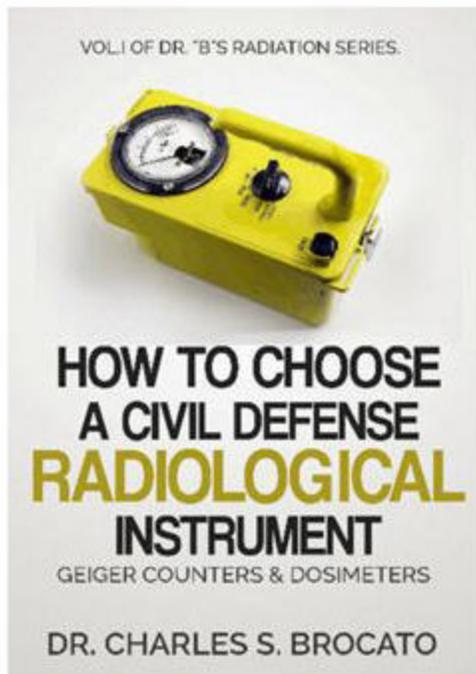


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A MANUAL
for
THE MANAGEMENT OF FOODS
in
LICENSED FALLOUT SHELTERS

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Prepared for the
DEPARTMENT OF DEFENSE
Contract No. OCD-OS-62-49

by
THE SCHOOL OF HOTEL ADMINISTRATION
CORNELL UNIVERSITY
Ithaca, N. Y.

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A MANUAL
FOR
THE MANAGEMENT OF FOODS
IN
LICENSED FALLOUT SHELTERS

This report has been reviewed by the Office of Civil Defense and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Office of Civil Defense.

Prepared by
The School of Hotel Administration
Cornell University
for the
Department of Defense

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HAS PREPARED FOR THE
DEPARTMENT OF DEFENSE

A MANUAL
FOR
THE MANAGEMENT OF FOODS
IN
LICENSED SHELTERS

As a supplement to A RESEARCH STUDY -
FOOD SERVICE PROCEDURE
IN
FALLOUT SHELTERS

FOREWORD

This manual has been prepared to meet the professional needs of persons selected to plan and manage the food program in a large public fallout shelter. It is a part of a research project on food service procedures in fallout shelters prepared by the Research Department of the School of Hotel Administration of Cornell University for the Office of Civil Defense, Department of Defense.

The manual outlines the purposes, responsibilities and functions of the food manager working under the over-all supervision of a general manager. The policies, principles and purposes presented, as well as specific operational details, should prove of value to the newly appointed food manager.

Working under the general assumption that intelligent planning and management of shelters can save the lives of a high percentage of the population of the community, pertinent information and experiences relating to food management in disaster situations have been reviewed and presented in this manual. This includes what is known of some of the disasters of history, food research, experiments in simulated shelters, contributions of the literature of psychology and of personnel administration to human deprivation conditions, and Civil Defense reports.

The fact that a nuclear attack can create conditions so devastating and bewildering that the population may be incapable of its usual adaptive behavior, puts a heavy burden on those selected to prepare for and assist the people under emergency conditions.



The management of water and food in past disasters and during disasters and periods of isolated confinement has been shown to be the crucial problem where survival was the goal. Hence, the conclusion has been reached that well informed leaders are required to manage and control these basic processes.

THE MANAGEMENT OF FOODS IN A PUBLIC SHELTER

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THE MANAGEMENT OF FOODS IN LICENSED SHELTERS

Introduction

In case of nuclear war, the government of the U. S. has planned a program for the protection of non-combatants against radiation from fallout. This project involves the building and designation of both public and private shelters. The public shelters will be the responsibility of the Federal Civil Defense Organization working through the local unit. It will be their obligation to designate usable buildings as shelters indicating their degree of safety, and making them habitable for at least a two week period. They will also stock each with a minimum ration of water and food for the confinement period.

Shelter Classifications

Shelters are classified in this report according to the following definitions:

- I. The private family shelter is one that has been built and financed by a family. It may be within an existing building, or a separate entity outside the home, either connecting with the basement or standing alone, above or below ground. It is assumed that the protection factor is adequate to provide shielding from residual radiation and that provision has been made for adequate ventilation. The type of ration provided for should be of minimum requirements and probably would contain off-the-shelf items of a household nature.
- II. A dual-purpose or integrated shelter is a shelter that has specific peace-time uses, but may be simply converted into a fallout shelter in time of emergency.
- III. A designed shelter is a structure that has been expressly built to be used as a fallout shelter

- IV. A designated shelter is a structure, or portion of a structure, which has been pre-assigned as a shelter by Civil Defense authorities.
- V. A public shelter is a shelter that has been properly approved and licensed under the National Fallout Shelter Program and stocked with austere rations of 14 quarts of water and 10,000 calories per shelter space per shelter stay. Medical, sanitation, and Radef kits are also stocked.
- VI. A semi-public shelter is a properly licensed public shelter but space preference has been granted, by license agreement, to occupants of the building. Any remaining space is then open to the public. It is envisioned that the rations and equipment stocked by DOD would be supplemented by the licensee to provide additional water and a diet consisting of supplementary spreads plus items of a "near-normal" nature. These stocks would be provided out of private funds. It is envisioned that other equipment might be provided, such as cots, blankets, and recreational items. Communication equipment and almost any added facilities for the comfort and security of the occupants might be furnished by the licensee, limited only by space and finances.
- VII. A community shelter is a shelter provided by local authorities and having no federal requirements to meet. In the barest sense, it would provide only shelter from radiation and not even necessarily be stocked with water or food. Local authorities would determine what to stock and how far to go in equipment.

All shelters except some community shelters and the private shelters will be operated under the local Civil Defense, a branch of the Federal Program. The Civil Defense organization will select managers, stock the basic water and food and through their system of communication, and provide critical information to the shelter during occupancy.

The public shelters with one hundred or more occupants will involve considerable planning, organization, and management. It is planned that each local Civil Defense organization, after designating the shelters in the community, will appoint a local manager for each unit. The manager in turn, will select assistants to assume responsibility for the basic operations under his general supervision. One of these important functions will be the procurement, storage and distribution of food and water for the designated number of occupants. The person appointed to assume this responsibility will be the food manager, who will select his own staff and train them for their different services.

In the light of the pressures, confusion and limitations under which he will probably find it necessary to operate, the food manager's work must be planned and organized before the shelter is occupied. Some of his assistants responsible for technical operations will need considerable training before undertaking their tasks. These should be selected early, and given whatever help is needed. Those who will perform the services such as the distribution of food, can be selected from the occupants after the shelter operations begin. The management of the feeding in the shelters will be unlike any ordinary food management post in our society in many ways. It is not to be expected that anyone could be found in most communities who had experience managing food and drink for such a situation as a fallout shelter might present. To collect useful information for the guidance of officials, it has been necessary to examine all pertinent data and knowledge relating to food management taken from disaster accounts, research on shelter occupancy under simulated conditions and from mass relief measures of the past. This material, together with

experiences gained from normal food and personnel management, has been assembled here and is designed to be of assistance to men or women selected to serve as food managers in large public or semi-public shelters.

Since each food manager will be confronted with a special problem because of variation in the size and structure of the shelter, the nature of the food stored, the equipment available, the kinds of people involved and the seriousness of the disaster, it will be well to confine this discussion to general principles and practices that may be used as a guide in organizing and managing a specific organization.

Scope

This guide will consider the problems of the food manager from his appointment by the local Civil Defense organization to the time of his release after the period of confinement in the shelter. It will assume a minimum of two weeks of shelter occupancy.

Functions for which he will be held responsible will include all problems dealing with food:

1. The analysis of shelter facilities for storing and preparing food.
2. Outlining a program.
3. Developing an organization chart.
4. Determining policies.
5. Selecting assistants and service people.
6. Setting up a training program.
7. Planning for storage of water and food.
8. Arranging for inventories and records.

9. Deciding on a daily schedule.
10. Assigning space for food preparation and distribution.
11. Determining and posting conduct rules and regulations for food handlers.
12. Arranging for sanitary inspection.
13. Preparing occupants for dealing with contaminated food and with the processes of decontamination in the post-shelter period.

Purpose

The dominating objective prefacing all selections and decisions will be (1) the survival of the occupants and (2) their perpetuation as an effective community organization in the post-shelter period. This will require sufficient water and food for at least an austere diet for the duration of confinement and instruction on how to subsist in a devastated area where uncontaminated food and shelter may be difficult to obtain in the post-shelter period.

In planning the food and water supply and service for the shelter, special thought must be given to the probability of overcrowding; to the novelty of many restrictions and frustrations; to the use of a simple, monotonous diet; to the lack of privacy; to working with an untrained voluntary staff; to trying to satisfy all ages and kinds of people with the same menu and routine; and to relying on one's own power of leadership for management and control, since there can be neither jails nor expulsions for those who refuse to conform.

To be effective and avoid as much grumbling as possible, the food manager should inform the public in advance, of the probable limitations on

9. Deciding on a daily schedule.
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food, space, comforts, and services, and of their privilege to arrange for supplementary foods under certain limitations.

Selection of Staff

The food manager will be selected by the shelter manager and he in turn will select his key assistants and people to carry out the various services of the organization.

Because of the concentration of interest and problems in connection with water and food during disasters, experience has shown that special attention must be given to the selection and training of the food manager. A strong person with prestige in the community as well as food experience should be selected. His qualifications should include ability to:

1. Select, assign, train and manage a team of voluntary assistants in such a way as to promote efficiency and good morale.
2. Plan and direct food procurement, storage, preparation and distribution in limited quarters to a confined and disturbed population.
3. Plan and manage essential equipment and facilities for all food operations.
4. Inventory supplies and determine the best method of distributing them and when necessary, balancing them for nutrient and caloric values.
5. Undertake strict rationing if necessary, with absolute impartiality and a minimum of disorder.
6. Supervise the proper cleaning and storing of all utensils and dishes used in the operation.

7. Get along with a confused, frightened and upset population trying to subsist under conditions of deprivations and confinement.
8. Resolve behavior problems arising in connection with food distribution and sanitary practices.
9. Determine policies and rules of conduct for the staff of the organization.
10. Encourage the staff and occupants to work cooperatively in the pursuit of the shelter purposes.

Philosophy

In determining his general policy, the food manager should base his action on an understanding of human nature and make his decisions tactfully and decisively in terms of an approved policy. His influence must rest on earned respect and an urge to cooperate in the interest of the group. Any suspicion of partiality or unfairness could terminate his usefulness as a leader.

Intelligent self-directing and self-sustaining people must be kept informed of the forces and circumstances they must deal with if they are to give maximum cooperation. Some advanced planning and effective communication with the staff, as well as occupants, could remove fears and build morale.

Organization and Authority

The organization of the food services will be determined by the food manager and his staff. In setting up his plan, he will take into consideration the capacity of the shelter, the nature of the occupants, the layout of the

space, facilities, sleeping plans, and feeding arrangements.

For effective service, both the occupants and the staff need to be well organized especially where crowded conditions exist. The occupants in a shelter of 100 or more people might well be organized into groups of 8 - 10 people with a chairman of each group. Such a grouping will be found to be very helpful in passing out packaged rations. In the larger shelters these primary groups could be combined into divisions and, where advisable, divisions could be organized into larger sections. The object would be to set up manageable units of control.

The staff should be set up on the basis of such functional operations as storage, preparation, cooking and distribution with people in charge of each division in the larger shelters. Once the doors are closed, final authority in the shelter rests with the occupants, with the general manager as their representative and executive officer.

A suggested table of organization for the shelter indicating basic functions and relationship is shown in the appendix.

POLICY

A pre-determined policy made with the help of assistants and approved by the general manager will provide ground rules for operating. Some suggested general policies could include the following:

1. The food manager should select the best available staff from the community to insure efficiency and reasonable morale.
2. Once selected, the staff should be given the best training and experience time and facilities allow.

3. Divisional assistants should be delegated as much authority as good discipline allows.
4. Democratic principles of control should be followed as far as possible in the determination of policy and the control of behavior.
5. Plans of operation should be made consistent with the amount and nature of the food supply and the structure of the shelter.
6. In assigning duties to shelter occupants, consideration should be given to involving as many people as possible in order to reduce boredom and spread responsibility.
7. Such critical functions as the admission of shelter occupants, water and food rationing and the enforcement of sanitary regulations may require strong control.
8. Confinement, lack of privacy, worry about friends and relatives, deprivation of food, water, fresh air, sleep and quiet make food management in shelters a new and trying experience. An analysis of the disasters and ordeals of history indicates that survival has often depended upon leadership and training.
9. Food staff and occupants should be prepared by the food manager for post shelter adjustment to devastation and contamination of foods where the situation warrants it.
10. The water and food inventories should be closely controlled and reported to the general manager. Rations should be adjusted to the inventory and the outlook for confinement.
11. Health, sanitation, and safety rules should be established for food handlers.

SPACE

Public shelters, when surveyed, licensed and marked according to federal standards, are expected to provide shelter space for a high percentage of Americans. Most, if not all, of this space will be in existing buildings which were not specifically designed as fallout shelters. It is conceivable that a portion of these structures may have a high protection factor, while adjacent areas offer a lesser degree of protection. The potential problem of overcrowding within the main shelter area of a building may be remedied by moving some of the shelter occupants after the first hours or days to these adjacent areas if the level of radiation permits. If conditions are favorable, such an outlet would relieve the food manager of the effects of crowding, but would create distribution problems.

In shelter experiments, the demand for particular areas in the shelter have been critical. Some areas have a higher protective value than others and may be more private. The food manager should be able, early in the planning, to set aside appropriate space for storage, food processing, serving, and refuse disposal areas. These areas should be adjacent, centrally located, and as far from the lavatory areas as possible. To keep children from getting in the way of food operations and accidents, a shield of some sort should be placed around the food area where possible. A service counter would be very desirable for such a purpose where space permits.

It should be emphasized by the manager that crowded conditions necessitate special cooperation for group welfare. By emphasizing the need for sanitary practices and the careful use of water and food by the

occupants under limited space, the food manager will improve his chances for maintaining discipline.

For purposes of effective distribution of water and food, shelters should be thought of as either horizontal or vertical in nature. In the horizontal shelter the space is all on one level. In the vertical shelter, the space is located on two or more levels making it very inconvenient to manipulate large containers of either water or food up or downstairs. In the horizontal shelter only one food center would be required to serve the one hundred occupants under consideration in this report. In the vertical shelter, one center may need to be planned for each floor, especially where containers for 150 pounds of water, as indicated in Federal Stocking Programs, are to be used.

Whether or not mechanical fans and auxiliary power is available in the shelter will have a marked influence both on space and operations. Where such equipment is not provided, 50 square feet of space per person will be required for purposes of ventilation. Under such conditions, movement and food equipment will not be limited. Where artificial ventilation makes it possible to get along with 10 square feet per occupant, the resultant crowding will restrict movement of service staff and demand highly organized food distribution procedures.

The food manager must place his operations in terms of either of these situations.

FACILITIES AND EQUIPMENT

Proper facilities and equipment, together with water and food supplies, are vital for shelter habitability. In fact, survival may well depend upon the kinds and amounts of supplies stored and the dependability of equipment such as mechanical fans to maintain an air flow.

The food manager will be especially concerned with supplementary food supplies brought to the shelter. He will want to register and store it as well as be sure that equipment is available for processing and serving it. Extensive canned foods with no can openers would be a problem. Unless the population has been carefully informed of the restrictions placed on shelter foods, restrictive measures must be taken at the entrance to the shelter. Where there is space and money, it is desirable to stock the shelter with additional foods and beverages over and above the O. C. D. provisioned shelter. These items should be listed with the supply inventory for distribution to the group by the food manager as needed.

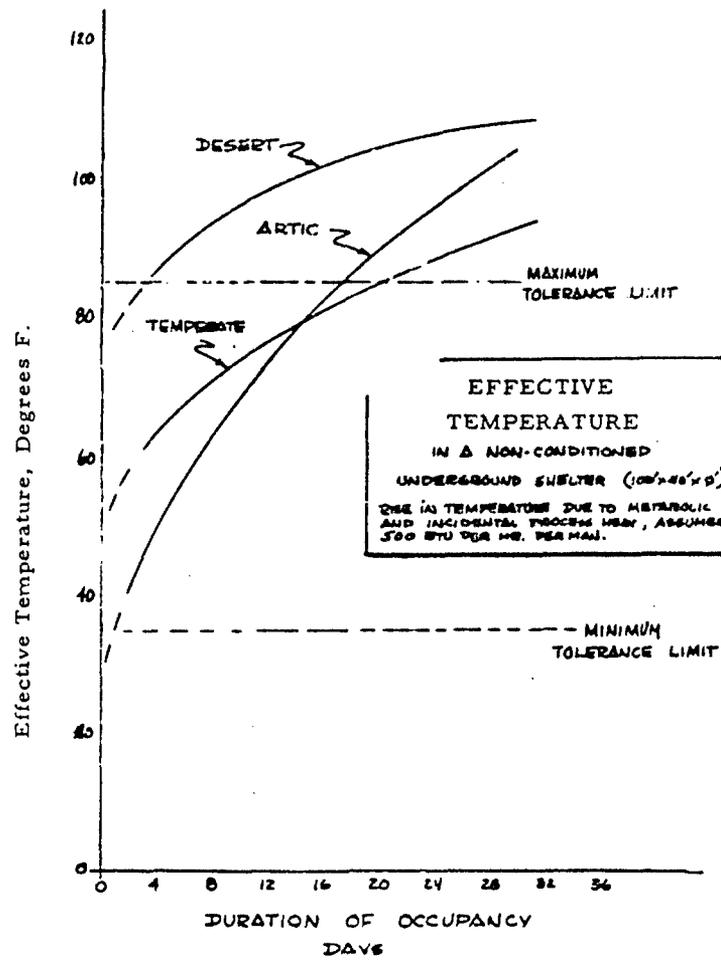
Generally, food, medical supplies and instruments should be stored in protected places and kept under lock and key. All garbage and other waste should be kept in tight containers, either in a separate room or in an isolated section of the shelter. Where feasible, caustics and disinfectants should be used to minimize the danger of infection in food handling.

Where the shelter situation seems to warrant the heating of food for one or more meals per day, the amount of heat involved and its effect on the temperature of the shelter is a problem of deep concern to occupants of the shelter.

Under summer conditions, heating food might have such an adverse effect on a closed shelter that it could influence the possibility of survival or at least contribute to discomfort. On the other hand, under winter conditions, additional heat may be most welcome and surely warm food would improve morale. The food manager must, therefore, control the use of heat and must know how much the temperature will be changed in his shelter with a given heat load. He should be aware of the fact that where hot foods or liquids are consumed, their B. T. U. * content is subordinated to the body control and does not appear as a contribution to sensible shelter heat load above what the individual consuming it contributes. For example, if one pound of water at 170° is allowed to cool to 70° , it will contribute 100 BTU's to the shelter heat load, whereas, if this pound of water were drunk by an occupant who previously was contributing 400 BTU's per hour, there would be no change in the rate of his heat contribution.

It is necessary then, for the manager to deal only with the heat transferred through the sides of the heating device during the period of both heating and cooling of the actual contents. Computations of this character, if accurate results are to be obtained, are somewhat difficult. However, estimates may be readily formed which produce heat transfer rates somewhat higher than actual, thus providing a safety factor. The formula for obtaining the rate at which heat will be contributed to the shelter through cooking or heating food or liquid is presented in the appendix for those who need to use it.

* British Thermal Unit or Units



EFFECTIVE TEMPERATURE IN A NON-CONDITIONED UNDERGROUND SHELTER (10'x40'x9') ONE IN TEMPERATURE DUE TO METABOLIC HEAT AND INCIDENTAL PROCESS HEAT, ASSUMED AT 500 BTU PER LB. PER MAN.

CLIMATIC REGION	INITIAL SOIL TEMP.	WALL AREA PER MAN
DESERT	80°F	150 ft ²
TEMPERATE	50	100
ARTIC	20	50

TEMPERATURE AND HUMIDITY

The problem of predicting and controlling the atmosphere in the shelter is a complex one and a very serious one indeed, to which a number of competent individuals have applied their talents. Considerable literature exists in this field. It is not the intent of this report to even review this literature, but certain aspects of the atmosphere problem should be known to the food manager.

1. Effective temperature. There is substantial evidence to indicate that when high temperatures (dry bulb) coincide with high relative humidity, a condition may be reached under which the temperature of the human body must rise because the heat produced by metabolism exceeds in rate that which can be lost to the environment. This situation occurs at an effective temperature around 85 degrees for sedentary people. See "Acceptable and Tolerable Thermal Limits for Healthy People at Rest, Properly Clothed", page 16. The consequences depend upon the degree of heat stress or rate of body temperature rise and the time of exposure.

The effective temperature is a somewhat complex measurement involving both relative humidity and dry bulb temperatures, and is intended to describe what the human body feels about the combined situations. No measuring devices read in "effective temperatures", hence its values are available only through other measurements and the application of either a chart or a computation. Because of this somewhat complex relationship, it is possible for the dry bulb temperature to be higher than 85° if the relative humidity is sufficiently low, and still produce an effective temperature of less than 85°. Boundaries can be established. For example, an effective temperature of 85° exists if the dry bulb temperature is 95° and the relative humidity is 100%. Thus, lower values for either measurement indicate an effective temperature of less than 85°.

ACCEPTABLE AND TOLERABLE THERMAL LIMITS FOR HEALTHY
PEOPLE AT REST - PROPERLY CLOTHED

Limits expressed in terms of Effective Temperature (E. T.) which is
the temperature of saturated air with minimum air movement.

Lowest temperature endurable in cold weather for at least two weeks in emergencies	35 degrees E. T.
Possible Chilblain, or shelterfoot	35-50 degrees E. T.
Lowest acceptable for continuous exposure Manual dexterity may be affected	50 degrees E. T.
"Optimum" for comfort, with 60% relative humidity	68-72 degrees E. T.
Perspiration threshold. Acceptable for continuous exposure	78 degrees E. T.
Endurable in emergencies for at least two weeks. Possible heat rash in prolonged exposures. Some susceptible individuals may become casualties.	85 degrees E. T.
Possible heat exhaustion in unacclimatized people	88 degrees E. T.
Possible heat exhaustion in acclimatized persons	92 degrees E. T.

2. Shelter Temperatures. Without air cooling, the shelter temperature and relative humidity may be higher than the corresponding outdoor conditions. (Exhibit C-2 - Duration of Occupancy)

The temperature and humidity existing within the shelter is a complex function of the number of inhabitants, what they are doing, the structure of the shelter, ground temperature, outside temperature air rates used in ventilation, and others.

3. Summer Months. It is likely that without significant quantities of ventilation air per minute and in some instances the use of air cooling devices, shelters will be overcrowded in the summer months to the extent that dangerous conditions may exist.

The situation is important to the food manager. On the one hand, he cannot add heat and steam to the atmosphere to worsen an already precarious situation. On the other hand, he must take prompt measures to provision people to move somewhere else. (See Preparation and Service). To limit the caloric intake necessitates the people remaining highly inactive.

4. Overcrowding. Assume that under the existing conditions in the shelter, a maximum of 50 occupants could survive. There are 75 occupants, however, whose total presence renders the atmosphere lethal, due to "overcrowding".

Overcrowding exists when the number of occupants present exceeds the number of occupants which the shelter will maintain under the existing conditions, which in turn, vary with the time of year.

If the 75 occupants remain, some will die, others will live. It is very probable that less than 50 will live. If the food manager and

the shelter manager were able to make provision for 25 of the occupants to maintain themselves somewhere else under a lower protection factor, an excellent possibility exists for significantly more than 50 to survive.

For a short time during the year when temperature and humidity conditions are adverse, such "overcrowding" might well exist. The number of occupants assigned to a shelter is not evaluated in terms of this adverse situation, so that if 75 occupants are present in a shelter which is designed to house 75 occupants, "overcrowding" will exist.

5. Detection of Danger. The detection of dangerous conditions can be effected with instrumentation and knowledge. However, it is a complex measure and the correlation between the final effective temperature determination and the reaction of the individual is not precisely known. It is suggested that body temperatures of approximately 10% of the population be taken at half hour intervals when high effective temperatures are suspected to exist, and that a body temperature rise of $1^{\circ} F.$ be accepted as positive evidence that action be taken to move more people to less crowded areas if such areas are available. The assumption is made, of course, that all available facilities for increasing the rate of ventilation have been employed.

6. Winter Months. In winter months, the situation is quite the reverse. If heating systems cannot be maintained operative, the shelter temperature will drop to extremely low and uncomfortable levels. People should be alerted to bring warm clothes. In a sense, overcrowding will be welcome. The food manager should provide the maximum of warm food if he has heating facilities and should increase the calorie content.

7. Humidity. Under some conditions which might prevail for a short period of time during the year, it is very probable that the humidity in the shelter will be high enough to result in condensation on many surfaces. Besides causing unhappiness on the part of the occupants, this dampness may be of such magnitude as to prohibit keeping any records. Under these conditions, the food manager must proceed as best he can. At this point, he will find that training and familiarity with his tasks will be of great benefit. If the inability to use paper does exist, it is all the more important that personnel has undergone previous training.

8. Protection from Excessive Humidity. The food manager is in a peculiar situation at this point. First, he must carefully protect those supplies which are adversely affected by humidity. For example, a tin of biscuits which has been opened must be protected. If some plastic material and tape has been provided, opened tins can be covered. As a last resort, they might be covered by an extra garment. If candies are available, they probably should not be opened under the circumstances unless food supplies are indeed low.

Secondly, if heating facilities are available, morale factors would suggest that hot food be prepared, while on the other hand, a contribution to the atmosphere of steam and water vapor resulting from heating water would worsen an already bad condition. It is probable that the advantage of hot beverages or food outweigh the increase of water in the shelter. In this decision area, it would be quite convenient to enlist the advice of the Advisory Committee, and inform the occupants.

Excessive humidity will create an additional problem for the food manager. If floors or horizontal surfaces are damp, occupants

will be on their feet and extremely restless. Possibly the number of meals should be increased to provide additional activity, or the recreation committee may create a "party", providing that no physical activity is involved.

Summary - Humidity is best lowered by air handling equipment, so if such devices are available, both humidity and effective temperatures can be controlled. It is doubtful, however, that many shelters except those created especially for the purpose will possess air conditioning facilities, so that high humidities and in some cases, high effective temperatures must be considered as a calculated risk.

Humidity can be lowered by use of dehumidifying agents such as silica gel or calcium chloride for examples. The use of such agents must be employed with caution, since one of the effects of their use is an increase in effective temperature. Thus, humidity may be decreased only during the situation where an increase in effective temperature does not result in discomfort. As a general safe rule, they should not be considered, though they can be used under the direction of an informed individual.

In connection with the discussion of the problem of generating heat through cooking, the food manager should be aware of acceptable and tolerable thermal limits for healthy people at rest and fully attired. These limits are expressed in terms of effective temperature, (E. T.) which is the temperature of saturated air with minimum air movement. The lowest temperature endurable in cold weather for at least two weeks in emergencies would be about 35 degrees E. T. Between 35° and 50° E. T., occupants would suffer from chilblain or shelterfoot, especially with decreased physical activity.

Between 50° and 68° E. T. manual dexterity might be affected but otherwise it could be lived with. From 68° to 72° with 60% relative humidity, optimum conditions for comfort would be obtained. Between 72° and 78° E. T. the temperature would be endurable and quite acceptable for most people. Between 78° and 85° E. T. for two weeks might cause heat rash, but above that point, while there are differences of opinion as to the danger of heat exhaustion, there is general agreement that it should be avoided. If such a temperature cannot be avoided, the management should be prepared to handle exhaustion cases.

In addition to problems of high temperature resulting from cooking, the food manager must also be on the alert for condensation and humidity conditions developing inside the air tight shelters. In some tests on simulated occupants in shelters studied for condensation effect, it was reported that 65% of the water fed to the simulated occupants collected on the walls and floor of the shelter. Ventilation would greatly decrease this percentage of condensation.

The fact that most shelter space may be used for other purposes during peace time suggests the need for careful consideration also of the portability of equipment and storage vessels. In vertical shelters this will be particularly important.

Heating Equipment and Costs

Equipment for heating in the shelter deserves special attention. If it is to be used in heating food or beverages, consideration must be given to devices as well as fuel to be employed. Where choices exist, an evaluation of the relative costs and merits of the common fuels is important. The accompanying tables showing the relative cost of four common fuels together with installation cost should be useful.

Cost of Equipment and Installation

A choice may exist in the use of electrical energy. Commercial or standby power may be used, or unit generators may be employed. A further choice exists as to whether water for beverages is to be heated or whether both water and food is to be heated.

1. In presenting the cost of equipment, all of these cases will be considered for four fuels.

a. Electricity

(1) For heating water only

a. Commercial or standby power

b. Unit Generator

b. Gas

(1) For heating water only

(2) For heating water and food

c. Kerosene

(1) For heating water only

(2) For heating water and food

d. Charcoal

(1) For heating water only

(2) For heating water and food

2. Recapitulation

a. Electricity

(1) For heating water only

a Commercial or standby power

	5 gallon Electric Institutional Heater	6 gallon Electric Domestic Heater Adapted
	<u>1500 watts - 120 volts</u>	<u>1250 watts - 120 volts</u>
Device	\$120.00	\$38.50
Wiring	25.00	25.00
Adaption Faucet and fill		<u>60.00</u>
TOTAL COST	\$ 145.00	\$ 123.50

b Unit Generator

Add to above:

Generator - 2500 W - 6.3 HP	400.00	
Exhaust Connection	100.00	
Storage tank - 550 gallon	90.00	
Gravity Feed installation	30.00	
Excavation costs	75.00	
Wiring	<u>100.00</u>	
	\$ 795.00	\$ 795.00
TOTAL WITH UNIT GENERATOR	\$ 940.00	\$ 918.50

(2) For heating water and food

a Commercial or standby power

	5 gallon Electric Institutional Heater	6 gallon Electric Domestic Heater Adapted
	<u>1500 watts - 120 volts</u>	<u>1250 watts-120 volts</u>
The total cost for heating water only from a-1 was	\$ 145. 00	\$ 123. 50
Add:		
Device - 5 gallon Institutional Heater	\$120. 00	
Wiring	<u>15. 00</u>	<u>135. 00</u>
TOTAL COST OF WATER AND FOOD	\$ 280. 00	\$ 258. 50

b. Unit Generator

<u>Add to Above:</u>		
Generator - 3500 W.	484. 50	
Exhaust connection	100. 00	
Storage tank - 550 gallon	90. 00	
Gravity feed installation	30. 00	
Excavation costs	75. 00	
Wiring	<u>100. 00</u>	
	<u>\$ 879. 50.</u>	<u>\$ 879. 50</u>
TOTAL COST - WATER AND FOOD	\$ 1159. 50	\$ 1138. 00

b. Gas

(1) For heating water only

	<u>30 gallon Domestic Hot Water Heater Modified</u>	<u>5 gallon urn with unit 10,000 BTU/hr. burner under</u>
Heater	\$ 84.95	
Modification - Hand fill and faucet	60.00	
Exhaust Ducting	100.00	\$ 200.00
3 Tanks of Gas	30.00	30.00
Piping	50.00	50.00
Urn		60.00
Stove		<u>7.50</u>
TOTAL COST	\$ 324.95	\$ 347.50

(2) For heating water and food

Add to above:

1 Urn	60.00	60.00
1 Stove	7.50	7.50
2 tanks	20.00	20.00
Exhaust Ducting	<u>50.00</u>	<u>50.00</u>
TOTAL COST - WATER AND FOOD	\$ 462.45	\$ 485.00

c. Kerosene

(1) For heating water only

Stove	\$ 8.50
Urn or Pot - 5 gallon	60.00
Storage Tank - Gravity 20 gallon	60.00
Installation	30.00
Exhaust	<u>200.00</u>
TOTAL COST	\$ 358.50

(2) For heating water and food

Add to above:

Stove	8.50
Urn or Pot - 5 gallon	60.00
30 gallon Tank - Difference	20.00
Exhaust	<u>50.00</u>
TOTAL COST WATER AND FOOD	\$ 497.00

d. Charcoal

(1) For heating water only

Charcoal Pan Burner - constructed	\$ 40.00
Urn - 5 gallon	60.00
Exhaust	<u>200.00</u>
TOTAL COST	\$ 300.00

(2) For heating water and food

Add to above:

Charcoal Pan Burner	\$ 40.00
Urn - 5 gallon	60.00
Exhaust	<u>50.00</u>
TOTAL COST - WATER AND FOOD	\$ 450.00

2. Recapitulation

	<u>Heating Water</u>	<u>Heating Water and Food</u>
a. Electricity		
<u>a</u> Commercial or standby		
(1) Institutional Heater	\$ 145. 00	\$ 280. 00
(2) Domestic Heater	123. 50	258. 50
<u>b</u> Unit Generator		
(1) Institutional Heater	940. 00	1,159. 50
(2) Domestic Heater	918. 50	1,138. 00
b. Gas		
(1) 30 gallon Domestic	324. 95	462. 45
(2) 5 gallon Urn	347. 50	485. 00
c. Kerosene	358. 50	497. 00
d. Charcoal	300. 00	450. 00

NOTE: Cost of exhaust ducts and hoods vary.

Heat Supplied to Shelter

A. By Vessels

The heat transferred to the shelter by a system applying energy to a vessel to heat water which may be made into coffee or used to heat food in cans is dependent upon the following factors:

1. Geometry of vessel
2. Temperatures of water and surrounding air
3. Thermal characteristics of vessel; i. e. , surface, insulation, and material
4. Air movement across surface of vessel
5. Efficiency of system

A number of systems can be devised, as well as a number of vessels selected, so that for each combination there will be a unique value of heat transferred. To arrive at a reasonable value, one example of a vessel may be explored and several methods of energy application may be considered.

System

These various systems are applicable:

1. Electric heater immersed in vessel
2. Bottled gas flame with vessel over it
3. Kerosene burner
4. Charcoal flame with vessel over it

Other systems can be employed, for example:

1. An electric hot plate with vessel over it. This will deliver more heat to the shelter than an immersion heater, and the assembly will be almost as high in cost.

2. A gasoline stove with vessel over it. Gasoline produces a significant hazard in the shelter, and rugged equipment is somewhat unavailable.

Rate of Heat Input

This is assumed to be at a rate of 1500 watts or 5100 B. T. U. 's/hour. Other rates may well result.

Geometry of Vessel

For purposes of illustration, a vessel of the following dimensions is selected:

Inside diameter = 10"

Outside diameter = 12"

Outside height = 30"

Inside effective water height = 22"

Volume of water content = 1 cu. ft.

Surface computed = 9.42 sq. ft.

Such a device is selected for an example because its capacity for food is of a high order (See Container Sizes), and is available with an immersion heater. (Also see Application Schemes for details of the device).

Temperatures

It is desirable to reach a temperature of the water within the vessel of 170° F. It is further assumed that before heating, both water and food will be at a temperature of 70° F. and that food will be heated to 160° F.

Case I

Thermal Characteristics of Vessel - Insulated

The vessel is of stainless steel and insulated with 1" of Fiberglass with a k value of 0.27.

It is desired to know the sensible heat load imposed upon the shelter in the use of such a device. Where hot food or liquids are consumed by the occupants, the transfer of heat to the surrounding air is subordinate to the body's control and does not contribute to shelter heat load. For example, if one pound of water at 170° F. is allowed to cool to 70° F. it will contribute 100 B. T. U. 's to the shelter load, while an individual standing beside it will contribute perhaps 400 B. T. U. 's per hour. If, however, the water is drunk by the individual, the contribution of the water becomes zero and the individual's contribution remains unchanged.

It is necessary then, to deal on, with the heat transfer through the surfaces of the device during the period of both heating and cooling of the actual contents.

Computations of this character, if accurate results are to be obtained, are difficult. However, estimates may readily be made, resulting in values higher than actual, which if acceptable, guarantee the results of actual practice.

The maximum rate of heat transfer for steady conditions through the surfaces of the vessel is determined as follows:

$$\text{BTU/hr.} = U A (T_1 - T_0)$$

where

$$\frac{1}{U} = \frac{1}{f} + \frac{x}{k}$$

$$f = 1.5, x = 1", k = 0.27, U = 0.228$$

$$T_1 - T_0 = 170 - 70 = 100$$

$$\text{BTU/hr.} = 0.228 \times 9.42 \text{ sq. ft.} \times 100 = 214 \text{ BTU's/hr.}$$

CASE II

Thermal Characteristics of Vessel - Uninsulated

It is convenient at this time to determine the maximum rate of heat transfer for steady state conditions for an uninsulated vessel.

In this case, $U = 1.5$ and
 $BTU's/hr. = 1.5 \times 9.42 \times 100 = 1413 BTU's/hr.$

In both cases, radiation transfer is neglected.

CASE I - Returning to Case I, it is required to know the time for bringing water and food up to $160^{\circ} F.$

Heating and Cooking Time

The cooking time will depend upon:

1. The temperature of the water bath
2. The size of the can
3. The material in the can, divided for ready rough reference into:
 - a. Quite liquid, such as green beans
 - b. Semi-liquid, such as tomatoes
 - c. Heavy non-liquid, such as baked beans

A test on simulated equipment was made. See Data, Exhibit I and Exhibit II. These results were corrected for the presumed temperature rise and results are shown in Summary of Results for Cans.

Data for Heating and Cooking Time

Cans Used:	Diameter and Height:	Size:
Pork & Beans 1 lb.	2-7/8" x 4-1/4"	214 x 404
Green Beans 15-1/2 oz.	3-1/16" x 4-1/8"	301 x 402
Tomatoes 1 lb.	3-1/16" x 4-1/8"	301 x 402

Pork & Beans	71	72	80.5	92.5	121	137	146	153.5	159	162	164	
Tomatoes	71	73	82.5	102.5	123	138	148	154.5	161	164	168	
Green Beans	71	102	142.5	162.5	169	169	168	168.0	168	168	168	
Water	71	132	162.0	172.0	170	170	170	170.0	170	170	170	
Minutes	0	10	20	30	40	50	60	70	80	90	100	110

Summary of Results

	Water	Quite Liquid	Semi Liquid	Non Liquid
Temperature Rate Rise	79°/hr.			
Total Heating Time-Min.	90.0	88.00	130.00	130.00
Total Heating Time-Hrs.	1.5	1.47	2.17	2.17*

* The time for the non-liquid contents results from the test of a smaller can than was the case for the other two products. The effect of an increase in can size will produce a longer time, which might be estimated at 2.5 hours.

The Temperature Rate Rise (TR)

The temperature rise rate is

$$64.2 \text{ lb. /cu. ft. water} \times 1 \text{ cu. ft.} \times \text{TR} + 0.228 \times 9.42 \text{ (See Equation 1)}$$

$$\times \text{TR} = 5100 \text{ BTU's/hr.}$$

$$\text{TR} = \frac{5100 \text{ BTU's/hr.}}{62.4 + 2.14} = 79^\circ \text{ hr.}$$

At the end of the first hour, the maximum heat rate will be:

$$0.228 \times 9.42 \times 79^\circ = 169 \text{ BTU's/hr.}$$

In the second hour, the maximum heat rate will be:

$$\text{(From Equation 1)} \quad 214 \text{ BTU's/hr.}$$

BTU's per hour during cooling time

This situation occurs after cans are removed from the vessel, and the water is allowed to cool down to room temperature. The water level in the container will be lowered and the hot surface of the vessel exposed to the room will be decreased, thus transferring heat at a lower rate. The vessel is presumed to have contained 35 cans, each of 34.6 cu. in. real volume (See Exhibit B-10) making a total of 1210 cu. in. The total volume of cans and water was 1 cu. ft. equal to 1728 cu. in.

Hence, the remaining water after removal of the cans equals $1728 - 1210 = 518$ cu. in. This results in a new water height of 6.62 inches with a resulting surface exposure of 2.514 sq. ft.

The maximum heat rate for steady state conditions is:

$$\begin{aligned} \text{BTU/hr.} &= U A (T_1 - T_o) \\ &= 0.228 \times 2.514 \times 100 = 57.3 \text{ BTU's/hr.} \end{aligned}$$

Recapitulation - Case I

Maximum rate - first hour	169 BTU's/hr.
Maximum rate - during cooking	214
Maximum rate - during cooling	57

Case II - Uninsulated Vessel

Although the geometry of the vessel will be different, due to lack of insulation, this will be neglected, and the transfer for steady state conditions will be computed only by changing the value of U.

From equation (1-a)

Maximum rate of heat transfer during cooking = 1413 BTU's/hr.

Temperature Rise Rate - (TR)

$$62.4 \times TR + 1.5 \times 9.42 TR = 5100 \text{ BTU's/hr.}$$

$$TR = \frac{5100}{62.4 + 14.13} = 67.7 \quad \text{say} \quad 68^\circ/\text{hr.}$$

Maximum Rate - first hour

$$= 1.5 \times 9.42 \times 68 = 957$$

Maximum Rate - cooling

$$\text{Same} \quad 57$$

Cooking Time - Roughly this is extended by $79/68 = 116.5\%$

Recapitulation - Insulated and Uninsulated Vessels

	Insulated	Uninsulated
Maximum Rate - first hour BTU's/hr.	169	957
Maximum Rate - during cooking	214	1413
Maximum Rate - during cooling	57	57

Cooking Times - Hours

	Insulated	Uninsulated
Water	1.5	1.75 *
Quite Liquid	1.47	1.72 *
Semi-Liquid	2.17	2.52 *
Non-Liquid	2.30	2.68 *

* Obtained by multiplying the values for an insulated vessel by 116.5%

B. By Fuels

The data shown in "Assumed Data for Various Fuels" were determined, computations made, and results shown.

The quantities of rate of heat delivered to the shelter are independent of the rate of heat delivered by heating the vessel, and should be added to them. It must be recognized, too, that with an unvented device, CO_2 is also delivered to the shelter, which may cause considerable difficulties if ventilation is not adequate. More elaborate devices might well be used and ventilating hoods provided which, when operable, would remove most of the wild heat and gases. In a designed shelter, such refinement should be employed. In the designated shelter which normally has other functions, it is felt that such refinement and provisions for ventilation might not be employed. However, in many instances, existing ventilating ducts might well be available which would function by gravity, and under these conditions, hoods should be provided.

LIGHTING REQUIREMENTS, SOURCES AND SCHEMES

One of the most basic needs in a shelter is light, from a morale standpoint if nothing else; but equally important to the handling of water and food. It is important that the food manager assures himself of adequate facilities to provide light as needed. This will involve a check on commercial facilities in the building, their reliability in a disaster, and possible substitutes should regular sources fail. The following schemes or devices seem applicable:

1. Commercial and Standby Sources - There is high probability that usual utilities will be available, and lights customarily used will be employed. After the selection of a food service area, the shelter management should provide light sources to light these areas to at least 5 foot candles, and preferably 20. Other areas should be lighted also, of course, and the total lighting load should be determined in computing standby generator sizes.

2. Unit Generator - In the examples taken for pricing unit generators, a small allowance was made for lighting the food service area, but no provision was made for any other application. When the lighting load for a specific shelter is determined, the generator size should be increased by that amount.

3. Batteries - A battery standby unit can be provided. This is costly, particularly if enough energy is to be provided to last 14 days or 236 hours. A battery bank for this purpose should be designed by qualified engineers. Batteries should be inspected at least four times a year.

4. Gas Lights - can be supplied from bottled gas. They produce high levels of illumination, and can be incorporated with the food

service area if bottled gas is used for cooking.

5. Hand-Generating Flashlights - can be used as auxiliary lighting, but are extremely awkward for any permanent duty.

6. Battery-Powered Flashlights - have the same disadvantages as battery power. However, they can be used if enough batteries are available. The shelf life of batteries is in the order of one year.

7. Candles - provide a cheap long shelf life source, providing a reliable last resort type of lighting. Plumbers candles should be used. These are about 1-1/4" in diameter by 4-3/4" long, and will burn in still air for 6 hours. Because of their broad base, they require no candlesticks. They should be stocked in a cool location.

8. Gasoline Lanterns - produce satisfactory light but introduce an element of danger in the fuel.

9. Kerosene Lamps - if obtainable, may well be used, particularly if the cooking fuel is kerosene.

SUMMARY: Some provision for lighting must be made; it might be wise to pair the light source with the cooking fuel, equating candles to charcoal. In any event, an adequate supply of candles is suggested, as a safeguard against having to operate without light.

Schedule of Operations

In the case of the food operations, routine activities must be inaugurated as soon as possible after the shelter closes its doors. For that reason, a schedule of operations should be worked out in advance and be posted in case the food manager is not able to be there. Such a listing of activities might include the following actions:

1. Organize a temporary staff to supervise essential activities and organize the population into manageable units.
2. Instruct the newly recruited staff in their essential duties for the day.
3. Assign space to the various divisions.
4. Announce the eating schedule for the day.
5. Acquaint the new staff with control centers for emergency resources.
6. Test the availability and operability of water, air and other emergency equipment.
7. Check the food supply and sanitary facilities.
8. Prepare service areas for food servicing and delivery.
9. Determine the number of admissions to be provided for at the first meal.
10. Identify individuals requiring special foods.
11. Ascertain sleeping schedules as a basis for adjusting feeding plans.

The food manager should also establish a daily schedule for performing routine functions. The schedule will vary from shelter to shelter, depending upon the sleeping and feeding methods, the

organization, and the nature of the food supply. Variations are endless, but some kind of schedule tailored to the needs and individual characteristics and desires of the shelter occupants should be drawn up. It is vital to operate the shelter with some semblance of order in the beginning. A simple sample might be:

<u>Time</u>	<u>Activity</u>
7:00 A. M.	Arise
7:30	Prepare food and beverage for breakfast
8:00	Serve breakfast
9:00	Clean up
10:00	Evaluate inventory as a basis for ration
10:30	Free time
11:30	Prepare food for lunch
12:00	Serve lunch
1:00	Clean up
2:00	Rest or recreation
3:00	Training classes
4:30	Prepare food for dinner
5:00	Begin serving dinner
6:00	Clean up
7:00	Recreation

The Nature of the Basic Ration

To fulfill the purposes of the shelter program, a minimum amount of food and water for each public shelter must be assured. The federal government has undertaken to supply this need by stocking each shelter with a basic ration designed to meet the requirements of the occupants for the two week anticipated occupancy. This ration will consist of at least 14 quarts of water and about 10,000 calories of survival biscuits per shelter stay. Carbohydrates, in the form of hard candy, may supplement the other food. This food will not exceed 1/3 of the total ration by weight.

The food will be packaged in cans of two sizes. One will supply seven persons with 10,000 calories of food each, and the other will supply five persons with 10,000 calories each. There are approximately 2,000 calories per pound. The candy will be packaged in moisture proof cellophane bags which in turn are packaged in a drum. If desired, they may be obtained in five gallon square tins with the cellophane containers. In the latter case, a scoop with cellophane envelopes for each portion can be provided.

The local Civil Defense organization will be responsible for the proper storage and safety of these supplies until the shelter is occupied. (See Chapter II, section B, "Menu Planning and Stocking")

The Storage of Food

The problem of selecting and storing the basic ration for a designated shelter will rest with the Civil Defense organization. Once this food has been delivered to the community, it will be assigned and stored in the shelters. It should be maintained under proper temperatures and in accordance with state sanitary regulations. This will require regular inspection.

Once the food manager has been appointed and the shelter readied for use, he will assume responsibility. His first job would be to make an inventory of both quantity and quality of the supplies.

Parents and guardians should have been informed of the nature of the basic ration and invited to bring special diets or infants food needed for health purposes with them. These additional foods must be carefully examined and catalogued as they are admitted as a part of the food supply. They should be turned over to the food manager for redistribution as needed. Where possible, the same standards suggested for the selection of the basic ration should be used for the admission of supplementary supplies.

Obviously, a large supply of improper supplementary food will aggravate the sanitary storage and waste problems.

In planning storage facilities in the shelter, consideration must be given to the maintenance and periodic replacement of the Civil Defense basic supplies during the pre-occupancy period, and to the security and convenience of the supplies once the shelter has been occupied. In general, all supplies and tools should be stored in protected places under lock and key or with break glass access in the event the key is not available when needed. Storage should be in a dry and freeze proof area, and as near to the food area as possible.

Where feasible, shelving should be installed that could support the heavy containers of 70 pounds or more on the floor level and then arranged above the floor according to weight. The shelves should be designed to conserve space and sturdy enough to support packages up to 50 pounds.

Both water and food stocks should be inspected every six months and canned food used and replaced every two years. Supplementary foods supplied by the community should undergo the same inspection after having met the same standards of selection for storage and consumption. Personal stocks of special diets should be turned over to the food manager for storage and later issued to the appropriate person. (See Chapter V, section B, "Issuing and Inventories")

Stockpiling Food for Overflow or Emergency Use.

It is planned that all designated public shelters will be stocked with a specified number of water and food rations according to the capacity of each shelter. It is assumed, however, that in many cases, overcrowding will be a problem.

Where such conditions exist, management may be forced to move some of the occupants to an adjacent area having a lower protection factor.

This being the case, it would be convenient if part of the food supplies were packed in individual parcels so that those who must leave the main shelter will have their own two-week supply of food.

With this in mind, the following survival menu has been designed to provide a nourishing and balanced daily menu. In addition to the basic ration of survival biscuits, three spreads and coffee, milk and sugar have been added. This makes a total of more than 1400 calories per person per day.

The food could be packed in a handy package which, with a supply of plastic spoons, a can opener and a cup, would weigh about 10 pounds. Such a packet could be easily picked up and transported by one moving to another area and would assure adequate food for the shelter period.

A greater degree of comfort might be achieved by adding additional equipment in the form of a sterno stove, fuel, and a small container for heating hot water. A person with such a food kit and equipment would then be independent of any other food supply.

The following list of foods with the given amounts of each indicated would constitute the contents of the Pac. The suggested daily menu may be varied according to the preference of the individual.

Such a food pac as specified would be welcomed by many householders throughout the country as a foundation for their own family stockpile of foods for emergency use, as recommended by Civil Defense authorities. The entire pac is light enough to be carried by travelers and kept in the trunk of the car. The total cost is about \$12., and the total weight is 12 pounds.

Additional fluids to the extent of one quart per person per day are needed. This might be in the form of bottled or canned beverages or juices.

"SURVIVAL FOOD - PAC"

Suggested Daily Menu

<u>Breakfast</u>	<u>Lunch</u>	<u>Dinner</u>
8 survival biscuits	8 survival biscuits	10 survival biscuits
1 oz. jam	1 oz. peanut butter	1 oz. cheese spread
8 oz. instant coffee	8 oz. instant coffee	1 oz. jam
1/2 oz. evaporated milk	1/2 oz. evap. milk	8 oz. instant coffee
1 ts. sugar	1 ts. sugar	1/2 oz. evap. milk
		1 ts. sugar
Total daily calories: 1403		
Total 14-day calories: 19,642		

The aforementioned items may be conveniently stored in an "8-Pac Food Kit" in the following containers:

- 1 5 3/4 lb. tin of survival biscuits (390 biscuits)
- 3 12 oz. glass jars, assorted jellies and jams
- 1 #1 2 oz. glass jar peanut butter
- 1 14 oz. glass jar cheese spread
- 1 13 oz. can evaporated milk
- 1 2 oz. jar instant coffee
- 1 improvised jar of sugar, 1/2 lb. contents

Other minimum supplies necessary to complete the food kit would include:

- 1 can opener
- 1 cup for coffee
- 12 plastic spoons
- 1 Sterno stove #25 (cost 99¢)
- 5 canned heat (cost 19¢ & 39¢ ea.)

Cost of food: 60¢ per day, or \$8.40

Other supplies: \$4.00 including stove & fuel

Total cost: \$12.40

Weight: 12 lbs.

The Selection of Food

In addition to the basic ration, other food may be available if the capacity of the shelter permits. The shelter occupants for a given area will have been advised that they may, under the above restrictions, supplement the basic rations with additional water or food.

Quantities and kinds of such food must be adapted to the shelter according to the facilities for storing and serving it, the equipment for preparing it, and the nature of the population. In general, the same criteria used in making up the basic ration should be kept in mind in receiving supplementary foods.

They are as follows. Food should be selected having:

1. A relatively long shelter life - to reduce replacement cost.
2. Palatability - food of the kind usually consumed in the area, and food that can be easily varied.
3. May be eaten hot or cold - circumstances may preclude cooking or warming up food.
4. Relatively economical - original outlay and replacement costs low.
5. Easily prepared and served - mass feeding with unskilled help makes this important.
6. Suitability - suitable to the clientele of the shelter.
7. Little waste - garbage disposal will be a limiting problem.
8. Variety in texture and consistency - a reasonable amount of roughage.
9. All containers should be vermin proof - especially for longer storage periods.

10. High calorie/bulk ratio - where space is limited food should have a high caloric content.
11. Hygroscopic qualities - low moisture absorption.
12. Minimum food spoilage - contents of cans should pour as clean as possible.
13. Foods requiring a short cooking time should be selected.
14. High liquid content would be helpful.
15. Freeze-proof - where frost is a factor.
16. Resistance to high humidity - ordinary paper containers would soon break down.

These suggestions are for the guidance of the food manager in recommending supplementary food for acceptance at the shelter.

In addition to the quality of the food, the manager should check the quantity in each container in terms of portions for distribution. The following table, Exhibit M-1, showing the actual capacity and 4 oz. portions in all different sizes of cans will be found to be very convenient in preparing relatively equal portions for distribution.

CAN SIZES AND PORTIONS

Nominal	Fluid Oz. Capacity Oz.	Nominal 4 oz. Portions Per Can	Actual Portions Fluid Oz.
1/4 oblong		2	
1/2 oblong			
3/4 oblong			
1 oval		3	
211 Cylinder			
12 oz. oblong			
6 oz.	6		
1/2 flat	7-3/4 - 8-1/2 oz.		
7Z			
8Z	7-3/4	2	3.88
1 picnic	9-1/2		
1 Tall	15	3	5
300	13-1/2	4	3.38
303	15	4	3.75
2	18	5	3.8
2-1/2	26	6 - 7	4.34 - 3.72
3			
3 Cylinder	46	11 - 12	4.18 - 3.83
5			
10	96	24-25-26-27-28	3.84-3.69 3.55-3.42

"Purchase and Use of Canned Foods" -

American Can Company, 100 Park Avenue, New York City

Exhibit M - 1

The Conservation of Food and Water

When all the food has arrived and is stored in the shelter, the food manager has a serious responsibility for its conservation. Once the doors are closed, it must be assured that there will be no additional supplies. The welfare of the group demands strict control and careful distribution of all resources on hand.

Until the depletion rate of the supplies indicates otherwise, an allowance of not more than 1,000 calories per person per day should be made. When the population has been determined and the probable duration of the confinement estimated, it is likely the ration can be increased. If it is evident that the supplies will support a more liberal ration, the amounts per meal should be increased.

Food should not be released to the occupants except at meal time and then only the amount they will consume. Trading in surpluses saved from a meal should be discouraged.

Sanitary Regulations for Food Handlers

With a voluntary food staff, training in sanitary regulations for food handlers would be very urgent. A list of regulations posted where all could read them, such as the items listed below, would constitute minimum conformity to health regulations.

1. Food exchange should take place in sanitary surroundings to avoid exposing food to contamination.
2. Anyone engaged in the handling of food must keep all parts of his body clean. He must keep clothing as clean as possible, cover any abrasions, cuts, or other sores with

a suitable dressing, and refrain from spitting or smoking near food.

3. Articles of equipment used in a food operation must be clean. They must be made of such material and in such a way as to prevent any risk of contamination.
4. Carriers of food should not have infectious diseases.
5. Food should not be wrapped in printed papers for storage or transportation.
6. When toilets must be near food operations, they must be clean and well ventilated if possible. No food should be stored in a toilet room.
7. All food handlers should be warned by signs to clean their hands before handling food.

If water is not available, disinfectants should be provided. A small pan in which a germicidal solution can be placed for hand washing after toilet use, together with disposable towels for drying hands, is advisable.

Occupants who cannot or do not care to abide by these regulations should not be employed in the foods division. The serious consequences of sickness and disease under shelter conditions justifies extreme precautionary safeguards in the preparation and serving of foods. These measures should include daily health inspection of food handlers and alertness in identifying sources of infection which may create a health hazard. Waste food and empty food containers after use, should be placed in a tight receptacle until they can be disposed of.

In the larger shelters, health and sanitation problems will be under the direct control of a special officer, but the preventive aspect

of health and the total supervisory problem in most shelters would be the responsibility of the food manager. With very limited water supplies for cleaning and restricted sanitary equipment, special training and extreme care should be undertaken by food supervisors.

In the limited space of the shelter, good sanitation is not merely a matter of comfort, it could be a matter of life or death. Human waste can spread such diseases as typhoid, dysentery and diarrhea.

Waste Disposal

The limited amount of fresh air and the serious consequences of disease under shelter conditions, justify extreme precaution in the disposal of waste from processing food. The use of packaged rations will minimize the sanitary problem but it will still bear inspection and planning. Empty cans should be crushed and placed in a closed container for final disposal at the first opportunity. When it is safe to open a door, they could be removed.

Shelter floors should be kept clean of litter or waste material without creating dust. Some of the extra help might well be used to police given corridors and see that all waste is properly disposed of. Each unit should police the area assigned to it. The shortage of water suggests the use of paper towels for cleaning, but they should be used several times before disposal to conserve the supply.

The Preparation of Food

As a result of the limited space and equipment, as well as the untrained help, the preparation of food in shelters should be kept as simple as possible. The basic ration will require someone to break open

food packages and hand the allotted number of biscuits to each shelter occupant, and perhaps opening some cans containing a spread of some sort to make the biscuits more attractive will be necessary. If heat is available, preparing water for coffee or tea will be essential.

Since little else can be done to enrich the taste of the food or relieve the monotony of the diet, attention will focus on equality of portions and sanitary operations.

Where significant amounts of supplementary foods have been stored and the use of heat can be tolerated, the situation becomes more complex. More palatable mixtures could be prepared and variation in the diet could be offered. It is strongly recommended that all supplementary food be in appropriate cans requiring a minimum of preparation. Where candies are provided, they should be prepared in individual plastic bags for distribution.

The Distribution of Water

Because of its importance to survival, the preservation and distribution of water requires thoughtful consideration. The water supply will help determine the number of people who can be admitted to the shelter and its equitable distribution will have much to do with the morale of the occupants. With a possibility of as little as one quart per person per day stored, as indicated by the basic ration, the first effort of the food manager should be to supplement this ration by at least doubling the supply.

A second problem is the size of the containers used for storing water. Some of the vessels proposed are too large for easy

manipulation and if they are found in a shelter, provision should be made for pouring from them into smaller containers for easier distribution. A five gallon water can is about as heavy as most people would be able to pour from safely without undue spilling or injury.

Where the 150 lbs. vessels contain the water, the following procedures are suggested for handling it.

A metal drum (17-1/2 gallon metal drum) with a removable lid, (diameter is 16", height is 21", capacity 17-1/2 gallons, weight 150 pounds) contains two formed polyethylene bags of 4 mil. thickness. The outer bag lying next to the drum has a cylindrical neck; the inner bag, of the same thickness, has a formed neck large enough to accept a garden hose for filling and may be adapted to a formed nozzle for pouring. After filling, the neck of the inner bag is twisted, doubled back on itself, and secured with plastic "wire". The entire inner bag is then covered with the folds of the outer bag, and the cover placed over the drum. (Stacking - 2 tiers - metal cover).

The service of water in this form of container involves removal from stores. Because of the weight involved, this will require the efforts of two or three able men, preferably experienced in lifting and handling heavy objects. They should be cautioned against shifting of load and the possibility of springing the top of the container while handling.

When the container is moved, it should be placed in an upright position on the floor, the top removed, the outer bag unfolded, the neck released, and the pouring nozzle inserted and secured.

Examine the edge of the can for sharp protuberances which should be removed or avoided. Two men should stand on each side of the container while a third manipulates the nozzle. The container should be carefully tilted until water gently flows over the edge of the container (although in the plastic bag). Gentle delivery of water can be accomplished by raising or lowering the neck and nozzle. In this procedure water will be contained in the plastic bag outside of the container. The quantity of this water should be kept to a minimum of perhaps 2 quarts being replenished from time to time by again tilting the container. Under no circumstances should the container ever be placed in a horizontal position until the total remaining contents of the bag are in the order of 2 quarts. Premature horizontal positioning will result in the bag and water rolling out of the can completely, providing possibilities for rupturing the bag with consequent loss of water.

As the contents of the container decrease, and the container must consequently be tipped more to the horizontal, thereby decreasing the height from the floor of the pouring nozzle, it is suggested, when the contents are about 2/3 gone, that the container be raised and set on either another full or previously emptied container to gain additional height.

When empty, the pouring nozzle is removed and used in the same manner for the next container.

This procedure, at its best, is awkward; and in inexperienced hands may well result in personal injury to the handlers, such as the development of a hernia, and the actual loss of water.

It may be improved by the acquisition of a Decanting Truck which permits securing the container to the truck and tipping the assembly on rockers under one individual's very stable control. Where the number of occupants exceeds 100, the provision of such a truck is highly recommended. It is also needed in shelters devoted to women and children, such as may occur in schools. The extreme awkwardness as well as the slowness of this process, particularly in crowded areas, must be recognized, and suitable barriers or guards established to protect it.

A second method of interest is to provide a flexible plastic tube with a shut-off on the end extending from the nozzle, and a disc of fiber board, whose major diameter is equal to 15-1/2 inches with a central hole of 4 inches. The nozzle and tube are passed through the central hole and the disc laid horizontally on the plastic bag. A downward force on the disc will exert pressure on the bag and cause the water to flow up through the tube. Release of the downward force will cause water flow to cease. Employing this principle, the container can be elevated on a like container, the tube carefully filled with water, including any air, and the system will operate as a siphon, when the end of the flexible tube is lowered below the water level of the bag.

To elevate the water to the top of the water heater will require more force than can probably be properly applied.

A more convenient type of water container would be desirable. The five gallon vessel described below has much to commend it, especially in vertical shelters.

These containers are standard 5 gallon metal cans with a locked down top, and a plastic "bottle" for water. The pouring spout is depressed and covered with a metal cap seal. Bottles are filled with distilled water and are sealed at the bottling plant. The assembly weight is approximately 22 pounds, and presents no problem in transportation, pouring or emptying into a water heater. The container will stack, and may be stacked four or five high.

In storing these containers, a light covering sheet of plastic should be placed over the top of each which can be removed before use, serving as a dust cover to prevent contamination while pouring.

To use, the light metal cover is removed, the neck of the bottle is pulled out, and the seal on the cap destroyed.

After emptying, the metal cover can be removed with a class five can opener, the top of the flank can be cut off, and the resulting container used for refuse or sanitary needs.

Water Container - Globe Equipment Corporation, Brooklyn 1, New York.
Approximately 10-1/2 ounces (207 x 411). United States Coast Guard
Approval No. 160.026/27/2.

These containers are easily handled and issued in units. Three cans constitute a daily ration, falling 1/2 ounce short of a quart. Their size is highly convenient for three times a day issue. They are opened with the class five can opener. Empties can be readily replaced in original containers.

Where the water situation is critical, each cup used should be identified and a control system worked out to avoid allowing any one

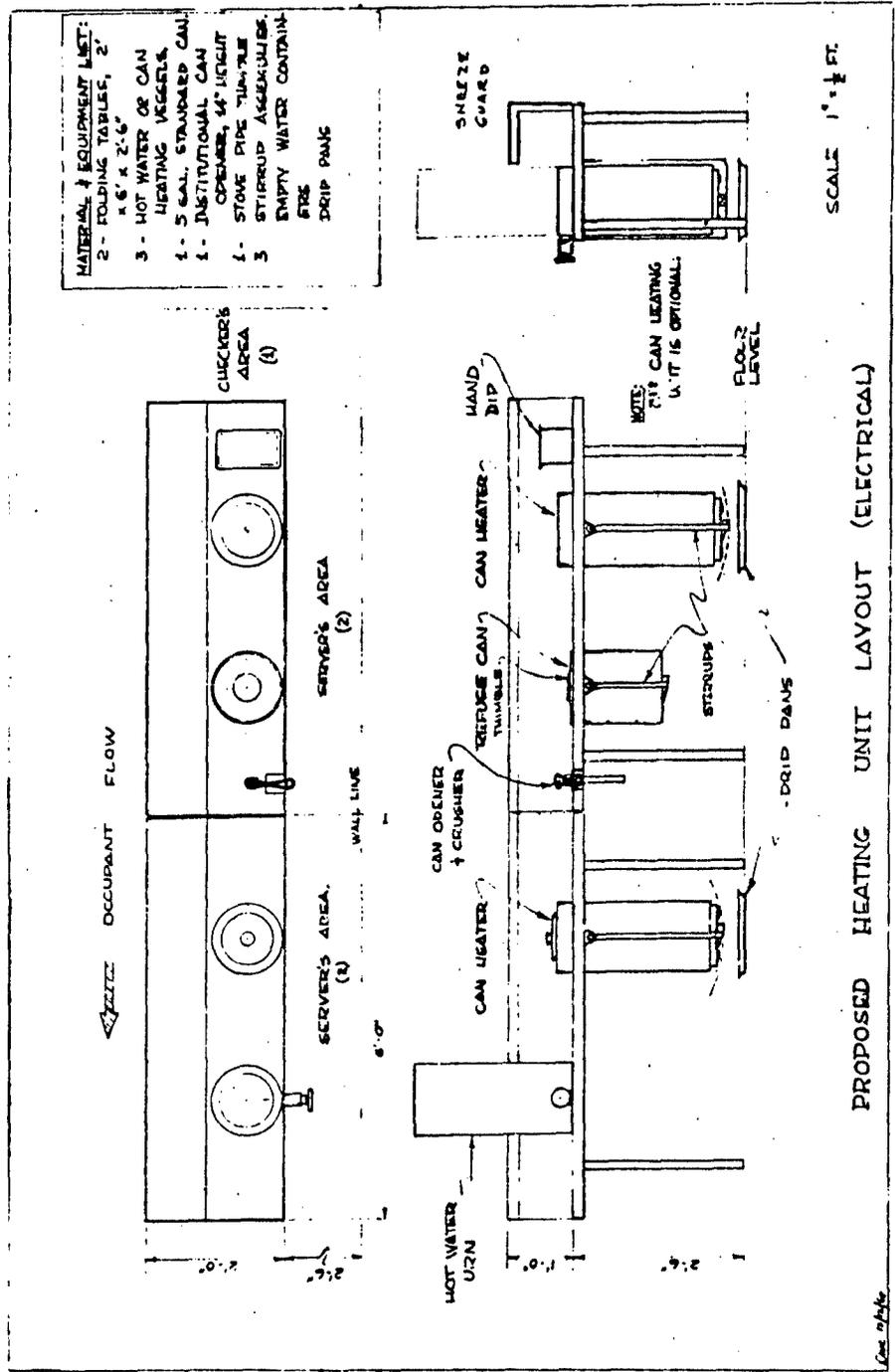
person to obtain more than his portion. Provision would also need to be made for cleaning hands, especially of food handlers, with something other than water.

The antiseptic recommended for shelter use is "benzalkanium chloride" also known as "Zephiran". Benzalkanium chloride is a mixture of alkyl dimethylbenzyl-ammonium chlorides and is cationic. This preparation is widely used as an antiseptic and germicidal agent in hospitals. Diluted 1:10 with water, it is effective as a hand disinfectant and in sterile storage of instruments. It is also used as a preservative in sterile eye solutions.

The Distribution of Food

The density of the shelter population, the space arrangement, and the food supply will influence the way the people are fed. A special service center near the food storage and preparation area, set apart with some tables or counters would provide a good arrangement for serving. The serving table shown in Exhibit M-2 would be very convenient for serving at least 100 occupants. (See next page).

Where the basic ration in the form of biscuits served cold is the chief diet, the need for tables or additional counters would be reduced. Under such conditions, the appropriate number of cans of biscuits could be turned over to the chairman of a small unit for serving to his group. If, on the other hand, there was a large supply of supplementary foods and conditions permitted cooking, more space and service as well as utensils would be required.



The distribution of cooked foods through crowded corridors could create hazards as well as become a potential source of waste through spilling.

If sleeping arrangements do not require day and night feeding shifts, the customary community routine of three meals per day should be the schedule. The eating rhythms of the group should not be disturbed more than necessary. The ration for the day should be set by the food manager after careful evaluation of the remaining supplies and the probable duration of confinement.

The entire day's ration should not be passed out at one time even though crowded conditions would suggest such a procedure. Food that is not consumed at a given meal is always in danger of being wasted or bartered, thus creating either a sanitary or morale hazard.

The training and disciplining of the service personnel in dealing with rationed food deserves special attention. Most of the staff will have had no experience with the distribution of rationed food. They will be under severe pressure to be partial in their handouts, especially as hunger and thirst develop. To surrender to such efforts on the part of some occupants would immediately arouse complaints and strife leading to turmoil. If persisted in, it would cause a breakdown of service. Every precaution must be taken by the food manager to insure impartiality. Portions must be carefully measured with no variations due either to carelessness or intent. People who have brought supplementary foods to the shelter to avoid strict rationing may create special problems of distribution.

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Hungry children will find it difficult enough to have to endure privations and would not understand differences in portions. Food supervisors will find it to their advantage to keep the occupants well informed of reserves and policies of distribution.

Because of the limitations on food and facilities, and the complexity of the population, no ethnic or religious laws will be recognized in the preparation or serving of food as far as the food manager is concerned.

The storing of supplies of food other than the basic rations will create complexities for the food manager. Before significant quantities of such supplementary foods are accepted for storage, the food manager or his representative should be assured that they have met the qualifications set forth earlier for the selection of shelter foods, (and that the following assumptions about the shelter can be verified.)

1. That adequate space, light, equipment and energy to prepare these foods exists in the shelter.
2. That a staff has been trained for preparing and serving them.
3. That they can be delivered in equal servings to all occupants of the shelter.
4. That processing them will not upset temperature, sanitary or humidity conditions.
5. That adequate water is available for cooking them and for food sanitation.
6. That no refrigeration is necessary.
7. That whatever heating is done can be done with cans and other available facilities.

Food and Beverage Delivery Control

The tendency for people involved to take additional food in other disasters suggests the need for preventing cheating or stealing through control systems. The most practical method of control is as follows:

As indicated earlier, all occupants are asked to form groups of 8 - 10 members with the understanding that this group relationship will persist through their shelter stay. They are asked to elect a group leader.

At the time of the first service of water or food, the group assembles as a unique entity at the service area, and a food control deputy gives each member of the group a number such as I-3, indicating the third member of group I. This mark is placed on the hand of each group member with indelible pencil. The group leader is asked to identify and remember each member, recording their names and group numbers if such accounting is possible. The total number in the group is recorded by the food control deputy.

No number or group assignment is to be made to an individual who already possesses an indelible mark, thus preventing an individual from becoming a member of two groups and so securing more than one issue of food or water. It is expected that the quality of the indelible marking will be such that it will persist long enough for the group leader to become familiar with the members of his group.

In any event, the total number in a given group will be known and controlled by the food control deputy. The group itself, once established, will reject any additional members, and an absent member who might be indisposed will be taken care of by the group. If desired, the indelible marking can be renewed from time to time.

Nutritional Values of Foods

The basic diet provided by the government was designed with the purpose of providing the essential dietary elements for energy and nutrients in the one biscuit. As long as the major portion of the food supply comes from this source, the food manager will have no problem of a healthy balance of food elements. Where, on the other hand, supplementary foods are used to a large extent, the question of values may be raised. The food manager will find the charts made up from the U. S. Department of Agriculture Handbook No. 8 very useful in such a case. These charts shown in the following exhibits give the composition of selected canned foods most likely to be used in shelters. The amounts of the foods have been reduced to ration size for easy calculation by the food processor.

COMPOSITION OF FOODS FOR SHELTERS IN
COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)	Food Energy (Calories)	Protein	Fat	Total Carbo- hydrates
<u>SOLIDS (MEATS & FISH)</u>					
79	Corned Beef Hash Canned 3 oz.	120	11.7	5.2	6.1
80	Roast Beef Canned 3 oz.	189	21.	11.	0
83	Corned Beef, Canned Lean 3 oz.	159	22.5	7.	0
84	Corned Beef, Canned, Med. Fat 3 oz.	182	21.5	10.	0
85	Corned Beef Canned, Fat 3 oz.	221	20.	15.	0
86	Beef Dried or Chipped 1/2 cup	168	28.3	5.2	0
525	Canned Ham, Spiced 2 oz.	164	8.4	13.8	.9
	Luncheon Meat - Canned Spiced Sausage, Pork 2 oz.	164	8.4	13.8	.9
591	Salmon, Sockeye (Red) Canned 3 oz.	147	17.2	8.2	0
592	Sardines, Canned Oil 3 oz.	288	17.9	23.	.9
692	Tunafish, Canned 3 oz.	247	20.2	17.8	.0
<u>SOUPS</u>					
612	Bean, Condensed 4 oz.	160	7	4	24.8
614	Beef, Condensed 4 oz.	83	5.0	2.8	9.2
621	Clam Chowder, Condensed 4 oz.	70	3.6	2.	10.
628	Pea, Condensed 4 oz.	119	6.	1.6	21.2
630	Tomato, Condensed 4 oz.	70	1.6	1.6	15.
632	Vegetable, Condensed 4 oz.	67	3.4	1.4	12.9
636	Navy Bean (Dehydrated) 1 oz.	92	5.0	.3	17.8

Exhibit M - 3

COMPOSITION OF FOODS FOR SHELTERS IN
COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)	Food Energy (Calories)	Protein	Fat	Total Carbo- hydrates
<u>JAMS AND JELLIES</u>					
350	Honey Strained or Extracted	1 tbs 62	.10	.0	16.40
353	Jams, Marmalades, Preserves	1 tbs 55	.10	.10	14.20
354	Jellies	1 tbs 50	.0	.0	13.50
415	Molasses Cane Light	1 tbs 50	.0	.0	13.50
472	Peanut Butter	1 tbs 92	4.2	7.6	3.4
665	Sugars Granulated	1 tsp 16	.0	.0	4.2
<u>CANDY</u>					
177	Butterscotch	1 oz. 116	.0	2.5	24.3
178	Caramels	1 oz. 118	.8	3.3	22.
179	Chocolate Sweetened Milk	1 oz. 143	2.	9.5	15.8
180	Chocolate Sweetened Milk Almonds	1 oz. 151	2.3	10.9	14.2
181	Chocolate Creams	1 oz. 110	1.1	4.0	20.
184	Hard	1 oz. 108	.0	.0	28.
186	Peanut Brittle	1 oz. 125	2.4	4.4	20.6

Exhibit M - 4

COMPOSITION OF FOODS FOR SHELTERS IN
COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)	Food Energy (Calories)	Protein	Fat	Total Carbo- hydrates	
<u>FRUITS AND VEGETABLES</u>						
11	Applesauce canned unsweetened	1/2 cup	50	.25	.25	13.2
12	Applesauce Canned sweetened	1/2 cup	92	.25	2	25.
15	Apricots Canned water pack	1/2 cup	38	.60	.10	9.90
16	Apricots Canned Syrup pack	1/2 cup	102	.75	.20	27.4
38	Red Kidney Beans Canned	1/2 cup	115	7.30	.50	21.
40	Red Kidney Beans Canned baked Pork and Molasses	1/2 cup	162	7.50	4.3	25.
41	Pork and Tomato Sauce	1/2 cup	147	7.50	2.70	24.
42	Beans, Lima canned	1/2 cup	88	5.0	.4	16.8
91	Beets, Canned	1/2 cup	41	1.10	.10	9.7
107	Blueberries canned water pack	1/2 cup	45	.50	.50	11.0
108	Blueberries canned syrup pack	1/2 cup	122	.50	.50	32.4
225	Chili Con Carne Canned no beans	1/2 cup	85	4.4	6.3	2.5
247	Corn Canned	1/2 cup	85	2.6	.65	20.60
275	Biscuits (Nat'l. Bisc. Co.) 1 biscuit		30	8.4	8.4	79.0
318	Fruit Cocktail canned	1/2 cup	88	.50	.75	23.8
326	Grape Fruit Canned in Syrup	1/2 cup	90	.45	.25	23.8
406	Pineapple Canned Syrup	1/2 cup	102	.60	.150	27.5
463	Peaches sliced canned	1/2 cup	38	.40	.10	10.1
474	Pears Canned water pack	1/2 cup	38	.35	.10	9.9
475	Pears Canned Syrup pack	1/2 cup	87	.25	.15	23.5
479	Peas, green canned	1/2 cup	84	4.2	.50	16.05

COMPOSITION OF FOODS FOR SHELTERS IN
COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)	Food Energy (Calories)	Protein	Fat	Total Carbo- hydrates
<u>JUICES</u>					
10	Apple Juice Fresh or Canned	* 1/2 cup	62	.10	.0 17.2
329	Grape Fruit Juice Sweetened	1/2 cup	65	.60	.20 17.2
332	Grape Fruit Canned Sweetened	1/2 cup	65	.60	.20 17.4
336	Grape Fruit, bottled Commercial	1/2 cup	85	.50	.0 23.1
445	Orange Juice Canned Unsweetened	1/2 cup	54	1.00	.30 13.60
508	Pineapple Juice Canned	1/2 cup	60.5	.30	.10 16.2
548	Prune Juice Canned	1/2 cup	85	.50	.0 23.2
686	Tomato Juice Canned	1/2 cup	25	1.20	.30 5.20
682	Tangerine Juice, Unsweetened	1/2 cup	47	1.10	.40 11.3
<u>BEVERAGES</u>					
234	Cocoa Beverage Made with Milk	1/2 cup	118	.40	.60 13
406	Evaporated Milk unsweetened	1/2 cup	173	8.80	9.90 12.9

* 1/2 cup equals 4 ounces

Exhibit M - 6

An adjusted austere ration supplementing the basic biscuits in the interest of more appetizing meals is shown in the following tables for breakfast, lunch, and dinner. These additional spreads and liquids add much to the palatability of the food.

SAMPLE SHELTER MENU - 1290 CALORIES DAILY

Three menus for shelter feeding are currently envisioned. The most austere is the federal-stocked ration consisting of survival biscuits and one quart of water per person daily.

Each survival biscuit, 2-1/2 x 2-1/2, contains 30 calories and is low in protein, high in carbohydrates. 2" x 2" biscuits contain 22 calories each. Twenty-four large biscuits daily will provide 720 calories.

This federal-stocked menu may be easily supplemented by adding spreads such as jam, honey, and peanut butter. Instant tea and coffee, evaporated milk, and sugar are added for the sake of morale. The daily caloric intake is thereby increased to 1290 calories. The following menu may be varied by using different flavored spreads throughout the fourteen day period. Each item has been analyzed to show its nutritive value.

<u>Breakfast</u>	Gm/ portion	Calories	Protein	Gm. %	Fat %	Carbohydrates %
* 8 biscuits	60.4	240	5.07	8.4	8.5	79
1 oz. jam	40.0	110	.2	.5	.5	71
8 oz. coffee						
1 tsp. sugar	4.0	16				100
1/2 oz. evap. milk	16.0	22	1.1	6.9	7.5	9
<u>Lunch</u>						
8 biscuits	60.4	240	5.07	8.4	8.5	79
1 oz. honey	42.0	124	.2	.23		80
8 oz. tea						
1 tsp. sugar	4.0	16				100
* 30 calorie biscuits						

Dinner

10 biscuits	75.5	300	6.34	8.4	8.5	79
1 oz. peanut butter	32.0	184	8.4	26.3	44.0	21
8 oz. coffee						
1/2 oz. evap. milk	16.0	22	1.1	6.9	7.5	9
1 tsp. sugar	4.0	16				100
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
DAILY TOTAL	354.3	1290	27.46	7.7	9.8	65

Problems of Abnormal Behavior

Provision should be made also for the psychological well-being of the occupants. Along with the physiological needs of water, food, air and temperature, management should be aware of the urgency of such psychological needs as achievement, affection, freedom from fear, security, group membership, and independence. Plans should be made from the opening of the shelter to reduce fear and provide a feeling of security.

There will be at least two periods of the shelter experience that will be characterized by unusual behavior on the part of many of the occupants. The first will be at the period of occupancy, particularly if a disaster has already occurred and fallout is a reality. The excitement, confusion, and fear during such a period would require unusual leadership to restore order and proceed with the routine of shelter living.

The second period will develop more gradually as the deprivations of both a physiological and psychological nature begin to impinge on the occupants. If space, heat, light, sound, food, oxygen, and water are not provided for adequately and supplies or controls break down, problems of behavior will arise which all supervisors will have to face.

The Problem of Deprivation

The supervisor of water and food in a shelter situation requires an imaginative grasp of the behavior of frustrated, frightened and restricted individuals. Few people have any real conception of what shelter living will entail. The many deprivations that must be imposed will cause physiological, psychological and social reactions that must be understood in order to avoid confusion and loss of control. These reactions may result from confinement, reduced water and food supplies, foul air, high temperatures or humidity, loss of sleep, bad smells, unusual noises, crowding and uncertainty.

The major studies of human reaction to shelter conditions have been made with healthy male subjects, and physiological effects rather than emotional and social reactions have been noted. With women and children in a real disaster where no escape is possible, many emotional and social problems will arise, that the food manager and his staff must identify and deal with, when no doctors are available.

Physiological or sensory deprivations are the most serious and every effort should be made in planning shelter living to reduce them as much as possible. Where fresh air, adequate food, and sufficient water can be made available, life will be preserved and good morale may be developed. A shortage in any of these basic needs will start a chain of reactions that will be difficult to control.

Oxygen Deprivation

This may cause temporary or permanent damage to the individual as well as severe problems of administration. Sufficient oxygen must be assured through a satisfactory ventilation system. If by accident,

the system should break down or overcrowding deplete the oxygen, violent, uncontrollable activity such as that of a drowning person ensues ultimately, and paralysis is apt to occur. Undoubtedly, the person is unaware of the onset of his situation and may fail to realize the seriousness of his plight. Hence, supervisors must be on guard for any symptoms.

Hunger

This may become an inescapable problem for many people in shelters if only basic rations are available. Semi-starvation is characterized by feelings of weakness, hunger pains, dizziness and blackouts upon standing up suddenly. The hunger drive becomes the dominant dynamic factor affecting the behavior of the person. There is constant preoccupation with thoughts of food. Ultimately the individual becomes unresponsive and uncooperative. Many emotional problems arise. Attempts are made to steal food and other signs of moral deterioration develop. The food manager is likely to have to deal with various degrees of hunger.

Thirst

Man can live for weeks without food, but he can survive only a few days without water. Next to air, sufficient water should be given top priority in stocking supplies. Deprived of water for a long period of time, men report that sensations of thirst become maddening. Adequate water should be stored and protected against waste by the food service division. Serious behavior problems arise from a depletion of water in the human system.

Odors

Bad odors in the shelter contribute to the discomforts of the situation and may be a real cause of complaint and turmoil. Fortunately, our olfactory senses become adapted to odors so that even foul odors become less objectionable, and very few people are known to have died from bad smell. Nevertheless, loss of appetite, nausea and depression may result from bad odors so that the food manager will struggle to reduce them as much as possible.

Illumination

Sensory problems with light may result from over stimulation or lack of it. Too much light has been known to cause increased tension among confined people, and no light can create innumerable problems. Darkness will lower morale by reducing activities, reading, and training. Problems of illumination should be carefully planned and controlled.

Temperature and Humidity

It will be very difficult to control these factors in fallout shelters with uncertain sources of power and little access to fresh air. Hot, humid air sometimes produces vomiting and with little, if any, water for sanitary purposes, it could result in a very messy as well as uncomfortable situation. Many of the internal temperature problems will arise in connection with attempts to provide hot foods so that the food manager may have to face controversial decisions in this case.

Sounds or Noise

Here the problem may be excessive stimulation rather than deprivation, but judging from other confinement experiences, continuous or loud noises or even continuous harmony may irritate some people and cause aggressive emotional responses. Every effort to mask or eliminate noises should be taken in the planning for shelter living. Noisy motors or fans may disturb some people. Control of unnecessary noise is a continuing problem for management.

Sleep

The pattern of behavior by which we satisfy the need for sleep is partly the result of cultural factors. Our pattern is based on the regular alteration of sleep and darkness. Man may go many hours without sleep although some sleep is necessary to recover from fatigue. Most people require from 6 - 9 hours of sleep daily, and when men have been allowed to sleep as much as they care to, the average was 7.9 hours per day. With sleep deprivation, concentration is impaired, motor performance deteriorates, and the individual is easily disturbed emotionally. Lack of sleep is a common complaint of people who have spent time in shelters. Many factors are involved, but every effort should be made to make sleep possible. Where lack of space makes it necessary to resort to shifts, the problems are multiplied.

Appetite and Taste

Appetite may be stimulated by the sight, odor, and taste of food with or without hunger. It can be stimulated by appetizers or destroyed by smells. Seeing others eat stimulates eating. Habit plays an

important part in the rhythms of eating when situations are favorable. Taste will of necessity be sacrificed to convenience and survival. Some people may refuse to eat under shelter conditions and may insist on release before the signal for opening the doors is given.

Crowding

Crowding involves most of the skin and muscle senses but its real effect may be on the imagination. A feeling of claustrophobia is not uncommon in confined spaces. The sufferer has a feeling that the walls are closing in on him and he is mentally very disturbed. By the very nature of the shelter, limitations in space will create problems of heat, odors, humidity, and aggressive behavior. Some people will insist on release in spite of any dangers that may be outside.

To these deprivations, some of which may become tyrannical in nature, must be added the uncertainty of the future and the possible breakdown of outside protection. On the other hand, with wise management, shelter confinement could be nothing more than an unpleasant interruption of peoples' lives.

If at all possible under the circumstances, it is much wiser management to avoid deprivations that have to deal with reactions from them. Wherever medical service is available, all indications of abnormal reactions should be referred to this department.

Problems from Fears and Tensions

Anxiety, as well as the stresses or deprivations to be endured, is also productive of emotional disturbances. Fear of the unknown is a cause of emotional upset. In the early hours of shelter occupancy

these symptoms may be quite common and may react unfavorably on the normal procedures of distribution and the morale of the occupants. The well trained manager will expect such problems and think first of involvement of these people in some activity to quiet them down.

To most Americans the call to a disaster will be a novel and horrifying experience. The problem of leaving homes and pets and rushing to a community shelter without knowledge of the security of some member of the family will be a common and very disturbing experience.

Less serious causes of emotional upset will be not knowing what to expect of shelter living; fear of contagious disease because of the close contacts with people; fear of suffocation in such a small space; possible fear of radioactive contamination through contact with other people.

In the initial stages some of these people will create serious management problems that will be reflected in rejection of food and increased aggression. Headaches and sleeplessness will follow with many of the occupants which they may attribute to food or noise. Both studies of actual disasters and polar studies have shown that the best way to deal with these initial disturbances is to find useful employment for these people if possible. Where space permits, some sort of activity could be organized or provided.

Minor complaints about lack of privacy, no hot food, no reading facilities, etc. will come later and be an indication that the occupants are returning to normal and panic is over.

Given such developments as high temperature and high humidity, additional fears and discomfort will arise, particularly if methods of

control are inadequate or absent. Even in submarines where careful attention is given by engineers to prevention of such problems, they occasionally occur and cause both discomfort and illness.

Some occupants will be sure to find the food unpalatable or at least monotonous and will refuse to eat. The problem will become a nuisance but it may become severe if they try to leave the shelter before the signal for opening the doors is given.

Many will suffer from constipation on the diet now provided, with its lack of liquid, fruit, and other normal items.

Complaining occupants need to be reminded frequently that all men can endure much more than they think they can if they have a will to do it, especially for the common good.

Post Shelter Adjustment

The period of shelter occupancy should be used by the food manager to prepare the occupants for the food and water hazards which they might face on leaving the shelter. Planning recovery from a real nuclear attack involves a very imaginative effort at planning and organization. Destruction could be widespread. Much of the food and water supply in the neighborhood could still be contaminated. The actual situation should be explored and reported on before people are allowed to return to their homes. If it is found that widespread destruction and contamination exist, the shelter organization should serve as a center for cooperative community decontamination activities. Shelters that have prepared during confinement for such an attack on disaster areas will be able to return to their homes earlier.

The people should be informed during their stay in the shelter that protection from fallout is practical and attainable when approached in an organized way. They should be made to realize that systematic planning and informed management will insure success if everyone will cooperate. The food manager should plan to use the confinement period as the time for teaching the occupants of the water and food hazards that could confront them. If fallout has been widespread, it is possible that foods in the homes, in restaurants, in stores, and in the fields will be contaminated. It is even possible that communication and transportation will be destroyed and chances for getting new food may be very limited. Under such conditions, instruction in the processes of selecting and decontaminating food should be undertaken while the people await favorable reports from scouts who are monitoring the area.

The responsibility of the food department to continue to supply non-contaminated food through the facilities of the shelter longer than originally anticipated is a distinct possibility. Supplementary foods stored in warehouses which have not been affected or are capable of decontamination may need to be brought to the shelter where they can be prepared and shared with those who have no such reserves.

If occupants are prepared in advance for such conditions, it will speed recovery and help to stabilize the community. Rescue and evacuation teams could be organized. A decontamination team could be established. Medical facilities could be planned for and law and order restored where needed. As soon as possible, clean-up jobs

could be undertaken in some areas. Utilities could be re-established, communication restored so that reports could be received about missing relatives, the fate of the government and national defenses determined and the outlook for the future estimated.

Post-entry training for post-exit existence would consist essentially of conveying reliable information of the danger inherent from fallout in the environment and keeping the occupants aware of changing conditions particularly as they apply to food. While emphasis should be on prevention of serious contact with radiation, attention should also be given to identifying danger signs, to protection against radiation by shielding, and the possibilities of decontamination when contact has been made.

Every responsible person should be expected to read prepared Civil Defense instructions on how to operate radiological equipment. These instruments will provide information about the extent and rate of change in the radiological situation. As far as possible, individuals should develop self-sufficiency before leaving the guidance of shelter officials. They should know the necessity of removing debris from around the house, and how to remove it safely. If in such a process, they become contaminated, they should know how to apply first aid. Emergency care of the sick and injured should be learned before leaving the shelter. Where the disaster has been widespread, shelter occupants might be the only source of aid.

The maintenance of law and order may be urgent in some communities to prevent looting. The procurement of additional supplies of food or the rationing of present stores may all call for

cooperation and sacrifices to restore the community to some degree of effectiveness.

Movement of people may need to be restricted or courts to be restored where former institutions have been interfered with. There could be a sizeable burial problem.

Problems with Contaminated Food and Water

The habitability of an area after a confinement period of a given period of time will determine when occupants of the shelter may leave permanently. This exit time, must of necessity, be flexible and subject to careful determination of radiation throughout the neighborhood. Some sections may continue to be unsafe for a much longer period than others and as long as there is danger from fallout, the occupants would be expected to continue to use the shelter at least for sleeping or eating. There will be no sure way to predict the best time to quit a shelter. This will be a judgment made by management who will be in contact with Civil Defense authorities.

This uncertain situation will create many problems for the food manager. It may be necessary to stretch his supplies farther than he had originally planned. On the other hand, foods stored in basements or warehouses may be available for distribution. As soon as it is safe for anyone to leave the shelter, information about stored foods should be sought and their relative availability determined. If ample safe food is found, occupants will need only to understand the need for caution in their use.

The food manager should learn as much as possible about radiation levels in surrounding areas before he uses outside food or permits occupants to use it. This means that a campaign of information about

these dangers and possibilities of serious consequences must be carried out once the shelter is occupied and ready for such instruction. Close contact with outside reports and radiological personnel within the shelter should be maintained for dependable information. With the consent of the manager, short excursions might be undertaken after a few days of occupancy by reliable staff members and samples they may collect for analysis might serve as a guide to further exploration. If supplies of food and water permit, the food manager should operate conservatively in undertaking the use of exposed foods.

Until he is quite sure of the accuracy of his data, he should make no predictions of the termination of his responsibility. The food service should continue until all occupants are assured of a safe supply of food outside.

If communication has been maintained with local headquarters of Civil Defense, their instruction with respect to the fallout situation should be followed, but occupants should not be released into an infected area until they have been carefully instructed about possible dangers.

Decontamination Processes

Since one of the objectives of civil defense actions is to minimize the radiation exposure of people to as low a level as possible, the internal as well as the external radiation hazard should be considered. Investigations have indicated that as a primary annihilator, ingestion of contaminated food and water is of little consequence. Radiation from ingested radioactive material produces gradual damage thus becoming a long-term postattack recovery problem.

Decontamination is the process of removing radioactive material from a location where it is a hazard to one in which it can do little or no harm. It is one of the means which are available for reducing the radiation dose that would be received from fallout. Radiation measuring instruments should be used not only to determine the effectiveness of the decontamination but also to make sure that the contaminated material is disposed of safely.

Because of its particular nature, fallout will tend to collect on horizontal surfaces, e. g., roofs, streets, tops of vehicles, on top of open foods, on the ground. The main effort should be directed to clearing such places in preliminary decontamination. If an adequate supply of water is available that would be the simplest way to achieve this. A detergent will make the water more effective.

Contaminated materials should not be burned. Ashes would carry the contamination wherever they are moved to. Radioactivity cannot be destroyed. It must have time to decompose.

If emergency food supplies are exhausted or become contaminated in the course of the attack, the food manager will need to be informed about the decontamination of such foods. If food stored in refrigerators or basements has been exhausted and canned foods are not available, he would have to resort to food in the fields. Fresh fruits or vegetables can be washed or peeled to remove the outer skins or leaves. Boiling or cooking the food has no effect in removing the fallout material. Potatoes, corn, or other field crops exposed to early fallout would be safe to eat after cleaning. Grain that has been covered would be safe but should be washed

The meat of farm animals and poultry is probably freer from radiation than meat on the market unless refrigerated and protected. Chickens are

relatively resistant to radiation, especially if they are raised under cover and fed packaged food. If available, eggs and poultry meat would be good food for the interim period of decontamination. Chickens should be provided with food and water for the period of the disaster as an important extra food reserve.

Every family, even though they expect to occupy a designated public shelter, might be well advised to put aside a two week supply of canned food and water that would be on hand when they emerge from confinement. If fallout has been general, it might be days before a safe supply of food from regular community sources would be available.

Stored food should be in cans, jars, or tightly sealed paper containers. Food should be selected that will last for months without refrigeration and can be eaten without cooking. As far as possible, the needs and preferences of family members should be taken into consideration. Familiar foods would be more acceptable in a disaster situation. As far as possible, foods should be stocked that meet nutrient and caloric values. A convenient set of tables for food values in canned food is available from the National Canners Association - Canned Food Tables.

Cans and jars of appropriate size for family needs for one meal should be selected. This is especially true for foods that deteriorate rapidly after the can is opened. Food spoilage in a well-filled, well-insulated home freezer does not begin until several days after the power goes off. The time will be from 3 - 5 days depending upon the size of the freezer. Food should be used as needed and replaced to avoid spoilage before the disaster.

Water Supplies

Domestic water supplies from underground sources will usually remain free from contamination. Water supplies from surface sources may become contaminated if watersheds and open reservoirs are in areas of heavy fallout. It should be emphasized that mere boiling of water contaminated with fallout is of absolutely no value in removal of the radioactivity. Most of the radioactive fallout would be removed by regular water treatment which includes coagulation, sedimentation and filtration. Chlorination has no value in removing fallout. Water may be distilled to make it safe for drinking purposes. The water contained in a hot water heater at home would serve as an emergency supply provided it can be removed without admitting contaminated water.

Radiation in itself does not affect water. It is only if the radioactive particles themselves get into it that the water becomes dangerous. The particles can be removed by a simple filtering process that is easily devised.

It should be kept in mind that in shelter planning and post shelter planning that water is more vital than food. Ample supplies for the confinement period and the cleaning up period should be safely stored where they will be secure from contamination, and destruction of the vessels containing it will not be likely.

The countermeasures for contaminated food and drinking water have been developed and evaluated. They include conventional food processing techniques and existing conventional water treatment procedures, plus suggested expedient measures. These involve no new principal or phenomena in addition to those already considered in the public health, sanitation and water supply field. The major portion of the fallout will be

insoluble and removed along with the sand, silt and other surface contaminants. In no case should food or water be wasted or thrown away. As a general rule, the best quality of water and the least contaminated food should be consumed first. However, no one should be denied food or water if the only source available is contaminated. Infants and small children should be fed a milk substitute like similac, saylac or a product like metrecal.

Post Shelter Psychological Problems

The psychological effect of emergence from a shelter may be more overwhelming than those noted at the time of entry. The failure to locate relatives and friends, the discovery of the complete destruction of homes, plants, churches, and familiar places, the feeling of guilt or frustration at not having helped save others; despair about the future and the feeling of helplessness in face of the hopeless outlook; all these can create situations in which only strong men could remain sane and rational.

It is hoped that the situation is more favorable at the conclusion of the shelter period. It is to be hoped that normal life can be resumed with certain precautions and organization provided to offer maximum protection. The preparation and training for rebuilding society may be the vital thing to satisfy the needs of the occupants for a new sense of purpose. Furthermore, training is the only way known to diminish fright.

Management should make it clear to the occupants of the shelter that they should remain in the shelter until the signal is given to leave. Before permanently closing the shelter and dismissing the staff, the manager should have assurance that all occupants can return to their homes or that provision has been made for their removal elsewhere.

Radiation Sickness

If the disaster has been widespread, radiation sickness may be a common problem both in the shelter and during the period following confinement. It would be helpful if it could be identified early so that proper treatment could be provided, or fears removed.

Radiation sickness is not contagious, of course. Many of its symptoms, however, may appear in anyone subjected to anxiety and great stress. Since many people in the community will experience these conditions, there might be a tendency for some people to panic and assume they have been contaminated with fallout unless they are familiar with these facts.

The severity of radiation sickness depends on the amount of radiation to which a person is exposed and on the length of the exposure time. The body can take a limited amount of radiation damage and repair itself without serious permanent injury. It is only when one gets too much, too fast, that radiation sickness or possibly death may result.

It might be helpful to think of at least three different degrees of radiation sickness in terms of the symptoms to be identified.

Some nausea, lack of appetite and fatigue shortly after exposure would characterize a mild attack. The best treatment would be rest and the person would be expected to recover rapidly and resume normal activities. Unless the patient has been exposed to fallout, it should be expected that these symptoms are the result of emotions or strain of some sort. These facts would be comforting to the sufferer.

When the same symptoms are more severe and are accompanied by vomiting and even prostration, the patient may be suffering from a

moderate attack. A few days rest may be all he needs but symptoms may recur for a few weeks.

Again, when the above symptoms are followed in a week or more with fever, sore mouth, and diarrhea or ulcerated and bleeding gums, and in the third week the patient's hair starts to fall out, he has had a severe attack. Recovery may take two months. When exposure has been overwhelming, death comes in hours or days.

The following treatment has been suggested for all degrees of exposure. General rest, aspirin for headache, motion-sickness tablets for nausea, liquids as soon as possible for diarrhea and vomiting, but not until vomiting has stopped, then one teaspoon of table salt to one quart of cool water to be sipped slowly. For sore mouth this solution can be used for a mouthwash.

Where professional medical care is not available, because of emergency conditions, the first aid handbooks in the medical kit should be followed closely.

When man is confronted with challenges to his existence, he has proved himself to be a highly adaptive animal. Somehow he has survived the disasters of the past, and unless totally destroyed he will survive the next one.

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