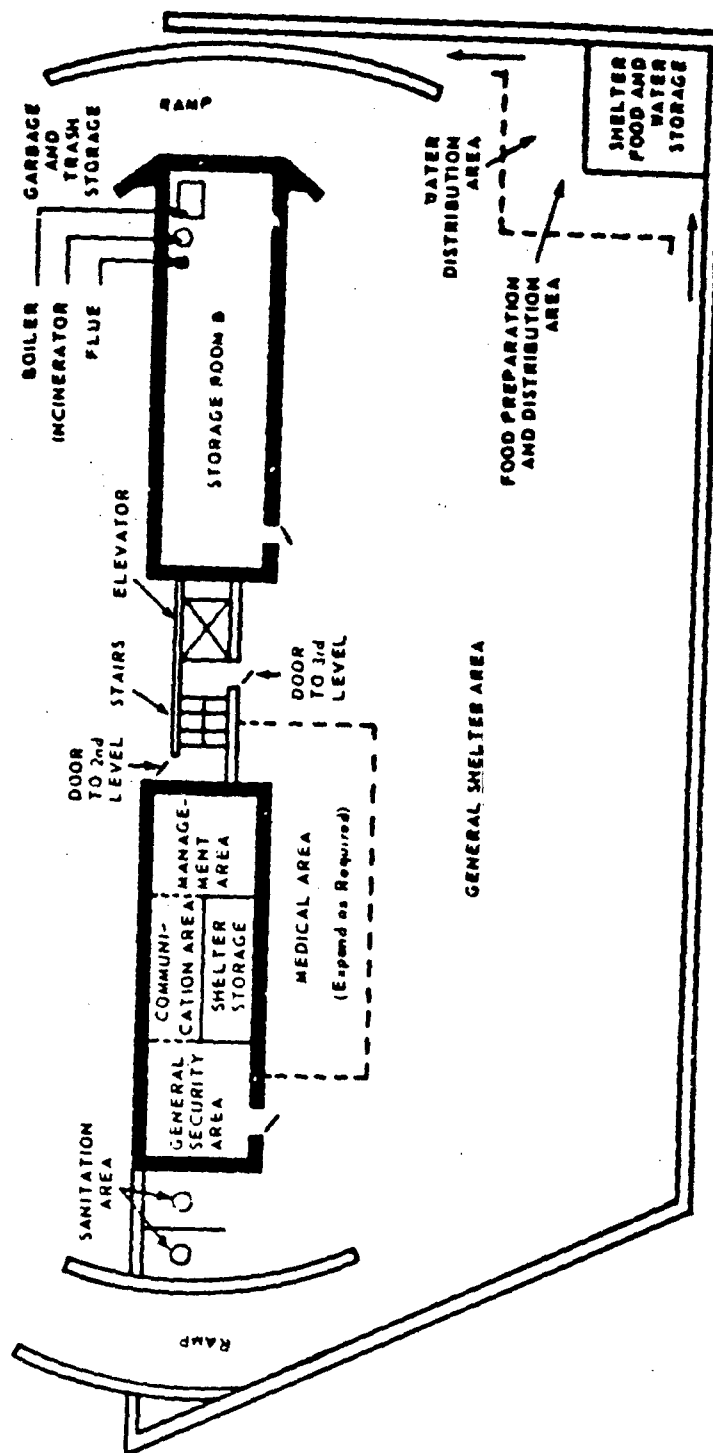


Figure 2. Shelter Area

Plan:

1. An organizational chart has been developed for the shelter and is presented in Figure 3. This organization assumes a shelter population of 175 persons, and reflects somewhat the skills usually available within the building.
2. Selection of this staff will be accomplished before final decisions are made for implementation of the basic plan.

Management Area

Need:

A private management area is necessary for this staff to carry out its duties without interruption. However, it should be located close to the security and communication areas.

Plan:

1. The management area will be located in storage room A.

Management Facilities

Plan:

1. A table and chairs will be stored in the room designated as the management area.
2. Paper and pens will be stored in the management area.
3. Small cardboard boxes will be placed in this area for storage of shelter records.

RADIOLOGICAL PROTECTION

Assessment of Available Shielding

Formal Assessment

An assessment of the shelter area was provided by the Federal Marking and Stocking Program for the purpose of:

1. Confirming the protection factor of the designated shelter area.

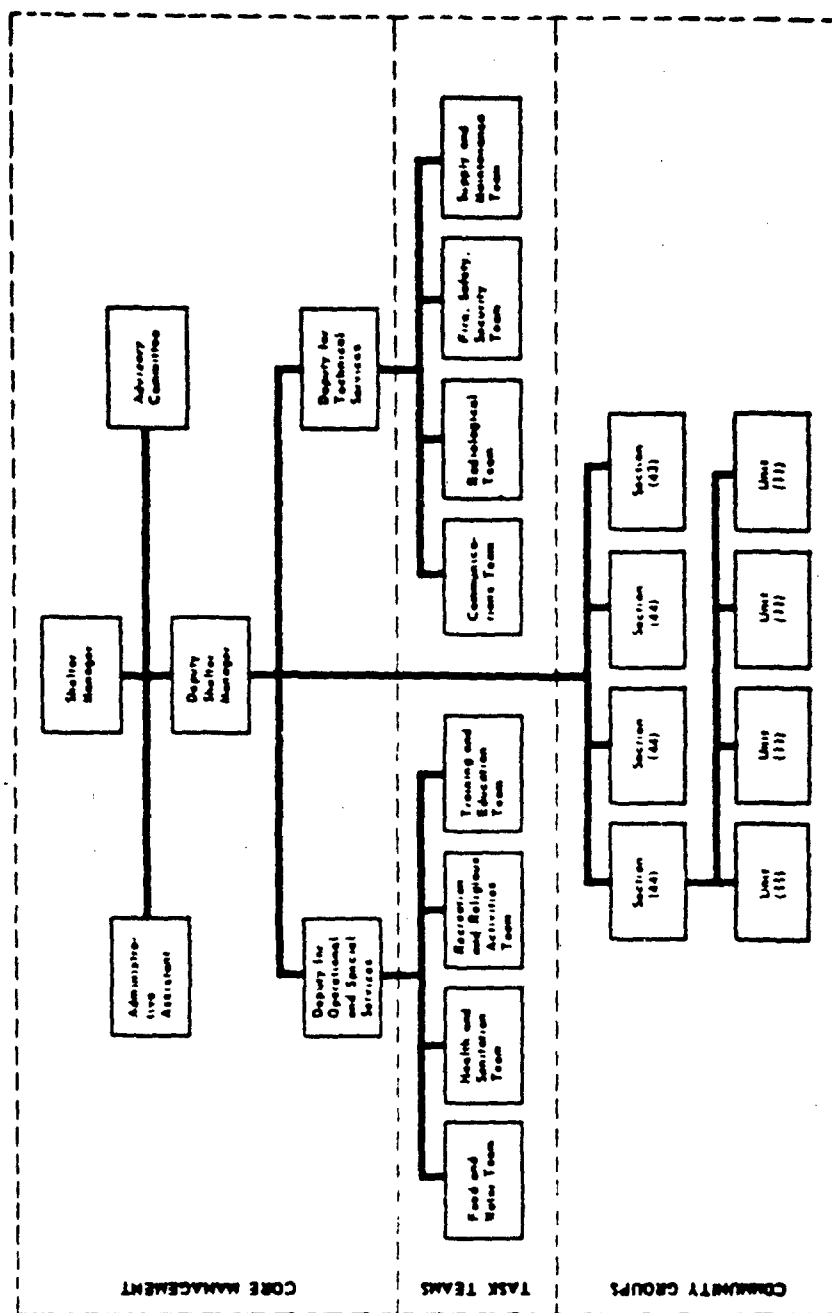


Figure 3. Organization Chart

2. Determining the capacity of the shelter.
3. Determining where and to what extent steps can be taken to provide adequate protection in other parts of the building.

Protection Factor
Assessment - 1,000 +

Providing Additional Protection

Shelter Location

This building is located in a geographical area where large amounts of highly radioactive fallout may be anticipated.

Need:

Areas leading into the shelter which should be closed off include:

1. Elevator shaft which leads to the shelter area.
2. Flue leading to the incinerator in the room adjacent to the main shelter area.

Plan:

1. The ramps are built in a curved manner which will impede the progress of radiation which travels essentially in a straight line.
2. The elevator shaft will be closed by stopping the elevator one floor above the shelter area.
3. The flue leading into this area will be sealed off on an upper level with cardboard or some other compatible material.

Radiological Monitoring

Equipment Needed

Ratemeters to determine radiation level of a given object or area.

Dosimeters to assess the amount of radiation exposure an area or person has received.

Plan:

1. Participate in the Federal Marking and Stocking Program entitles us to radiological monitoring equipment for our shelter.
2. Personnel will be recruited and selected to be trained in the use of these instruments.

Decontamination

Need:

We do not expect many late arrivals into our shelter. In cases where people do arrive late, we will use dry decontamination methods.

Plan:

1. Immediately after entering the first level of the garage, any late arrivals will be confronted with a sign indicating that they should stop for any decontamination which might be necessary. This sign will be printed on the reverse side of a peacetime sign in this area to insure that it will be posted immediately after an attack warning.
2. Rags, brooms and brushes will be stored in a room adjacent to the first level of the garage for dry decontamination.
3. We may possibly post instructions in this area expressly for the purpose of self-decontamination.

AUXILIARY POWER

Need:

Auxiliary power is an asset to any shelter system. Our building includes among its present equipment a natural gas, water cooled 15 KW emergency generator. This generator is located on the first floor in the core of the building.

In addition to the public gas and water supply necessary to the operation of the generator, it would be helpful to have a back-up supply of these resources.

Some shielding from flying debris, etc., should be considered for the generator because of its location on the first floor. Our shelter needs include lighting facilities and possibly some communication equipment.

Plan:

1. As a back-up supply of resources for our generator, we may sink a well and install a tank for storing natural gas. The well will not only supply water for cooling the generator but will be used for drinking water, fire suppression and sanitation purposes.
2. We plan to consult with qualified people about the legal and technical aspects of sinking a well and installing a fuel storage tank.
3. Sandbags which can be stacked around the generator for protection immediately after an attack warning also will be stored in the room housing the generator.

MAINTENANCE

Plan:

1. Tools and other facilities used for peacetime maintenance will be available for shelter use.
2. Personnel for maintenance of equipment during the shelter stay might be those people normally on duty during peacetime. These people live close enough to get to the shelter after working hours.

TEMPERATURE AND ATMOSPHERE CONTROL

Air Exchange

Plan:

Because the shelter is located on the third level of the garage, it will be possible for us to leave the doors open which lead into the garage without the danger of fallout drifting into the main shelter area. This should be sufficient to maintain an adequate air supply for the shelterers without the need for forced ventilation.

We have allotted the required 500 cubic feet of space for each shelteree under conditions of natural ventilation. This permits us to house the maximum of 175 people in the shelter.

Control of Air Temperature

Plan:

Since we do not expect crowding problems in our shelter, the 500 cubic feet of space allotted for each shelteree should also permit adequate control of air temperature.

WATER SUPPLY

Amount

Plan:

Our water supply of 3.5 gallons per shelter space is being provided through the Federal Marking and Stocking Program.

Provision and Storage

Need:

In addition to the water we will receive from the Federal Marking and Stocking Program, we are going to study the possibilities of using available facilities.

Plan:

1. Consultation with professionals is planned to determine the capacity of the water system in the building and the feasibility of using water trapped in these pipes after an attack warning.
2. If our plans for sinking a well go through, we will definitely use this as a water supply for the shelter.
3. We also plan to collect water in various containers, such as wastebaskets, immediately after an attack warning.
4. The water which we receive through the Government program will most likely be stored at one end of the shelter, close to our food preparation

area and as far away from the latrine area as possible. Periodic tests of the water will be made to insure its purity.

5. If a well is used as a water supply, it will be periodically checked for purity, standing capacity, and flow. The well's pumping system will also be checked periodically for damage or deterioration.

Purification

Need:

We do not foresee any major problems with regard to the purity of our water supply. Maintenance and purity checks will be made to insure the purity of the supply before a shelter stay. However, we are going to consider some means of purification in case of unforeseen situations which might arise which would cause contamination.

Plan:

1. Water purification tablets are provided in the supplies given out through the Federal Marking and Stocking Program.
2. Iodine, which is effective in destroying bacteria in water, will also be stocked.

Distribution

Need:

Because our shelter is relatively small and crowding is not anticipated, a method of fixed-point distribution seems the most feasible idea at this time. However, this is subject to change if we find that the management of this type of distribution for our shelter is not as efficient as we anticipate it to be. Individual drinking containers for the shelterees must also be considered.

Plan:

1. With Federal water supplies, our plan will be to dip and pour water from large cans into individual drinking containers. If other methods are used, such as obtaining water from a well, we will probably employ the same basic method of

filling large cans from the well and dipping and pouring the water into individual containers for the shelterees.

2. Plastic cups are provided as drinking containers for the shelterees through the Federal Marking and Stocking Program. In addition, all personnel will be asked to bring to the shelter the cups which they retain for "coffee breaks" during peacetime. We will also bring our supply of paper cups which are kept for various uses during peacetime.

FOOD

Procurement

Need:

The shelter population of this building consists of relatively young male and female adults. As the shelter population stands now, we do not expect many adolescents, aged, babies, or pregnant women. For this reason, we do not foresee any real need for exceptionally different kinds of food for the above-mentioned people. However, we do feel that it would probably be ideal to have supplementary food in some form to break the monotony of the regular shelter diet.

Plan:

1. Shelter rations will be supplied through the Federal Marking and Stocking Program.
2. Plans for supplementing these foods include bringing to the shelter the contents of the various vending machines which will be located on the second floor of the building. We will also request those who have extra food to bring it with them to the shelter.

Storage

Need:

Federal stocks are packaged fairly well. For this reason, our needs for storage will be primarily concerned with environmental control of the food with regard to the preparation area.

Plan:

1. Food supplies will be stored at one end of the shelter next to the water supply.
2. At the time of arrival of the food supplies, they will be marked with the date and the shelf life. A periodic inventory schedule will be set up to inspect these supplies.

Preparation

Need:

With Federal stocks and provisions from the vending machines, preparation need not be elaborate. However, some utensils will be required in the simplest preparation method. A preparation area will also be required.

Plan:

1. The extent of preparation of the shelter food will be limited to unpackaging and possibly some mixing. No cooking is planned at this time. Federal stocks contain a can opener and wooden strips for mixing purposes. Some kitchen utensils and heating or cooking facilities will be available in the building such as spoons, knives, pots and pans, coffee urns and hot plates. Procedures will be set up for the removal of these utensils from the floors closest to the shelter area after an attack warning.
2. Because preparation will be mainly limited to unpackaging and mixing, the food preparation area will be relatively small. Boards, which will be stored in storage room B, will be made into makeshift counters after an attack warning. This will serve as a work area for preparing the food as well as limiting access of unauthorized personnel to the area.
3. The preparation area will be located in the same area as the food is stored. This area is located as close to the water supply as possible and as far away as possible from the medical and toilet areas.

Distribution

Need:

Our shelter is moderately sized, and extreme crowding is not anticipated. Because the food supplies are not elaborate, relatively simple support equipment will be required for the distribution process.

Plan:

Food distribution will be carried on from a fixed point. We expect to use this area for preparing as well as distributing the food.

Additional support equipment for distribution will be provided in the form of dishes (plastic or paper). These will be purchased for shelter use.

Provision of Eating Facilities

Need:

Being a garage area, it will not be feasible to set up a formal eating area with tables and chairs during peacetime. Also, there is little room directly around the shelter area in which we might store this type of equipment. We do feel that some type of eating area should be designated.

Eating utensils of some sort are needed both for ease in distributing the food as well as making the shelterees comfortable.

Plan:

1. A section of the shelter will be set off close to the preparation and distribution point as an eating area. At this time we do not plan to furnish this area, but we are considering setting up some type of make-shift furniture from cardboard boxes, large cans, etc.
2. Plastic eating utensils will be purchased. This plan is dependent upon whether or not we will have enough water available for cleaning these utensils. If water will be scarce, we may use wooden utensils and paper plates which are disposable, although more expensive.

LIGHTING

Need:

General lighting is provided in the garage area because of the lack of windows to provide natural light. These lights will be incandescent, and should be sufficient for such shelter tasks as food preparation, reading, and movement about in the shelter.

High intensity lighting will be required for the medical area and possibly around vital equipment such as the emergency generator. This type of lighting may also be required in decontamination and radiological monitoring areas in order to see fallout particles and read vital instruments.

We do realize the usefulness of back-up lighting but do not plan to go to the expense of installing equipment other than the primary lighting system at this time.

Plan:

1. Lights now available in the shelter area will be connected with our auxiliary power source.
2. A system will be installed which will allow us to turn on alternate bulbs in areas where only very dim lighting will be needed, e.g., most of the general shelter area during sleeping hours.
3. High intensity lighting in the medical area will be achieved by using higher wattage bulbs.
4. Portable lighting equipment is available to us in the form of flashlights and a few battery-powered lamps. These will be used to increase the lighting in areas where higher intensity is required. They will also be used as crude back-up lighting in the event that the primary lighting system fails. Most of this portable equipment is stored during peacetime in the room housing the generator on the first floor and boiler room. This will aid in bringing the equipment to the shelter area as quickly as possible after an attack warning.
5. If for some reason all means of lighting failed, lights on the automobiles will be utilized. This

can be done by driving the cars to the ramp openings leading into the main shelter and allowing the lights to shine directly in on this area.

FIRE PROTECTION

Prevention

Need:

Fire preventive measures should be taken in all parts of the building. However, certain precautionary measures should be especially noted for the storage of fuel and other materials, installation of equipment, the general make-up of the shelter area and peacetime use of the shelter.

We will require fire prevention procedures in shelter as well. These will be left mainly to the organization and management phase of shelter planning. We will be using OCD reports on management, especially Bend, et al, 1963.

Plan:

1. A consultant from the local fire department will be contacted to review our fire prevention program.
2. All flammable materials such as wood, paper, gasoline, etc., will be removed from the storage rooms and from the room housing the generator where sparks may ignite them.
3. After the fuel storage facility for our emergency generator is installed, a periodic check will be made for leaks or other damage.
4. All volatile medical supplies will be stored properly in fireproof containers.
5. All extra electrical equipment will be installed by qualified electricians.
6. The shelter will be used in peacetime as a garage. For this reason, certain measures will be taken to insure that gasoline or other volatile materials are not used or spilled in the shelter area.

Detection

Need:

There is no doubt that quick detection of fires limits damage both in shelter and around the shelter area. In our building we have no instruments available for fire detection. We also cannot afford the expense of purchasing these instruments.

Plan:

1. Our fire detection method will be tied closely to the management and organization of our shelter. Personnel in the building will be selected as fire detectors both in and around the shelter area. These people will learn their specific duties from our organization and management procedures.
2. Fire detection drills will be held periodically during peacetime both in and around the shelter.

Suppression

Need:

There will be a definite need for some fire suppression equipment in the shelter. Even if there were no danger from fire immediately after an attack, there is a danger of fire starting in the shelter from such things as cooking equipment, smoking, etc. We may find that we will have a large quantity of water available from the well. However, by using this method there may be a danger of increasing other hazards such as flooding and increased humidity.

Plan:

1. A consultant from our local fire department will be contacted to discuss the various aspects of our fire suppression program.
2. All portable fire extinguishers available throughout the building will be utilized.
3. A fire fighting team will be selected. Part of their duties will be to bring a certain number of fire extinguishers to the shelter area from elsewhere in the building.

4. Buckets filled with sand and empty buckets which can be filled with any kind of water to put out small isolated fires will be stored.

MEDICAL

General Medical Area

Need:

Hopefully there will be very few critically injured people in our shelter. Nevertheless, we feel that we must plan some type of general medical area. Due to our shelter situation, it may be rather difficult to plan any extensive medical set up. There will be virtually no isolated rooms close enough to the shelter for us to use. Storage room B will be taken up mainly by decontamination facilities. Storage room A will probably be used primarily as the management area.

Plan:

1. A small section of the shelter next to storage room A will be the medical area.
2. Screens or other partitions will be stored near the shelter area which may be set up immediately after an attack warning to segregate the medical area from the rest of the shelter.
3. The medical area will be placed as close as possible to the stairwell leading to the shelter. This will be done so that all shelterees entering the shelter who are injured will not have to pass through the main shelter. It will also facilitate any necessary body disposal.
4. Bunks may be hard to come by for the medical area. The possibility of improvising beds from car seats for medical use will be investigated.
5. Lighting in this area will be checked to see that it meets the standards for the type of work which will be necessary to carry out there.

Medical Facilities

Need:

Our building does not have a formal dispensary. For this reason it will be necessary to procure

medical supplies for our shelter. We should not have much of a storage problem. There will be space available in storage room A.

Plan:

1. Medical supplies will be procured through the Federal Marking and Stocking Program.
2. All personnel who require special medication such as insulin will be notified to keep a supply at work which they can bring with them to the shelter.
3. A metal cupboard, capable of being locked, will be purchased in which to store the medical supplies. This cupboard will be placed in storage room A.
4. These supplies will be inspected periodically.
5. The medical staff will be recruited from personnel in the building with some previous medical experience such as first aid courses, etc.

SANITATION

Human Waste Disposal

Need:

We do not have any peacetime toilet facilities near enough to the shelter to warrant their use by the shelterees. Also, it is not safe to assume that the public sewage system will be in operation. Therefore, other methods for disposing of human waste must be found.

Plan:

1. Sanitary kits for human waste disposal will be provided through the Federal Marking and Stocking Program.
2. Large garbage cans with tight fitting covers will also be stocked. Toilet seats will be purchased for these cans.

3. Disinfectant will be on hand in our regular cleaning stocks as well as that provided through the Federal Marking and Stocking Program.
4. The latrine area will be located at one side of storage room A next to the ramp leading into the shelter.
5. Screens will be stored in storage room A which can be erected to give privacy in the latrine area during the shelter stay.

Garbage and Trash Disposal

Plan:

1. Since no extensive food preparation is planned in the shelter, garbage disposal should not be a problem. All empty food containers for other shelter uses such as drinking cups, ash trays, etc., will be utilized.
2. The large containers in which the Federal food supplies are packed will serve as excellent garbage and trash containers. They are equipped with tight fitting lids to eliminate the hazard of disease.
3. Waste baskets will be brought to the shelter from other parts of the building. Large covered garbage cans will be purchased into which these smaller cans may be emptied. Disinfectant will be available for addition to these cans.
4. All garbage and trash will be stored in the ramp area next to storage room B.

General Shelter Cleanliness

Plan:

1. In conjunction with organization and management, procedures for shelter cleanliness will be emphasized to the shelterers.
2. Available cleaning equipment in the building will be brought to the shelter. This equipment includes brushes, brooms, rags, mops, etc.

Personal Hygiene

Plan:

1. At present, we are not sure of the amount of water which we may have available for personal hygiene. For this reason, waterless hand cleaner will be stocked especially for food and medical personnel.
2. A sizable amount of rest room supplies such as soap, paper towels, toilet paper, and sanitary napkins will be backlogged. A careful assessment will be made as to the quantity of supplies which will be necessary to sustain our shelterees for a two-week period. The possibility of storing many of these supplies near the shelter area during peacetime will be investigated.

Body Disposal

Plan:

1. Part of the next garage level will be used for body disposal, if necessary. Location of the medical area close to the stairwell will facilitate the moving of dead bodies to our disposal area.
2. Medical and mortuary personnel will be consulted for more information concerning the procedures and equipment needed to support body disposal.

COMMUNICATIONS

Communication Area

Need:

We feel that a relatively isolated communications area is a necessity. This is to insure that all incoming messages will be clearly heard. An isolated communications area will also permit the shelter management team to screen information that they feel ought to be given out to the total shelter population.

Plan:

1. The communication area will be located in the storage room where the management area is located.

Equipment

Need:

At this time, we do not have a two-way communications system with the civil defense center outside the shelter. We also do not have any extensive radio equipment in the building. We also realize that we will not be able to rely on public telephone service.

Plan:

1. In-shelter communication will consist of runners in the shelter to convey messages to various personnel.
2. Several hand megaphones which can be used to make general announcements to the shelterees will be purchased.
3. For beyond-shelter communications the cost and complexity of a two-way system directly to our local civil defense center will be investigated.
4. A standard radio receiver will be purchased specially for shelter use. An antenna will have to be installed for effective use of the radio. This antenna will be installed with protection against outside damage from fire, flying debris, etc.

SECURITY

Security Area

Need:

It is felt that a general security area as well as a confinement area should be provided. The general area will serve as a meeting place for security personnel and the confinement area will be used for those people causing trouble in the shelter.

Plan:

1. The general security area will be located in storage room A.
2. The confinement area will be located in a storage room on the second level of the garage where there is also a certain amount of shielding protection. This will facilitate isolation of those shelterees who are a disturbing influence.

Procurement and Storage of Security Facilities

Need:

The building housing the shelter has no peacetime security force from which these facilities can be obtained. For this reason, it will be necessary to purchase these facilities. We should not have much of a storage problem. There will be space available in storage room A.

Plan:

1. Security facilities will be purchased from surplus stores or other wholesale dealers. These facilities will include:
 - a. Arm bands for identification.
 - b. Whistles and a few megaphones to aid in crowd control.
 - c. Handcuffs and possibly a few blankets for restraint.
2. A cupboard or box capable of being locked will be purchased for the storage of these facilities.
3. These supplies will be inspected periodically.
4. The security staff will be recruited from personnel in the building with some previous security experience such as military or auxiliary police.

SLEEPING FACILITIES

Sleeping Arrangements and Facilities

Need:

Our biggest problem in dealing with sleeping provisions is the lack of a separate room for this purpose.

We do not have bunks available for this area and cannot afford to purchase them. Even if we do purchase them we would not be able to store them in the shelter area nor even around the shelter area.

Also, because our shelter is in a third level basement garage, it would be very impractical to attempt bringing down tables and desks for sleeping purposes.

Plan:

1. The sleeping areas will be located as far away as possible from the shelter entrance. It will also be located relatively close to the latrine area, but as far removed as possible from the food and medical areas.
2. A one-shift sleeping arrangement is planned. The shelterees will have to sleep on the floor. Rugs will be brought from other parts of the building immediately after an attack warning.
3. Car seats may be brought into the shelter from those cars located in other parts of the garage.
4. All shelterees will be asked to bring any extra clothing with them which can be used as bedding.
5. The sleep area must be partitioned from the rest of the shelter. Folding screens may be purchased for this purpose which can be stored fairly easily in one of the storage rooms.
6. Lighting requirements for this area will be discussed with our respective consultants.

WARNING AND SHELTER ENTRY

Warning Systems

Plan:

1. The public warning system now provides our attack warning. Our building is located one block away from a public warning siren which is installed on the roof of a public library.
2. The possibility of installing the bell-and-light system will be investigated. When the warning comes in, the switchboard operator could

immediately notify all shelter management personnel who in turn could possibly activate a general warning system in the building.

3. The general warning system for the building might take the form of signal bells or buzzers which can be inexpensively installed at strategic points throughout the building.

Opening the Shelter

Plan:

1. There will be no problem with regard to opening the shelter because it is a garage and will be open at all times.
2. Stairwells do not lock from the inside and will, therefore, always be open to the shelterees within the building.

Access Routes

Plan:

1. An assessment will be made of passageways, stairways, etc., in consideration of the most efficient way to get to the shelter.
2. Access routes will be established so that most people will come down the stairwell or, for a short time, take the elevator to the shelter area. If after running shelter drills this proves to be too few entrances, some shelterees will come down through the upper garage levels and enter the shelter by means of the automobile ramps.
3. Shelterees will be oriented as to the access routes they are to use.
4. Drills will be run to determine just how effective the access routes are.
5. Markers will be put up around the building directing the way to the shelter. Control points coordinated with organization and management will be established along the access routes to the shelter. These will be established to control jamming and panic on the part of the shelterees, and other emergencies which might arise.

6. These entrances will be lighted the same as in peacetime and will probably stay in operation before an attack occurs.
7. All hindrances to entrance of the shelterees, such as protruding door sills, will be identified and removed.

Shelter Closing

Plan:

1. Due to the nature of the shelter, no closure is planned until after the blast. Immediately after the blast, the ramp entrances will be blocked.
2. The elevator will be stopped on the floor above the shelter to close off the shaft.
3. Late comers will be able to enter the shelter through the door leading to the stairwell. Here decontamination procedures will be carried out, if necessary, before entry into the main shelter area.
4. Security personnel assigned to the confinement area can also supervise late comers.

NON-OPERATIONAL ACTIVITIES

Need:

It is felt that supplies for certain non-operational activities should be planned for in order to give the shelterees something to occupy their time when they are not performing their regular shelter tasks. At the present time we are planning for religious and recreational activities only.

Plan:

1. Bibles and non-sectarian religious literature will be procured for religious activities.
2. Arrangements will be made to bring books and other materials to the shelter after an attack warning from the building's library which is located on the first floor.

APPENDIX B

Actual Basic Shelter Plan

BASIC SHELTER PLAN

_____ HOSPITAL

_____ AVENUE

Standard Location Code _____

Facility Number _____

This facility was licensed November 1, 1962. There is a total of 2,999 spaces located on three floors and the basement in the north, south, and west wings of the building. These spaces are divided as follows: 2,128 spaces with PF 4-8* and 891 spaces with PF 2. There are 72 additional spaces located in the _____ Convent, some fifty feet to the east of the main shelter building, which will be covered by the same plan. The building is a modern, fireproof hospital operated by the Sisters of the _____. The average patient load is 230. For informational purposes, the morning can be referred to as period 1, the afternoon as period 2, and the evening as period 3. Following is a chart covering these three periods.

	Periods		
	1	2	3
Patients (average)	230	230	230
Employees	250	150	100
Visitors	200	200	300
(estimated average)	(9-11am)	(2-4pm)	(7-9pm)

Since all stairways are in fully protected areas, internal circulation of the occupants will be very easy.

Blast Protection

This building is one of two buildings located on a tract of land approximately six city blocks in area. Although it was not designed for blast protection, the

*Ed. Note: The number 4-8 represents the protection factor category of this shelter rather than the protection factor, which in this case would be 100-1,000 + .

building was built to withstand winds with velocities reaching to 150 miles per hour. The basement has a total capacity of 2,696 spaces and it is completely surrounded by earth. Arrangements have been made to cover the six sump openings with sand bags or earth.

The engine room with its heavy equipment is located at, or near, ground level. It is considered, however, to be adequately protected for any emergency excluding a direct hit.

Auxiliary Power

Auxiliary power consisting of one 160 KW and one 100 KW generators has been installed. This equipment is operated by natural gas fuel provided by the local gas company. Arrangements have been made for a standby supply of butane gas to be provided in the event of either an emergency or a pending emergency. The necessary fittings have been installed on the equipment to permit a hook-up to the supply of butane gas. This auxiliary fuel supply should permit the various facilities of the hospital to operate without interruption.

Warning and Shelter Entry

The present city public warning system consists of a series of sirens which reach 70% of the population. The shelter is located in a residential area, and it is the largest of the few shelters available outside of the downtown area.

The building is marked both on the exterior and the interior. Interior markings indicate the protected areas. Access to the shelter will be no problem since it is open at all times. Entrances to the shelter will be located at both the east and the west ends of the building and all the other building entrances will be closed. Ideal decontamination areas exist at each entrance.

Water

A water supply of 3-1/2 gallons per shelter space has been provided through the Federal Marking and

Stocking Program. It is estimated that 12,000 gallons of water will be available in the pipes of the building. Provision has been made to make this water available in the shelter. The water containers are stored in an area readily available to the shelterees at an absolute minimum of exposure. It will probably not be necessary to purify the water supplies, but adequate provisions for purification have been provided through the use of the tablets furnished by the Federal Marking and Stocking Program.

Food

Shelter rations have been supplied through the Federal Marking and Stocking Program. In addition, the public is being urged to carry food to the shelter. A seven-day peacetime food supply for approximately 500 people is normally stored in the shelter. By careful handling, this supplemental food supply could probably provide a fully occupied shelter with food for approximately three days. Some special foods will be needed because the shelter is a hospital. These will be provided by the hospital. Since approximately 10% of the shelter population will be patients, additional problems in food handling, preparation, and distribution will arise. Food supplies are stored in an accessible place. It is planned that experienced personnel will be available and will be placed in charge of food stocks. An area restricted to preparing and serving of food will be provided as a practical matter and not because of sanitation.

Sanitation

Human Waste Disposal

There are adequate toilet facilities in the shelter area. As long as the local sewage system is operating there will be no problem. Disinfectant is available through normal hospital supplies, and the building is equipped with a sewage ejection system. If the local sewage disposal system becomes inoperative, sanitary kits for human waste disposal have been provided through the Federal Marking and Stocking Program.

Garbage and Trash Disposal

There should be a minimum amount of garbage and trash. It is planned to store such waste materials in the empty food supply boxes. These boxes can be stored on the floors of the building with less than adequate fallout protection facilities. This can be done with a minimum of exposure to the person disposing of this material.

General Shelter Cleanliness

Shelter management will outline and assign shelterees to the job of maintaining general cleanliness in the shelter. Adequate cleaning equipment is in the building and will be stored at a point that will make it readily available for the use of those assigned to this task. There is a complete laundry in the building that can be used as long as the public water supply is operating.

Personal Hygiene

Since the amount of water available for personal hygiene purposes must be limited, extreme care will be taken to see that no water is wasted.

Body Disposal

There is a room in this shelter that was designed to be used as a morgue. If necessary, this room will be used for body storage.

Medical

A reasonably generous allowance of space must be made for a medical area in the shelter, since it is a hospital and approximately 10% of the shelterees are patients. This area will be established in the most isolated area of the shelter.

Medical Facilities

An adequate supply of medicines and medical supplies are available in the shelter. Adequately trained personnel will also be in the shelter. A special request is being made to all of our citizens to bring their own special medication, such as insulin or heart medicines, to the shelter.

Temperature and Atmospheric Control

The present hospital is completely air conditioned and as long as regular or emergency power facilities are operating, temperature and atmospheric control should pose no particular problem. In the event of power failure, upper level ventilation may be provided by opening windows and properly arranging the opening of doors. Air conditioning ducts are also constructed so that they may be opened for added ventilation in the event of power failure.

Fire Protection

This building is a modern fireproof building and the possibility of a large fire is minimal. Fire extinguishers are stationed throughout the building and detection and warning facilities are available. This building has both a sprinkler system and a standpipe system with hoses both on separate water supply systems. Shelter management will make certain personnel responsible for accumulating paper and other flammable materials and disposing of them with trash and garbage. Because of the size and design of the building, and the large number of occupants, detection of a fire should be immediate. In addition, there is an internal fire alarm system in the hospital that reports the location of fires to the office of the chief engineer. A group can be assigned to maintain and handle portable fire extinguishers and work as a fire fighting team. Fire detection training can be a part of the activities of the shelter. The local fire department will be consulted and asked for suggestions on this training.

Radiological Protection

Radiological monitoring equipment has been assigned through the Federal Marking and Stocking Program and is presently located in the shelter. The engineering staff of the hospital has a nucleus of trained personnel who can train other shelter occupants. The X-Ray room in the hospital has personnel who are trained in radiological monitoring. A portion of these trained people will be located near each entrance-way to check late arrivals. Decontamination will be carried out in an area adjacent to each entrance.

Sleeping Facilities

Because of the number and type of occupants, sleeping arrangements will be a minor problem. There are a number of upholstered chairs in an auditorium that is part of the shelter area that will provide room on an emergency basis for some sleep. Blankets and other bedding are available in the hospital. With proper use of the area adequate sleeping arrangements can be made. It is possible that it will be necessary for rest periods, or sleep periods, to be divided among the occupants of the shelter, with approximately one-third of the shelterees occupying the area at a time. It is not anticipated that arrangements can be made for beds to be provided for this purpose. It might be possible for some to sleep in beds and others on the floor, under the beds. If this can be arranged it would provide more restful accommodations.

Communications

in Shelter

A public address system located in the building can be used for intra-shelter communications.

Beyond Shelter

RACES (6 meter) radio equipment has been assigned to, and is presently in, the building. While this will furnish a sufficient media for inbound communications, it will be useless for outbound communications.

Shelter Maintenance

All tools necessary for maintaining the shelter equipment are located in the shelter area. In addition, the tools necessary to convert the auxiliary generators to use butane gas are stocked especially for shelter use. The shelter always has maintenance personnel on duty. Nevertheless, clear instructions for both preventive and corrective maintenance have been provided for shelter use. Basic operating and maintenance instructions have been posted on the associated equipment.

Non-Operational Activities

Plans will be developed to train shelterees for in-shelter and post-shelter living. Religious activities will be conducted by the nuns associated with the hospital. No plans have been developed for recreation.

Lighting

As long as regular or auxiliary power facilities are operating, existing lights will provide sufficient lighting for shelter operation. In addition, a limited number of battery-powered, portable lamps are stored in the shelter. These lamps could provide back-up facilities in the event of a failure of the general shelter lighting system.

Security

The hospital has a limited peacetime security staff which will be responsible for shelter security. The security staff has an office in the hospital basement where all of the security supplies are stored when not in use. No plans have been made to buy additional security supplies.

Shelter Management

A shelter management organization chart has been developed (see Figure 1). A copy of this organization chart and the basic shelter plan have been posted in the shelter.

Five people have been sent to shelter management courses. Two of these are associated with the administration of the hospital and will serve as shelter manager and assistant shelter manager. Three of these trained managers are nuns living in the convent. Two of the nuns will head the community department and the other one will serve as the deputy for operational and special services. In addition, two physicians have agreed to serve on the medical team as head and assistant head. A radiologist has agreed to serve as the deputy for technical services. A small area which contains the communications equipment has been set aside as the management area.

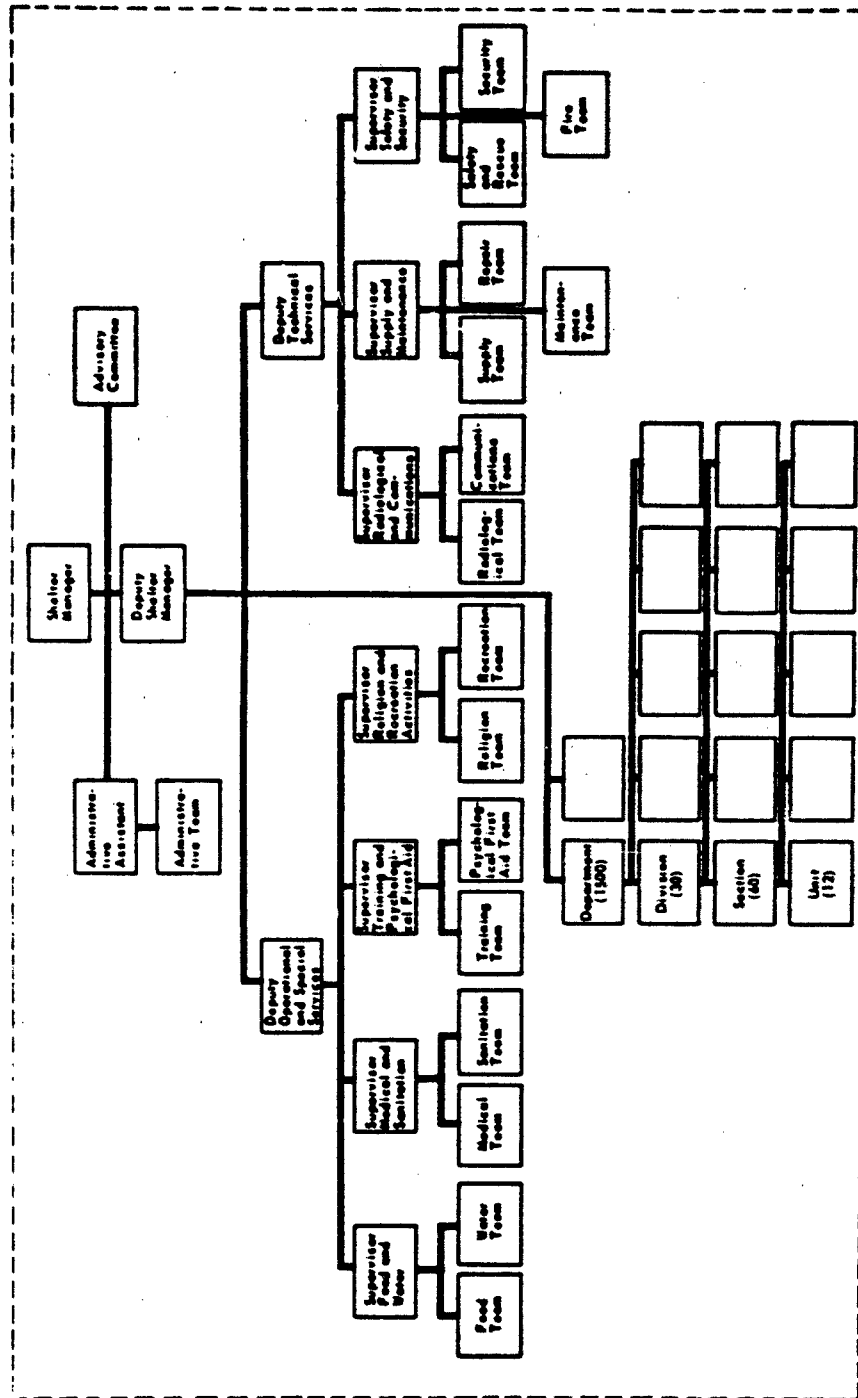


Figure 1. Shelter Management Organization Chart

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