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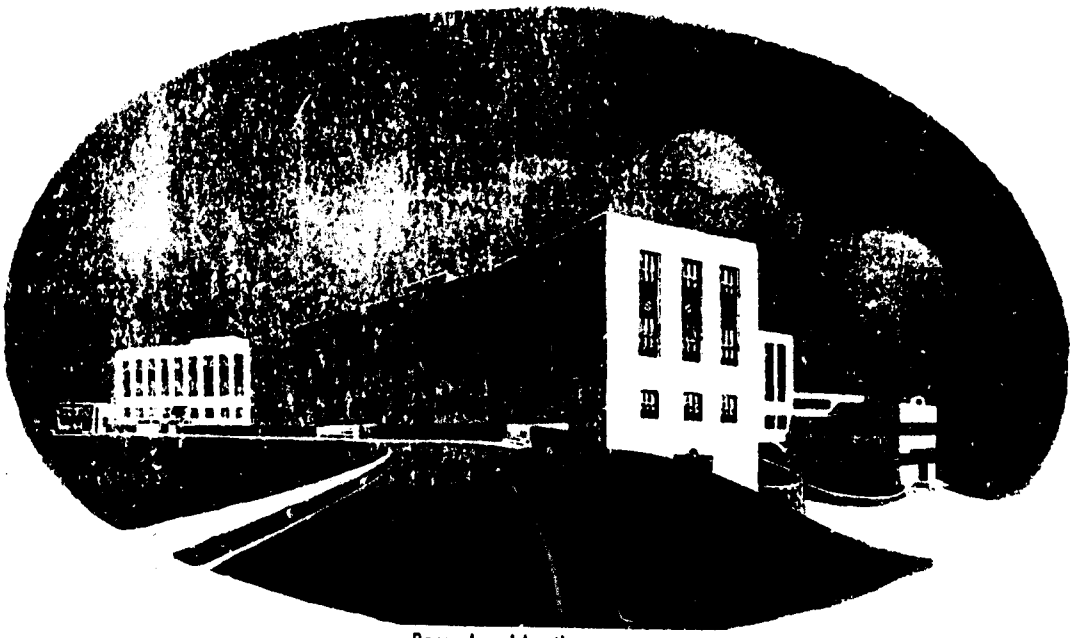

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U. S. NAVY FALLOUT AND BLAST SHELTER NATIONAL NAVAL MEDICAL CENTER SURVIVAL TRIAL STUDY

RESEARCH REPORT

MR 005.01-0001 02-

Report No. 4

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U. S. NAVY FALLOUT AND BLAST SHELTER
NATIONAL NAVAL MEDICAL CENTER
SURVIVAL TRIAL STUDY

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NAVAL MEDICAL RESEARCH INSTITUTE
BETHESDA, MARYLAND

7 July 1965

ABSTRACT

The protective fallout and blast shelter at the National Naval Medical Center was used for an evaluation study conducted by the U. S. Naval Research Reserve Company 5-10 as part of a Life Sciences Seminar for 35 naval reserve officers on active duty for training. The men were unexpectedly confined for 4½ days under conditions simulating an emergency. Their reactions, observations, comments, and recommendations on the structure, engineering, hygiene, and operation are reported.

Conducted by United States Naval Research Reserve Company 5-10, during Life Sciences Seminar, 12-25 May, 1963, at the Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

Issued by the Naval Medical Research Institute

FOREWORD

The Naval Medical Research Institute (NMRI) welcomed the opportunity to serve as host and to provide research resources for this shelter survival trial study. It was anticipated, first, that the results of such a study could add valuable data to the rapidly developing but incomplete bodyof knowledge concerning the survival of individuals and groups in blast and fallout shelters. A very salient gap in this knowledge is the question of the extent to which existing data may or may not be generalized to the Navy's and to the nation's population at large. Obviously, this question will be answered not in a single study, but rather by the systematic accumulation of knowledge from many studies, in each of which a sample is drawn from a different segment of the population. To our knowledge, that segment of the population represented by members of Naval Research Reserve Company (NRRC) 5-10 had not been sampled in previous shelter studies. The availability of these officers as subjects in the present study constituted, in this light, a valued research opportunity.

A second source of value of the present study lay in the fact that these shelter occupants differed from previous samples in possessing appreciable degrees of *naval* orientation, training, and experience. It had been observed before that some of the environmental stress factors associated with shelter isolation and confinement might well be characteristic also of certain phases of shipboard living. It was seen possible, therefore, that the reactions of the experienced naval officers of NRRC 5-10, in terms of both their stress responses and their recommendations for alleviating stress, could provide data contributing to increased operational effectiveness of the fleet.

For both of these reasons, the present study was considered to be of significant value to the naval service and to the nation. The Commanding Officer and staff of NMRI were thus pleased to support and to participate in this study.

John R. Seal
Captain, MC, USN
Commanding Officer

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I. Introduction

The use of protective shelters against atomic warfare is a complex, socio-political and civil defense issue. The most effective use will draw upon many sciences, disciplines and professions. A number of governmental agencies as well as private industry and community planners presently are involved in various stages of planning, management and funding. The range of problems encountered in developing an effective shelter program is large, and reliable solutions are difficult to obtain.

The present study was undertaken as an assessment of the experimental, 100-man protective shelter designed by the Bureau of Yards and Docks for installation at the various Naval shore establishments. This prototype shelter, located at the National Naval Medical Center, Bethesda, Maryland, was completed in the fall of 1961. Two major studies have been completed. The technical report on the first of these studies (Winter Trial) was released on December 31, 1962 by the U. S. Naval Research Laboratory, Washington, D. C. There have been a number of other studies concerned with various aspects of fallout shelter occupancy: NRDL and AIR in 1960. All of these studies were generally concerned with shelter organization and management problems, discomforts, and responses to the shelter experience. In the above instances, a variety of volunteer military and civilian subjects was used.

The organization of the present study was based on background information obtained from the studies described above. The study was undertaken as part of a Life Sciences Seminar sponsored by the Naval Research Reserve Company 5-10, Bethesda, Maryland. Officers of the Research Reserve volunteered for a two-week tour of training duty to participate in the seminar without prior knowledge of the plan for a shelter trial. Thus, they represented a variety of scientific and technical backgrounds relevant to protective shelter construction and operation and served as subjects in the trial without advanced preparation or pre-training. During the second week of the Seminar these officers assessed their experience and made recommendations regarding shelter construction, management and operations. This report is a description of the shelter trial and a summary of the psychological, engineering and medical observations and recommendations. Additional detailed reports are being prepared on the medical and psychological aspects of the study.

II. Conditions Surrounding the Shelter Trial

As indicated above, the trial was one phase of a two-week Life Sciences Seminar for which Research Reserve officers had applied to satisfy a requirement for training duty. Their educational and other characteristics are listed in Table 1. The participants had been provided an outline description of the seminar, home study materials on fallout and shelter design, and indications that there would be field visits to various shelters. They were requested to bring appropriate work clothing, not to bring their families along because of indefinite, remote field trips, and to avoid plans for social engagements until after final arrangements were made for the anticipated field trips. The seminar was organized* to operate as a customary lecture and discussion seminar both during the shelter trial and during the final week. Closed loop TV had been installed to transmit the lectures into the shelter.

The seminar program was started by CDR Rasmussen with a review lecture on the Navy findings in the two previous shelter trials. The group had been informed of a visit to the Bethesda shelter that afternoon and the officers were instructed to wear appropriate work uniforms. The shelter, designed to accommodate 100 occupants, had been restocked and all ventilation and other equipment maintained for instant occupation.

After lunch, the group reassembled and CDR Rasmussen continued his lecture. The lecture stressed the importance of empirical investigation, and assessed the specific deficiencies of generalizations from previous studies using young, volunteer subjects who had been prepared for this experience. The lecture was concluded with a visit to the shelter so that detailed aspects of the NMRI studies could be reviewed "on location" in the shelter. The presentation in the shelter was concluded with an elaboration of the criteria for a realistic

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*Planning for the Seminar was done over the previous 18 months by a committee of NRR Co. 5-10. Under the Chairmanship of Dr. G. Z. Williams, the committee included: Drs. Richard Trumbull, Sherman Ross, William Abt, John T. Holloway, Urner Liddel and Maynard Eicher. Formal approval for the study was granted by the Office of the Secretary of the Navy. Full collaboration in planning was received from Capt. J. R. Seal, CO, NMRI, and Capt. J. W. Jockusch, Jr., Director of Research Reserve Activities, ONR. (CDR John E. Rasmussen and LCDR C. M. Wagner of the NMRI Behavioral Sciences Department joined the planning effort approximately six months prior to the trial). Invaluable assistance was received from David Minard, Capt., MC, USN, and his staff at NMRI and from Dr. E. A. Ramskill and staff of NRL.

simulation of a spontaneous alert and shelter occupancy situation. The group was requested to volunteer to continue the seminar in the shelter from that moment for an undesignated period without any preparation. There is no question that the participants were taken completely by surprise when they were requested to remain in the shelter. Their faces betrayed a moment of disbelief followed immediately by the cooperative acceptance of an unexpected situation for which Naval officers are trained.

Each officer was provided two forms, the first (Fig. 1) a volunteer agreement and the second a notification form for personal messages to next of kin. All officers were informed fully of their privilege to withdraw from the study and continue the seminar in the lecture hall without prejudice. They were told about the closed circuit television system for continuation of the seminar discussions by guest lecturers, and about a telephone circuit to the Command Center. They were asked to analyze and report their experiences after the trial was completed. It was emphasized that they were not "just test subjects", but special participant-observer-consultants concerning shelters and shelter problems. The group was told that the trial would start after the departure of the briefing group by a simulated bomb burst through the speaker system followed by failure of power. One officer returned to the outside with the briefing group. He was a university professor who was committed to provide final examination questions within three days. He went at once to the BOQ, wrote and mailed the examination and, voluntarily, returned to the shelter later that day as a "casualty".

The essential characteristics of the trial were (1) the unexpected nature of the start, (2) total lack of advanced preparation or pre-training of the scientific, engineering and medical Reserve officers, (3) simulation of a burst, immediate isolation underground and the attendant problems, (4) an unknown duration (but obviously not exceeding the total training duty period of 14 days), (5) absence of a designated shelter commander or prearranged shelter organization or management, (6) medical studies, and (7) closed circuit TV lectures on fallout problems. Some of the problems encountered were real, i.e., leadership, organization and functioning. One realistic simulation was provided in the form of an outside radioactive "fallout" source, the measurement of which supplied information upon which participants could compute the duration of the trial. This source was manipulated by the radiological safety personnel outside the shelter to simulate fallout conditions. Radiation meters and protective clothing were available for shelter participants to check external radiation from the controlled source. From this data the decay rate could be calculated and the date when a "safe" level outside would be reached could be projected. The simulation for this trial was continued for four and one-half days.

III. Organization and Management

Previous military indoctrination and naval practice immediately emerged to the exclusion of civilian experience in the organization and selection of competent leadership. The shelter commander and heads of departments were designated by seniority of rank within the several general categories of administrative, engineering, supply and medical personnel. The organization quickly evolved in a pattern characteristic of shipboard operation. Within two hours the shelter group was well-organized, most officers busy, and the food, water and medical supplies were inventoried. The largest number of officers worked with the engineers setting up bunks; the commissary detail calculated the food and water daily rations based on the assumption of two weeks duration. To conserve water, bathing and washing were prohibited except for hand washing by food handlers. These restrictions were recommended to the Shelter Commander and announced to the occupants.

A radiological monitoring team was assigned to the engineering department and by 1630 the first afternoon they had found protective clothing and instruments and made their first readings of outside radioactivity.

After the first meal (evening) the medical officers organized the physiological and medical studies requested in the instructions provided in the shelter. All occupants were weighed and physically examined. Nineteen of the 34 officers volunteered to participate in the medical studies which included daily body weight, food consumption, water intake and output, blood chemistry and repeated bacteriological cultures of skin, nose and throat. All officers in the shelter cooperated by filling out psychological questionaires left in the shelter for that purpose.

A daily operating schedule was developed and announced by the command staff. This included medical specimen collections, meals, clean-up details, radiological and other environmental (temperature) monitoring observations, educational lectures, and lights out. One or two lectures each morning were conducted via the closed circuit television receiver and audio system wired into the shelter. The lecturers were those authorities who had accepted invitations and were scheduled on the Seminar Program. They spoke through the two-way television--audio system from the Television Studio, NNMC. The shelter occupants could see and question the speaker via this system. The lectures were pertinent to fallout, radiological and shelter life problems.

The table of organization and daily schedule are included in the appendix. No management problems developed during the shelter trial except minor dissentions concerning operational policy between the shelter group and the officers manning the outside control center.

IV. Engineering Aspects of the Shelter Trial

The group of officers in the shelter included a well-qualified architect and several experienced engineers who were intensely interested in design, structure and the engineering problems of shelter operation. They were enthusiastic about this opportunity, analysed every detail and conducted an organized study including daily discussions and recorded observations.

THE STRUCTURAL DESIGN AND CONSTRUCTION OF THE SHELTER

Construction and Space Arrangement

The shelter is a reinforced quonset hut 25 feet wide and 48 feet long. It is 12 feet high along the center line. It was constructed for blast protection of at least 75 psi overpressure, radiation protection factor of 5000, and biological, chemical, and fallout protection; decontamination of entering personnel; maintenance of protection for at least two weeks; provision of environment and support to maintain personnel capabilities for post shelter requirements; and minimal cost.

A cutaway, perspective drawing is depicted in Figure 2. During the trial reported herein 34 officers occupied this space, which in previous trials was used by 100 test subjects. A full description of the shelter is available in NRL Report 5882, chapter on Construction and Supplies, pp. 3-13, by H. E. Hassler and J. T. White.

The most important consideration in shelter design being to insure the integrity of the structure during and after the attack, the structure is designed to resist the effects of blast and shock.

For personnel shelters of the shallow-buried type the conditions of surface and air bursts determine the design criteria. The Navy shelter used in this trial is well-designed for structural integrity and includes:

- --reinforcement of the basic magazine structure with 6-inch I beams spaced at 4 feet.
- --prevention of blast entry into the shelter by appropriate valve protection and door construction, and
- --burial of the shelter below the earth's surface with a minimum of five feet of earth cover.

However, there are a number of details of design and construction which merit modification to significantly improve function at modest cost. These are based on the experience of living in the shelter. The participating group concurs in the following suggestions. Figures 3 and 4 represent proposed design modifications of this type shelter.

Floor Slab -- The isolated floor slab joint with the wall footings may rupture under blast pressure and could permit water flooding the shelter. The floor slab should be integral with footings and tied in with reinforcing rods in sites with high water tables. The concrete surface is dusty and should be improved if painted or otherwise treated for maintaining cleanliness.

Entrance -- The outer entrance should have an overhanging roof and vertical doors to shed snow and fallout material.

Generator Room -- This space should be hardened so that the generator would be functional in spite of blast and heat. If this is not feasible a remote control starter switch in the filter room or in some other engineering space well-protected from fallout would facilitate operation with less hazard.

Entry Passage (Blast door to Fire door)-- Dual use is suggested after the blast and firestorm period. This passage could be used for occupants such as an infectious disease isolation area, since the radiation protection factor is high in this area.

Trash Room -- The overhead exhaust valve handle could be relocated. There were several slight head injuries caused by bumping into this handle in its present position.

Filter Room -- This space is large and if separated from living area by 8"-thick concrete block wall would provide more protection since the filter will collect fallout dust. This room is convenient for secure storage of tools and instruments which should not be available to untrained occupants. Storage shelves or lockers could be provided for radiation monitoring equipment. The main power transfer switch and breaker panel could be located here to conserve personnel space.

Decontamination Rooms-- Experience with simulated fallout conditions revealed that the Shower Drying Rooms are not needed. This space, therefore, could be utilized for occupants The Shower Room can be eliminated by the use of a bag-type vacuum cleaner for fallout decontamination of personnel.

Lint pick-up rollers can be substituted in case of power failure. This also would conserve water supply. Decontamination trash barrels should be stored more remotely behind 8 inch concrete walls.

Toilets -- Four toilets would be adequate for 100 occupants, conserving more space.

Storage -- The ample space above the decontamination and shower rooms with a ladder on the bulkhead for access would provide additional food storage.

Bunks -- The framework system was found very good for flexibility in arrangement. However, the canvasses were found difficult to assemble and if in the form of a single sleeve would be much improved. Canvasses should be longer for tall men. They should be mildew-proofed and non-shrinkable.

Acoustics and Appearance -- The metal surface should be painted to prevent stress corrosion, to insulate from cold and to contribute to morale. The air outlets could be baffled to lower the decibel level of noise. It was necessary to turn off the blower during telephone calls, lectures, messages, etc.

PHYSICAL ENVIRONMENT

Conditions during current study -- During this trial the following conditions were recorded.

Temperature range: 60°-70°. Cold temperature predominated.

Relative humidity: 55 - 65%

Particulate Matter: Very little due to minimum of smoking, blanket shaking, etc.

Toxic gases: CO, CO_2, oil vapor, oxides of N_2: insufficient to detect. Only traces of CO (less than 10 ppm)

Maximum "Button up" period permissible: 15 hours

No carbon dioxide measurements were made during this test.

However, it was calculated that the shelter could be occupied continuously for 15 hours before accumulation of 3% CO_2 would have been exceeded under the conditions of use by 34 occupants. The chief discomfort was caused by the cold. There was no auxiliary heating facility. The ventilation system was operated at minimal level to reduce intake of outside air which was 5 to 10°F. colder than shelter air. Thus the ventilation system was adequate for contaminant control under cool weather conditions. There was no humidity control except by ventilation.

The filter system was adequate for the test, but it is to be remembered that there was almost no smoking by occupants, the concrete floor remained very damp and there was no outside dust condition. Although the major source of contamination from within the shelter will be the normal respiratory metabolites, CO_2 and water plus combustion products such as cigaret smoke, these were of no concern in this smaller group with almost no smoking. Carbon monoxide concentration measurements, made several times during each day, indicated only trace amounts of CO, less than 10 ppm. The Bachrach unit provided by the Navy is more difficult to use than the MSA, Kitagowa or Drager units. We suggest that one of the other units be made standard equipment.

Total particulate messurements indicated that the concentration decreased with time, since fresh filtered air was being introduced to the shelter periodically, and no new sources of particulates were added by excessive cigarette smoking or Diesel generator exhaust fumes. At no time was the total particulate concentration excessive or obnoxious.

Nitrogen oxides and oil mists were not measured, since the Diesel was inoperative. Under emergency conditions these contaminants must be monitored and could present a significant contamination problem.

The instruments, protective clothing and decontamination space and gear were adequate. Outside measurements of radiation were effective. Measurements were made in the outer passageway every day at 1600 for calculations of decay and estimation of date of safe radiation level for leaving the shelter.

Radiological safety equipment provided was of minimal adequacy; pocket dosimeters -2 (long range 200 mr), radiac GM counters - 2 (max. 500 mr/hr), film badges; radiological decontamination equipment provided included: gas masks (WWII vintage) - 2, coveralls (with pockets (X-large) - 2, gloves (rubber and cloth)- 2 pairs, hoods - 2, plastic boots - 2, protection grease - 2 canisters, air sampler (GM count particulate matter.

Experiences in the current shelter study emphasize the desirability of the following recommendations.

Ventilation and Temperature Control -- The electric "on" switch for the blower should be moved inside the living space of the shelter, preferably close to the "command corner", so that it is not necessary to "suit-up" and go into the filter room to turn on the blower. Frequent stopping and starting of the blowers due to cold necessitated repeated "suiting-up" to enter the filter room. The instructions should clearly state the necessity for closure of valves #6 and #7 in the filter room. A simple duct diagram would be helpful.

The exhaust air flow should be controlled to channel air out of living area into the head, than out the exhaust vent. An additional exhaust duct from head floor level also would help reduce diffusion of undesirable odors into the living space.

The feasibility of a bicycle drive for the manual emergency blower should be restudied. It is the opinion of this group after experience with the hand operated type that use of body weight would be preferable to arm power.

When shelter is occupied by only one-third of rated personnel heat accumulation from body radiation is insufficient to raise the air temperature to comfortable level when the wall temperature is 60°F. or below. For heat conservation it is suggested that the walls be lined with non-inflammable insulation batting. The possibility of substituting a larger blower and filtration system with capacity of 1000 to 1500 cfm and a dehumidification device for adequate ventilation during the hot weather conditions should be considered. Several surface thermometers to measure shelter wall and floor temperatures would be useful. Detailed instructions are needed for temperature control, button-up and vent time procedures.

The ventilation system would provide for long "button-up" periods with full occupancy if the filter system were modified to include: an "absolute filter" to remove liquid and solid particulates; activated charcoal to remove nitrogen oxides and organic vapors, hopcalite to catalyze carbon monoxide to carbon dioxide; and lime to absorb carbon dioxide.

The standby, hand-operated, internal air circulator system could be modified for use in emergency conditions, when outside air is dangerous, by an in-series filter of activated charcoal, hopcalite, and lime, which could be clamped directly to the exhaust of the manual blower.

The sampling of all contaminants may be accomplished by a simple air sampling hand pump which can be designed and adapted to hold both the chemical sampling tubes and the molecular filters. Also an O_2 analyzer kit would be useful. Monitoring for contaminants should be performed at least once every four hours or more often at the discretion of the shelter commander, upon the advice of the medical officer.

Radiological Monitoring was found important and deserves more specific consideration because groups may occupy the shelter without prior training in use of these instruments. The shelter should contain specific instructions to initiate and log data and operating instructions for making measurements. A plastic coated chart for plots of dose rate vs. time, and a working example would be helpful. It is desirable to provide higher level dosimeters to cover range from 250 mr/hr to 1000 r/hr; a charger for pocket dosimeter. The rate meter should cover mR to KR range.

Disposable paper floor covering for decontamination room, new paper bags and rolls of paper for discarding brushed off fallout, and plastic bags to cover monitoring equipment when making outside measurements would be very useful.

A larger clean room to store clean clothing, decontamination and medical supplies, with disposable waste can is suggested.

Disposable plastic or paper protective coveralls, boots, hoods and gloves would be safer to use and provide ample protection.

Tools and Maintenance -- There were very few tools available during the current trial. The shelter should have a well-labelled toolbox containing pliers, screwdrivers, wrenches, small hammer, file, hack saw, machine oil, pocket knife, scissors, and small sewing kit with needles and thread. Also, a hand hydraulic jack, wrecking bar and several timbers would be of critical importance for repair of shelters damaged by blast.

Only one large log book was available. For keeping several logs of operational equipment, at least six small log books should be provided.

The occupants during this trial were convinced of the desirability for lists of concise instructions, especially for operation of equipment. Suggested lists are included in the Appendix.

COMMUNICATION FACILITIES

The loudspeaker system for communication within the shelter proved inadequate in overcoming the noise level created by the blower system even with the small occupancy of 35. A battery powered megaphone may be desirable. Only the more important information need be announced over this system to indicate its priority importance. Other information may be posted or passed by word of mouth through the organization by group leaders.

Provision for reliable external communications under all conditions may be critical to survival and effective post-shelter activity. The main external communication is by telephone. This will be accessible under most circumstances and even limited destruction of wire centers will not completely destroy such facilities. One of the most important purposes the telephone can serve is to tie the shelter to the command center and other shelters. A significant morale factor could be retained simply by providing such a link with the outside for exchange of information concerning measurements of radiation, air contamination, external conditions, etc. Important assistance would be available from professional or technical personnel such as doctors, nurses, engineers and mechanics in other shelters.

There should be some provision of radio and walkie-talkie facilities as a back-up communications facility. A radio antenna could be provided and extended through a roof opening indicated for its use.

A communications team should be designated as soon as practical after entering the shelter. A communications log is essential.

POWER

During the present study power was obtained from the shore-based distribution system. It is conceivable that in case of attack there might be no interruption of this source. But since survival in the shelter depends on power, reliable back-up facilities are important. The Diesel generator is the best standby facility but immediate and continuous operation of the unit must be assured. This power plant should be operated, tested and maintained periodically to assure readiness and reliability.

Batteries constitute a limited source of power. Additional emergency lighting should be furnished by individual flashlights and spare batteries rather than the two bulky battle lanterns which were available in this study. The batteries must be tested and replaced periodically.

A third possible source of emergency lighting is the special candle which produces oxygen when burning.

The present lighting arrangement is quite adequate except that more light in the toilet area is desirable and would be conducive to maintaining cleanliness. The battle lanterns should be located on wall brackets; one just outside blast door, and others at convenient points. A total of six is recommended. Automatic activation of one lantern by power failure would be desirable.

V. Sanitation, Hygiene and Medical Care

During the trial experience a number of features in structure and location of certain facilities were found unsanitary or hygienically undesirable.

Water Supply

Food and water supply facilities should be located as far as practical from the area of human waste disposal. The application of this principle reduces the opportunities for contamination of the food and water, moves the food preparation and eating areas away from repugnant odors and visible objects often distasteful to the participants.

Drinking water was available only at a spigot which was at the entrance to the head. In our attempt to move this to a greater distance from the head, a plastic water hose was draped over the forward bulkhead structure, including miscellaneous electric cables and terminated on the port wall, opposite the head. Unfortunately, the plastic hose imparted an objectionable taste to the water and caused some persons to waste considerable quantities of water in attempts to wash out all stagnant water from the hose before drawing a portion for drinking. Furthermore, an undesirable hazard was introduced by placing the water hose over the electric wires. It is recommended that a permanent scuttlebutt water line be installed on the port side as far as possible from the head.

The test group of officers recognized the theoretical need for water rationing. However, several thought there was a tendency for this to be unnecessarily carried to the extreme. The original storage tank costs a basic amount. The size of this tank can be increased significantly with only a minimal addition in cost. There seems no logical reason to create an unnecessary water stress in this type of shelter. Consideration should be

given to available water supply in the water system of the Medical Center, and the tank used only in case of loss of the main supply.

No provisions are made for securing the water line at, or near the supply tank in case of damage which could cause a leak. For example, the shock effect from a blast wave could cause leaks in line or fittings, which might be irreparable with tools available in the fallout shelter. A globe shut-off valve near the tank would remedy this condition.

No method is available for checking the water level in tank. If the tank developed a leak, so that part of the water supply was lost before shelter was occupied, the water ration would have to be adjusted. Furthermore, this water on the floor of the shelter in an emergency might be a health hazard. It is suggested that a simple manometer to measure the level of water is practical.

No provision is made for checking the water supply for possible pollution, and there is no provision for chlorination when the situation might warrant.

Food

To improve palatability, it is suggested that more variety be considered in the food. For example, the basic cracker could be provided in several different flavors. Other varieties of crackers, still maintaining the low salt content and concentrated food value, are possible. Certain dehydrated products, such as "Tang", would provide variety and vitamins. Dehydrated soups would add variety, occupy less storage space and reduce the trash disposal problem. The morale value of variety is well illustrated by the enthusiastic response of this group to the rations of peanut butter and jelly. They looked forward to the meal with these "delicacies". Also, the availability of tea, in addition to coffee, was favorably noted. Powdered milk should be provided for children, as well as for adults who weary of coffee and tea. Baby foods should be available for infants in those shelters where they are apt to be housed.

When the test group of 34 officers entered the shelter, the food was stored in cans and boxes along the wall immediately adjacent to the head. It is recommended that the food be stored on the side opposite the head.

This trial provided no experience for evaluating equipment needs for 100 persons for a 14-day period. Hot bunking and space requirements for 100 would undoubtedly require more flexible equipment than was necessary for 34 shelterees. The shelter has been improved from previous trials and contains many improved features. Some specific suggestions follow:

Specific recommendations

Hot water was an excellent morale supporting factor.

One exclusive area should be designated for the cooking equipment.

Survival biscuit cans should have a self-contained opener, such as the key opener on coffee cans or beer cans.

Farther separation of food supplies and preparation from toilet area.

Two or three steel table knives would be useful.

Brushes and other equipment for cleaning pots, table, etc. should be provided.

Bunks and Miscellaneous Items

A longer canvas berth on the bunk pipes would provide better support for the taller people, and would reduce complaints about the need for a pillow. It would also prevent the overhang of blankets and feet onto the face of the sleeper below.

Alternate head to toe bunking should be established at the very beginning to minimize exposure to respiratory infections and reduce the annoyance of halitosis and snoring.

Equipment for tagging bunks should be present for names and head-foot designation.

A few wore shoes in their bunks and most wore full clothing for the entire trial period because of the cold. Strict instructions concerning these practices should be issued to all hands at the beginning of shelter life.

Corner pieces of some of the bunks were unfinished and sharp and caused a number of skin wounds and torn clothing. These projected hazards should be finished smooth or covered.

The ventilator outlets should be baffled to prevent blowing of cold air directly onto occupants of the top bunks.

Some insulating material on lower bunks should be provided to prevent cool air from floor interfering with sleeping.

Sleeping

Light shade for sleeping needed.

Cotton or ear plugs should be available.

Recreation Equipment

a. The equipment should be centralized in one area and listed.

b. New or at least usable complete decks of cards should be available (bridge and pinochle).

c. Floor covering to alleviate cold and permit games should be arranged.

d. Catalogued lists of recreation equipment should be available.

e. Restocking of books, magazines, and other recreation equipment is recommended after each extended use.

f. Song books could be used.

g. Folding chairs were not comfortable. Little use was made of the benches except for the storage of equipment. Central storage racks for each department for cooking, recreation, etc. could be placed in central wall containers.

Smoking

At the time of entering the shelter, only 6 of the 34 officers smoked cigarettes and 5 smoked pipes. Of the cigarette smokers only one habitually smoked more than two packs daily and the others smoked less than one pack daily. Since no one was aware of the shelter test prior to entering, the smokers had no opportunity to bring a supply of tobacco. They shared about two packs among four officers for the trial period. Two smokers took advantage of the opportunity to stop smoking. This accounts for the low reading on the air monitoring filters. The highest readings were 0.58 - 0.60 - 0.70 during the first evening in the shelter and after the first smoking session. That night during sleeping hours it reduced to 0.33. On the following morning it rose to 0.67 and fell that afternoon to 0.34 and remained lower for the duration of the trial. It is the strong opinion of the officers participating in this trial that smoking should be prohibited in shelters, especially under conditions of

excessive crowding, minimal ventilation and mixed population.

Medical Care

There is no assurance that a medical officer always will be assigned to each shelter, or that if assigned, he will arrive before the door is closed or the bomb explosion occurs.

In the instances when no medical officer or other medical department personnel are present, someone else must assume the responsibility for the medical care of the enclosed population. These duties must include inspection of food, ventilation, sanitation, sick call, first aid and medical advice to the Shelter Commander. In the present trial two experienced medical officers, one bacteriologist, one biologist and one biochemist were in the group. A small medical area with minimum necessary medical supplies was set up in the port forward corner of the shelter on a set of shelves. OCD Manual 8520.1 outlines two lists for medical supplies: (1) Kit A is designed for 50-65 people and (2) Kit C is for 300-325 people. It is suggested that Kit C or equivalent be included in this type of shelter. Except for a few minor items, the medical supplies provided were adequate for this short test period since no illness was experienced, but they would have been inadequate for 100 or more occupants for two weeks.

Appropriate use of the medications in these kits will depend on the competence of the personnel assigned to medical duties. The kit should be stored in two containers; one for use by medically untrained personnel and the other for a trained hospitalman or medical officer.

Medical Problems

The medical staff of two medical officers, bacteriologist and biochemist conducted the medical and health studies, taking body weights, temperatures, pulse rates and collecting specimens for cultures and chemical studies. One medical officer also conducted sick call morning and evening and treated a few minor medical emergencies as they occurred. Two men had typical primary small pox reactions in the pustular stage with a surrounding zone of inflammation and swollen lymph nodes in the left axilla. One of these patients developed headache and herpes simplex on the right upper lip on the second day. The headache responded to APC and the herpes simplex responded to sodium bicarbonate paste applications. The other suffered no complications. Two officers developed diarrhea of short duration; one on the second day and the other on the fourth day. Both responded to Benadryl. Two officers developed headaches for no

obvious reason. Both responded to APC. One was on the second day; the other on the fourth day.

One person suffered a severe toothache in his left upper canine tooth on the second day. This had been bothering him for some time. It was filled with Zinc Oxide and Eugenol on the second evening with relief of pain. On the following day pain recurred and was treated with APC and Seconal. During the night he awoke, lit a cigarette, and shortly thereafter became nauseated and vomited, but recovered and had no symptoms the following morning. He was referred to the Dental Clinic, NNMC, at termination of the shelter trial. On the third day one man fainted while watching the medical staff draw blood from the volunteers. Examination revealed no abnormalities or injury. On the fourth day two men sustained small abrasive lacerations on their fingers and were treated by cleansing and applying antiseptic. One was sustained on the sharp edged piece protruding from a bunk bar and the other while opening a can of crackers.

To summarize other medical experiences: of 34 officer participants 4 had brief sore throats or were hoarse; 19 were flatulant, complained of ususual amounts of gas; and 14 continued for 1-3 days after termination of the trial; 11 were severely constipated, 0-1 bowel movements (BM) in 5 days; 7 moderately constipated, 2-3 BM/5 days; 11 were normal; 4 had diarrhea; and 13 noted mild diarrhea for the first or second day after leaving the shelter probably due to change of diet; 3 suffered mild headaches.

Medical and Health Studies

Body weight loss and water consumption were the most consistent changes in physiological parameters. Average weight loss for the 34 officers was 2.36 lbs.; ranging from 013 to 5.3 lbs. One officer gained 0.5 lb. and one maintained his weight.

Fluid intake measured in terms of number of cups of water, soup, coffee, etc., consumed and recorded immediately on a posted chart revealed an average fluid consumption of only 1070 milliliters (approx. 1 qt.) per person per 24 hours. This is rather low, but undoubtedly due to the cold environment and absence of sweating. The metered water for drinking and cooking measured an average of 1350 ml per person per day. The discrepancy is due to waste, washing cups, rinsing out plastic hose, etc.

Of particular interest were the bacteriological cultures of the nasopharynx and hands of the 19 volunteers for medical studies. Swabs

(moist) were taken within 2 hours of entry into the shelter to determine the "normal" flora for each individual and then on the 3rd and 5th days to discover any change of the flora. Only eight of the 19 (42%) were carriers of hemolytic, DNase positive Staphylococcus Aureus in their noses and throats coming into the shelter. Eleven were found with this organism at 5 days. This indicates that 3 of the 11 non-carriers picked up this potentially pathogenic microorganism during the shelter association in spite of the relatively ideal conditions, low temperature and lack of crowding.

Of Blood measurements the hemoglobulin content, hematocrit and sedimentation rate were normal in all 19 volunteers. However, the white cell counts were interesting. In 16 of the 19, white cell counts fell significantly during the trial and 8 of these remained lower for 1 week after leaving the shelter.

Blood chemistry revealed no remarkable shifts of constituents but a few trends were interesting in view of the physical inactivity, rigid diet and uniform cool environment. The potassium fell 0.3 to 0.4 M Eq/L in 10 of the 19 for no obvious cause. The most consistent change was a significant reduction in the level of blood sugar in spite of the high carbohydrate cracker diet. However, the blood specimens were drawn at 0630 before breakfast and the low sugar probably indicates the absence of sugar sustaining protein intake at supper the night before.

Urinalyses revealed significant and consistent conservation of electrolytes as indicated by continued reduction in excretion of sodium (17 of 19) potassium (14 of 19) and chlorides (16 of 19). Urea excretion fell in 8 of the 19 as would be expected on a low protein diet and creatinine clearance fell in 12 of 18 measured. The excretion of steroids was very interesting in view of the emotional stress of entering the shelter unexpectedly. All 19 rose 50 to 100% above the entrance level for 2 days, then fell to near or below the original level by the end of the trial and 10 of 19 rose again although not as much, immediately after leaving the shelter. These changes are interesting in their consistency and in view of recent reports that urinary corticosteroid excretion rises in response to mild emotional stress.

Caloric consumption was limited to a maximum caloric intake by rationing all items. The limit was based on the available supply and a calculation that it must provide for 34 officers for a maximum of 2 weeks. This was done by the commissary group and the resultant caloric daily ration was approved by the medical staff and the Shelter Commander. Consumption was monitored and recorded for every meal.

Survival Biscuits (Southern Biscuit Company) were rationed at 52 crackers per day per person supplemented with 1 cup of tomato soup, 1 teaspoonful of peanut butter, 1 of jelly and 3 individual bags of Pream and sugar (for coffee or tea). This represents a potential ration of about 1700 calories per day. However, many did not consume their full ration. The total number of crackers consumed during the test period varied from 90 to 208. Including peanut butter, jelly and soup, total caloric intake ranged from 765 (this officer lost 2.5 kilo body wt.) to 1700 calories (this officer lost only 0.13 kilo). The average was 1414 calories (average wt. loss was 1.1 kilo). Although the ration was just sufficient to maintain weight under conditions of minimal activity, monotony and distaste for the diet reduced consumption much below the level for weight maintenance. For one week this could be tolerated without significant physiological consequences but for two weeks this diet probably would not sustain strength in a youthful military group. Our group was largely middle-aged men, less active and metabolically less demanding than growing young men.

VI. Behavioral and Motivational Aspects of the Trial

As previously noted, these officers had been given absolutely no advance preparation regarding either operation of the shelter or organization of the personnel. The immediate reaction of this group of well-educated, individualistic Reserve Officers may reflect some of the behaviors of any group of Americans who find themselves suddenly and without preparation in similar circumstances of isolation. Among these officers approximately equal numbers accepted the situation as: (a) an interesting challenge and opportunity to study at first hand and by personal experience isolated shelter life; (b) reacted with immediate and surprised anger at being "exploited" but were willing to volunteer; (c) a few bordered on belligerence; (d) some were indifferent or initially unhappily accepted the inevitable and withdrew or became reluctantly and minimally cooperative. Within a short time the more aggressive and vocal group reacted intelligently to the challenge, cooperated vigorously and demonstrated initiative in the organization and work of shelter life. The natural leaders emerged from the two categories (a) and (b) above. Within minutes several of the younger, more aggressive officers found the battle lanterns, searched out the main power switch in the filter room, turned on the lights and found several sets of instructions for operation of the shelter equipment. Immediately, general activity increased, senior officers compared dates of rank and by common consent the senior Captain assumed command. He surveyed professional qualifications of other senior officers and selected an

administrative staff and department heads for engineering, commissary and medical operations.

In the meantime the least active officers had found the blanket supply and wrapped themselves in a blanket apiece against the damp chill of the 50°F. temperature (one who wore a short sleeved summer uniform into the shelter remained in his blanket for the duration of the trial).

There were at least three major psychological variables which influenced the performance of the entire group, probably from the very beginning of the experiment. These variable artifacts must be kept in mind in any evaluation of the group's motivation and behavior.

First, the group clearly was aware that it was special. They had been told the trial was a "first". The television monitoring camera suggested that the group reaction was under observation. A few members of the group responded by overtly "playing-up" to the viewers from the outside at certain times. On the other hand, the majority perceived the trial as a serious challenge and an opportunity to make a contribution.

Related to the fact that some of the group reacted directly to the attention it was receiving, was a growing belief by a few that it was being manipulated from the outside; the "game" was being controlled. This question constituted another artifact. Some individuals reacted with casualness and a lack of initiative. Finally, there was an awareness that no really disastrous event would be permitted by the control center. A realistic sense of urgency about the shelter trial was lacking in contrast to that which would occur in the real situation.

These variables represent influences which stem directly from the response of the group to the fact that they were part of an experiment. They obviously tended to color the individual and group reactions to the problems of shelter life.

Some individuals utilized the trial as an accidental opportunity to: "quit" smoking, rest, or lose weight. Others found it to be a sort of adventure or personal test. Some few individuals were concerned quite seriously about outside commitments during the period of unexpected isolation.

The major operational goal was maintenance of physical condition and survival. Some group goals were manifested, particularly in engineering, medical and supply. The responsibilities of the individuals in these departments resulted in organized activity. There was no need for concern about post-shelter events, and therefore, planning for post-shelter survival did not emerge in the activities.

APPENDIX A

RECOMMENDATIONS FOR SHELTER OPERATION AND MANAGEMENT

From the experience gained in the shelter, the following recommendations are made regarding shelter operation and management.

General Description of Shelters and Auxiliary Facilities

Layout

Floor Plan - A large durable and clearly labelled floor plan of the entire shelter should be posted in the living area of the shelter.

Labels - All items of installed equipment should be labelled clearly.

Instructions - Simple, concise operating instructions could be painted on walls or enclosed in plastic and posted near each piece of equipment, such as the generator.

Access Routes - The painted pathways on the deck are a very effective device for improving traffic. The present lines should be repainted.

Functional areas - Spaces set aside for Medical and Messing departments, etc., should be labelled by signs on the bulkheads.

Mechanical equipment - Each piece of operating equipment should be described in some detail in a shelter instruction manual, several copies of which should be placed in the command area of shelter.

Security Storage of Supplies and Tools - To provide some protection against pilfering, the outside door into generator room should be locked, and the medical supplies, and dangerous tools should be locked in separate lockers. A key locker should be located in the filter room and contain keys to the medical and tool lockers and instruction manuals. The Shelter Commander may issue these keys to the appropriate department heads.

The following operating instructions are examples of the type which could be posted within the shelter to facilitate rapid organization and efficient operation of the shelter.

Emergency Instructions (Post Within Shelter)

Seal shelter against blast and radiation

Battle lanterns are located _____.

Shelter Commander take charge immediately. (If not previously designated, senior experienced person take charge)

Commander select group leaders and establish organization.

Maintain sealed condition for 4 hours after attack.

Shelter commander distribute keys to department leaders; immediately inventory supplies.

Designate radiation monitoring team of two men and issue protective clothing, radiac, and instructions.

Radiation monitors suit-up and check radiation levels in generator room.

Prior to unsealing shelter to start the generator, test air in generator room and outside of CO and CO_2. Instructions posted by copper tubes over doorway.

Designate task groups to assemble bunks, commission toilets and fire up power.

Operate manual blower briefly to check temperature and quality of incoming air.

Start up generator in accordance with posted instructions.

Open blast valves in ventilator system.

Start up electrical ventilating blower in accordance with posted instructions.

<u>Water</u> (Post near tank or outlets)

1. Check tank contents.

2. Open supply line valve. Check for leaks.

3. Draw off water sample and have checked by medical department.

4. Post appropriate notices and check-off sheet if water is to be rationed.

Heads

1. Check globe valves in drain lines from each toilet to assure they are closed.

2. Obtain jar of chemical for each toilet and mount in rack. Connect by plastic line and hand plunger to toilet.

3. Charge toilet with water and chemical in accordance with instructions on bulkhead of toilet compartment.

Lighting-off Power Supply - The engineering group should immediately familiarize themselves with instructions on the power supply system and check off against instructions posted in the shelter at the generator. They should fire up the generator and check operation after being brought up to speed and then switch on load when directed by shelter commander.

Ventilation and Temperature Control, and Sanitation - Similar instructions should be posted for these operations.

Logs and Check-off Lists - The following logs constitute a minimum record of operations.

1. Generator Log - Operation, Servicing and Minor Repairs performed.

2. Ventilation Blower Operation Log - When operation is intermittent.

3. Radiation Monitoring Log - Include all readings.

4. Chemical toilet - Check-off list for entry of times when chemical is added, (Post on head compartment bulkhead).

5. Water Supply Log - Measure water supply twice daily. Log amount used and amount remaining. Directions for reading meter should be provided.

6. Communications (external) Log - Record times and content of all messages to and from outside contacts.

7. Sick Call Log.

APPENDIX B

DISCUSSION OF ENGINEERING ASPECTS OF SHELTER TRIAL

PHYSICAL ENVIRONMENT

Ventilation and Temperature: Requirements and Controls

When studying the requirements for ventilation and temperature in a fallout shelter two primary factors are pertinent: Requirements for survival and requirements for comfort. The environment must support the occupants so that they can carry out survival tasks and responsibilities within the shelter and upon leaving the shelter. To this end there must be sufficient control to eliminate health hazards and undue physiological stress as much as possible.

A prime environmental condition to permit survival is ventilation sufficient to reduce the amounts of contaminants in the air such as CO, CO_2, particulate matter, and products of combustion to a level compatible with life. In order to determine the amount of ventilation required, the concentrations of these contaminants are monitored. Man produces 0.6 cubic foot of CO_2 per hour. Since the level of CO_2 is the best indicator of adequate ventilation, it is an effective guide to the minimal ventilation required or that amount which will maintain the CO_2 level below 3% of the total air present.

The maximum permissable concentration of CO_2 may be determined by calculating 3% of the volume of air space in the shelter.

EXAMPLE:

Shelter dimensions - 48 by 12 by 24 feet; equals $48 \times \left(\frac{12^2 \times 3.14}{2}\right) = 10{,}850$ cu.ft.

(The shape of this shelter determines the formula for calculation)
Approximate vol. of shelter - 10,000 cu. ft.

Allowable CO_2 (3%) = 300 cu. ft.

If there are 100 people in the shelter producing 0.6 cu. ft. CO_2 each per hour, this amounts to 60 cu. ft. of CO_2 per hour. Thus, the maximum time for a sealed off or "buttoned-up" condition is $\frac{300}{60} = 5$ hours. At the end of 5 hours it will be necessary to provide ventilation to maintain the CO_2 concentration below 3%. To avoid the unnecessary accumulation of CO_2 during the "buttoned-up" period absolutely no combustion can be permitted. The intake must be filtered to prevent the intake of radioactive dust, chemical gases or biological contaminants. It is possible that under true

emergency conditions there will be no one in the shelter with this knowledge. Therefore, it is suggested that related instructions and an example such as above be included in the shelter manual. Since post-shelter survival activity is very important whenever possible more than the minimal survival requirements should be provided to support the occupants' physical comfort needs and morale.

Depending on the power available and the capacity of the ventilator system, the system may be used to provide comfort by changing the air temperature, relative humidity, reducing odor and by removing particulate contaminants. Methods for removing the high humidity produced by human respiration are desirable. If there is sufficient power supply a dehumidifier would not only remove water from the air, but this water could be salvaged and used for cleaning purposes and thereby conserve drinking water.

Extreme temperatures have little real effect on personnel in shelters if transient. However, exposure to extreme temperatures for long periods may produce drastic hazards to health, greatly reduce personnel effectiveness, and may be fatal.

In the winter, especially in cold climates, the walls, floor and ceiling of the shelter as well as the inlet air may be very cold. The output of heat by shelter personnel and equipment may be inadequate to overcome heat loss through the shelter structure and air exhaust. This condition was experienced during the current study and overheating was confronted during earlier Navy trials. The amount of heating power required will depend also on the quantity of clothing, blankets and other protection available.

Generally if temperatures between 68° and 70° F. can be provided in the shelter most occupants will be comfortable and able to carry out assigned tasks. Every reasonable effort should be made to provide adequate cooling or heating as the conditions demand. It is to be noted that outside air source may provide for heat exchange depending upon its relative temperature to shelter air. Several thermometers would have been useful for measurements of shelter air temperature, shelter structure temperature (surface) and inlet air temperature.

It is desirable to record temperatures at different locations within the shelter several times each day.

Atmospheric Contamination

The primary contaminants in the shelter are carbon dioxide, carbon monoxide, total particulates, combustion products such as nitrogen oxides and radioactive dust. The maximum permissible concentrations for continuous shelter occupancy are:

Contaminant	Maximum Permissible Concentrations		
	PPM	%	mm/l
Carbon dioxide	20,000	2.0	
Carbon monoxide	25	.0025	
Nitrogen oxides	10	.0010	
Total particulates			2.0
Oil mist			2.0

Therefore, a simple but effective evaluation and control of the contaminants during the period of confinement is essential. The control procedures that must be initiated in the shelter will be directly related to the proper evaluation of these factors. Since certain basic contaminants in the air are reliable indices of general atmospheric contamination, the number and types of analyses may be kept to a minimum.

APPENDIX C

WE FELL FOR A FALLOUT SHELTER

by

Commander Eli A. Rubinstein, USNR

I'll tell you a story, and it's a beauty,
Of thirty-four men on a tour of duty.
They came to Bethesda for a two-week stay.
To learn about shelters in a thorough way.

The seminar started on Monday at eight,
With all of us ready, - but Urner was late.
We were welcomed aboard by Admiral Brown,
And finished the morning just settling down.

It was later that day we made our first slip.
Commander Rasputin had planned a field trip.
"Come look at our shelter," the Commander said.
We trooped out behind him, like sheep being led.

He showed us the set-up, then started to grin,
"You're going to stay here, you've volunteered in.
It's a simulated test - we'll set off a bomb -
But the shelter's equipped, so you remain calm."

Just do what is needed, and make your readings.
We'll watch on TV and view your proceedings.
We purposely tricked you, to make it seem real.
But let me apologize, I know how you feel."

So that's how it started, sheltered and cozy,
With orders not clear and no place to mosey.
But like officers true, right down to a man,
We quickly developed an operating plan.

We chose Captain Hawley, who took the Command.
All Divisions were filled, all watches were manned.
We checked our equipment, and found the supplies.
The head was inspected, to test the seat size.

The next thing we did was to fix up our sacks.
And unwrap the blankets, all tied up in packs.
Those blankets were handy, the weather was cold.
We draped them around us, a sight to behold.

The food was unstowed and we counted the rations.
The medics and engineers took to their stations.
In less than two hours the shelter was shipshape, -
A ship, incidentally, we couldn't escape.

Chow-time came quickly, a delightful repast.
Twenty-four crackers, each the same as the last,
Plus coffee or tea, completed the dinner.
All guaranteed to make thin men thinner.

To check radiation, we sent out two men,
Who were destined to do it again and again.
They made computations and gave us the word -
If everything went well, we'd leave July third!

At twenty-three hundred, we called it a day,
A day to remember, is what you might say
The snorers began then, some raucous, some soft.
Still others were moaning, while some mainly coughed.

May fourteenth, the next day, we started anew
No showers, no shaving, and not much to do.
Mornings wakes for breakfast, and jam, if you please
If it weren't so cold, a real life of ease!

We heard our first lecture, that morning at ten,
Through closed TV circuit, wired into our pen.
We learned about fallout, its effects on man.
The data were mainly from bombing Japan.

Then lunch and more lectures was afternoon fare.
The theatre was forming, as we were aware.
The second day ended, without any fuss.
Despite the cold weather still bothering us.

At this point I'll shorten the rest of my tale
Indeed, give the highlights of our week's travail.
I'll mention the fellows and give them acclaim.
For what they did that led to their fame.

There was Bell, Briggson, Smith, and Everson, too,
Bidding slams in all suits, and losing a few.
"Are you smoking more now?" Ray Blackmore would ask
This survey of his was a personal task

And then there was Boston, an exercise man,
With push-ups and chinning, done catch as catch can
Brownson liked modeling the brain's hemisphere.
While Brunner provided our meals so austere.

To Caplan and Wilson, all suited up tight,
We looked for the data to end our sad plight
While Carlton endeavored that last day or two
To check on the answer that said we were through

As second in command we had Donovan -
A nice quiet fellow, with self-discipline.
Old Engeset lived in the uppermost bunk
His climbing that distance took plenty of spunk.

Quite quiet were Finley, Fowler, and Hawken -
And Graham, too, rarely could be found squawkin'.
A joke that delighted was recounted by Hall,
About "Wooley Bugger," an animal small.

Hygienic Hausler worked as a medic -
Taking cultures and weights and helping the sick.
The skipper was Hawley, his number was low.
He gently and calmly directed the show.

Casualty Lommasson, the man who came back,
Did reading and writing, and hitting the sack.
The one guy who fainted, and fell with a thud,
Was Morgan, while watching the Doc sample blood.

The last day found Murray, leading a song fest.
While Oesterreich and Richards sang out with the rest
When not engineering, Nelson taught us "Go."
A game he had mastered in old Oklaho

Of Rubinstein's prowess at scrabble and chess,
I'll merely make mention, - I couldn't do less.
There also was Fitcomb, our architect friend,
Whose ideas for changes, we all can commend.

Doctors Walsh and Williams, physicians quite good,
Were watchful for illness, like good doctors should.
Psychologist Trumbull gave out questionnaires,
To detect if we were disturbed anywheres.

Gene Wagner, the artist, sculpted a female,
While Watko had toothaches and stomach travail.
I've left for the last one, the birthday feller,
It's Weinstein, the jokester, our story teller.

And that is our story, as I've summarized.
A field trip - quite different than we visualized.
Thirty-four officers thrown in a shelter,
On rations designed to make them all swelter.

So let me indicate, in closing this poem,
The lesson we learned in our underground home.
Reserve training duty in the U. S. Navy
Sometimes is such that is isn't all gravy!

May 20, 1963

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Commanding Officer, NMRI
Commanding Officer, NRL

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TABLE 1

CHARACTERISTICS OF THE SUBJECTS (N = 34)

Education	Ph.D.	20
	M.D.	2
	MA/MS	4
	AB/BS	8
Age.	25 - 34	4
	35 - 44	16
	45 - 54	13
	Over 55	1
Rank:	CAPT	3
	CDR	8
	LCDR	14
	LT	8
	LTJG	1
Employment.	Governmental	16
	Academic	10
	Industrial	6
	Self-employed	2
Designator	Line	17
	MC, MSC	8
	Other staff	9
Geographical Distribution	East	3
	South	8
	Mid West	13
	West	4
	Local	6
Community.	Urban	16
	Rural	18

FIGURE 1

CONSENT FORM

NAVAL MEDICAL RESEARCH INSTITUTE NMRI FORM 3 (6-63)

NATIONAL NAVAL MEDICAL CENTER

BETHESDA, MARYLAND

CONSENT TO VOLUNTARILY PARTICIPATE IN RESEARCH EXPERIMENT

DATE _____

I hereby volunteer to participate, as a test subject, in a research subtask being conducted by the Naval Medical Research Institute entitled:

_____

_____

the experimental design of which has been approved by the Chief, Bureau of Medicine and Surgery and use of human volunteers approved by the Secretary of the Navy. The nature and purpose of the procedures have been explained to me. I understand that the procedures are experimental and that my consent to participate does not constitute a release from any possible future liability by the Navy attributable to the experiments.

SIGNED: _____

(TYPED NAME, RANK, RATE, OR GRADE)

WITNESSED: _____

Copy to:
Service Record, jacket or personnel file

FIGURE 2. CUTAWAY DIAGRAM OF SHELTER

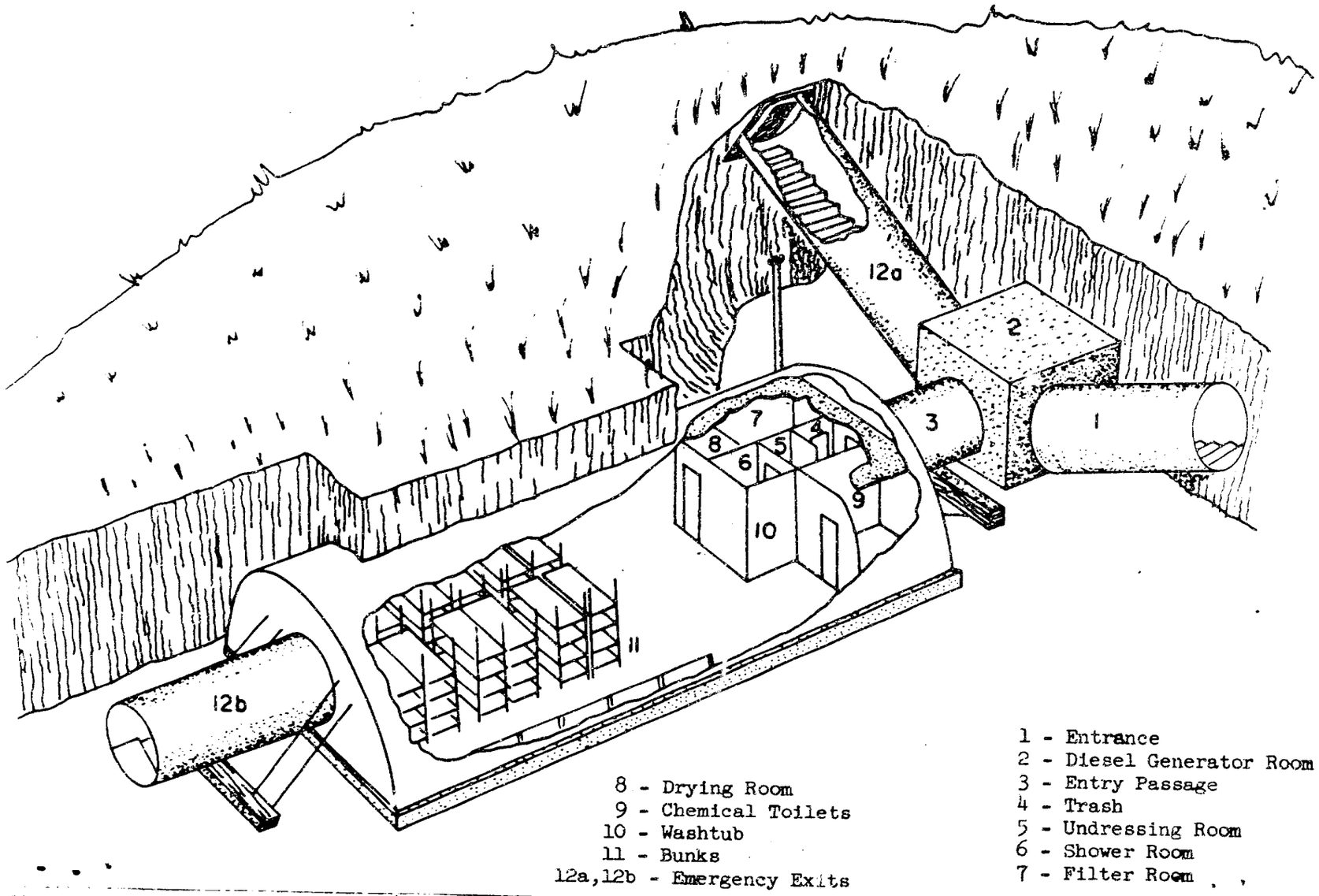

FIGURE 3. FLOOR PLAN OF SHELTER SHOWING PROPOSED MODIFICATIONS

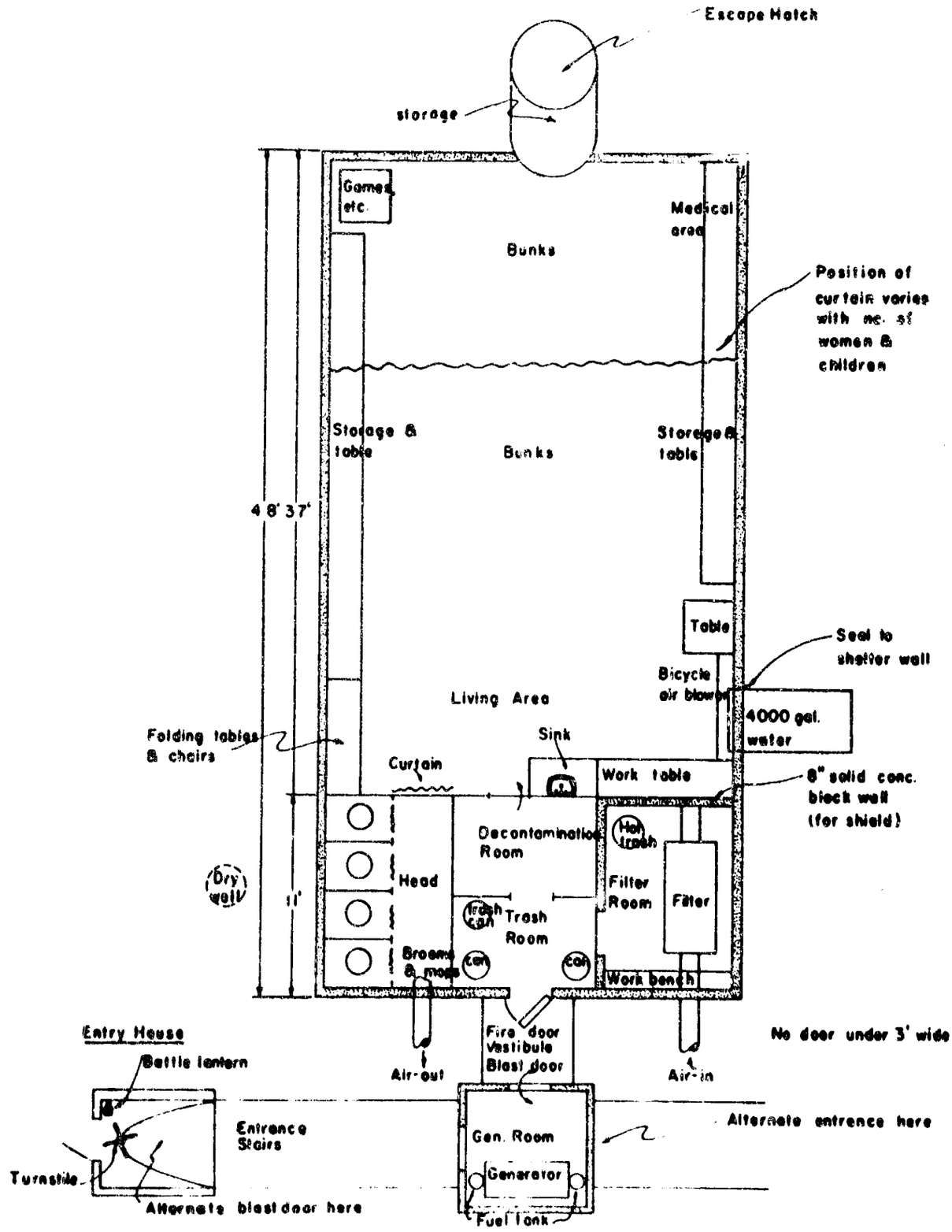
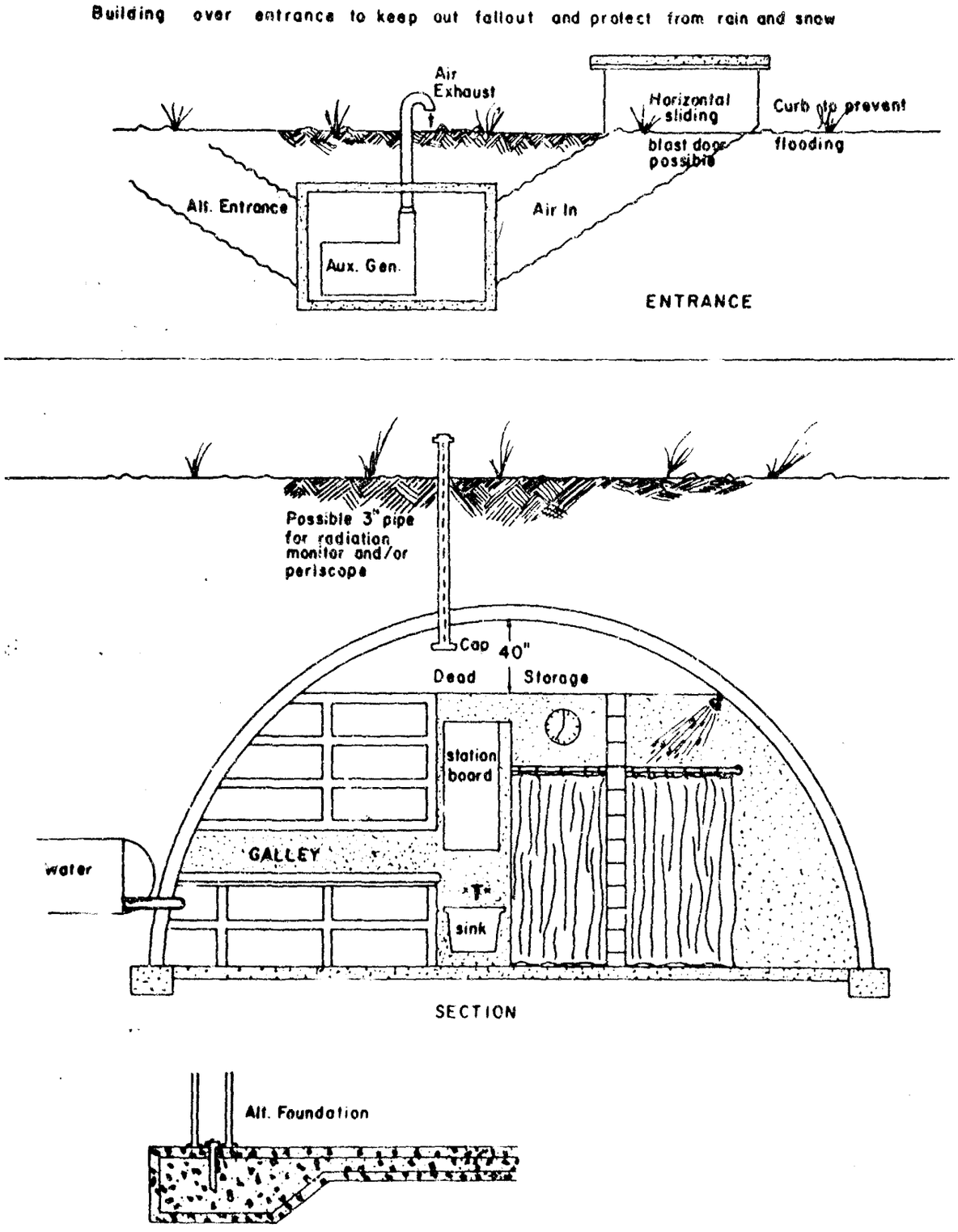
FIGURE 4. END VIEW OF SHELTER SHOWING PROPOSED MODIFICATIONS