Operations Analysis Department

Research Memorandum

OAD RM 106

LINCOLN SHELTER UTILIZATION STUDY

Volume I—A Review of the Requirements for Shelter Utilization Planning

Prepared for:

DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE
WASHINGTON, D.C.

CONTRACT OCS-OS-62-135

STANFORD RESEARCH INSTITUTE

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This is a working paper presenting the results of work in progress. The methodology, views, and/or conclusions contained herein are preliminary. Accordingly, this document does not constitute an official report of Stanford Research Institute, and therefore, may be expanded, modified or withdrawn at any time.

OCD REVIEW NOTICE

This report has been reviewed in 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.

ABSTRACT

This report assesses the situation with regard to Civil Defense in Lincoln, Nebraska. Lincoln is a typical mid-western city and representative of many cities in the United States. As a result, the subjects treated in this report are applicable to many cities.

The serious problem of insufficient existing buildings suitable for use as shelters is considered. A solution involving the use of buildings with lower protection factors and a mobility system after attack is proposed. A radio communications system suitable to the needs of the area is proposed and discussed.

A method of assigning people to shelters is demonstrated. A series of maps is developed which aid in making the shelter assignments.

A separate and supplemental report, Volume II of this study entitled "LINCOLN SHELTER UTILIZATION STUDY - A Shelter Assignment Procedure," has been issued, and provides a specific assignment of the people of Lincoln to existing shelter and shows the need for additional shelter.

FOREWORD

This report was prepared under Contract No. OCD-OS-62-135 for the Office of Civil Defense, Department of Defense, and is devoted to the study of shelter utilization planning. This report deals specifically with civil defense in Lincoln, Nebraska. Separate reports have been prepared which assess the problems of shelter utilization planning for the cities of Boston, Massachusetts, and San Diego, California.

This report looks broadly at major problem areas concerned with making a shelter system. A range of possible solutions for many civil defense problems is described. Many of these solutions are not discussed in detail herein, but would require additional serious study for implementation.

A few specific problem areas such as pertain to shelter assignment are treated in greater detail in a separate document.* This supplemental report deals with a shelter assignment method for all the people in Lincoln.

This report is not a complete operating plan but is designed to be used as a CD planning guide. Its aim is to provide the local planner with information on the problems to be expected, and with practical techniques to apply to their solution.

This study was performed under the direction of Rogers S. Cannell, Director of the Operations Planning Research Center, Stanford Research Institute, and was prepared within SRI's Operations Analysis Department.

The development of this report, involving as it did a great deal of detailed investigation in the field, owes much to the courtesy and assistance of many people associated with Civil Defense, who freely gave their time to discuss these grave problems.

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* A Shelter Assignment Procedure, which is Volume II of this study.

We would like to acknowledge gratefully the assistance of: The Hon. Frank B. Morrison, Govenor of Nebraska, who gave us counsel and graciously smoothed the way at the beginning of our investigation; Major General Lyle A. Welch, Adjutant General of Nebraska, who, as an enthusiast for Civil Defense, gave us much of his time; Mr. Richard A. Vestecka, Civil Defense Director, Lincoln, Nebraska, and his staff, whose unfailing cooperation enabled us to see and talk with many helpful persons; Mr. George F. Drake, Deputy Director C.D., Lincoln, who was very obliging in obtaining for us shelter survey records; Mr. Selmer A. Solheim and Mr. Starr of Selmer A. Solheim and Associates, who conducted the shelter survey in Lincoln; Col. Donald G. Penterman, Col. Russell Wallace, and Mr. James Hetrick of General Welch's staff, who were all most helpful in giving us background information and escorting us around the Lincoln area.

Finally we would like to express our appreciation to Mr. Ren F. Read, Region VI Civil Defense Director, and Mr. Robert D. Hubbard and the Region VI staff, who have been very helpful throughout various stages of this work, and to Rear Admiral A. G. Cook (Ret.), USN, who recently retired as Director, Disaster Council and Corps, City and County of San Francisco, who acted as a general consultant.

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I INTRODUCTION

This report is concerned with the problems of planning civil defense at the local level. It is the purpose of this report to offer techniques that will aid communities in utilizing those shelters identified under the National Fallout Shelter Survey Marking and Stocking Program.

Using Lincoln, Nebraska as a model city, we are confining our discussion to the assessment of alternate methods of assigning a community to fallout shelters and of stocking these shelters. It is not our purpose to evaluate the post-attack problems, such as shelter management and emergence from shelters. We are concentrating on the objective of building a civil defense plan, using local people and local organizations.

We have prepared this report with the understanding that the enclosed data will become input for a prototype operational manual. The primary purpose of this manual, therefore, is to show local officials the wide range of problems which must be considered in development of an operational civil defense plan. Where specific judgments have been made we are also including the analysis and data to explain the basis for them.

An important part of our task on this research project has been to observe the pertinent civil defense structure and policies and to make suggestions for improvements where needed. In order to evaluate civil defense operations it has been useful to acquire a general background of the recent civil defense history. A summary of the current civil defense organizational structure and policies is presented in Sec. II.

Since the primary requisite for an operational civil defense plan is optimum utilization of the shelters found in the survey and marking program, a technical report dealing specifically with this subject,

entitled "A Shelter Assignment Procedure," makes up Volume II of this report series. It deals with a specific assignment of the people of Lincoln to existing buildings having protection factor 40-100 and 100 and up.

However, the number of such shelter spaces is too small, and their locations are not ideally distributed to accommodate all the people of Lincoln. The use of buildings with protection factors from 20 to 40 (Category 2) would substantially enhance the Lincoln shelter program until better shelter could be provided. Such use, however, was not attempted in the assignment exercise as specific data on the availability of this shelter category were not available to the research team. The study did point out, however, the areas of town where the survey should be extended to locate this category of protection. The assignment as presented accepts the present situation, in which a large number of people will not yet have publicly provided shelter.

A distinction arises between day and night time assignment due to population shifts, and this is also considered.

The supplementary study (Vol. 2) demonstrates that the different distribution of people by day and night requires separate assignment plans. Since people are mobile, and any person might be at any one of a number of locations at any time, assignments were made on a location-to-location basis. That is, assignments were not on an individual, personal basis; instead, fixed areas commonly occupied by people were assigned to a given shelter facility within the area or nearby. Thus a person in his home area might have a known shelter to go to, but he would have a different shelter in his work area, shopping area, etc. Nobody would "own" a shelter space, but nobody would have to make his way across town to one (and only one) shelter during an emergency.

Following this criterion, a few locations such as outlying residential areas were assigned to the same shelter space for day or night. A few areas in the concentrated downtown sections also received the same assignment day or night. However, for most of the city, it was necessary to assign areas (usually census blocks) to one shelter for the daytime and a different shelter for nighttime.

II BACKGROUND

On August 1, 1961, the Office of Civil Defense as now constituted was established under the Department of Defense. On this date the Office of Civil Defense was charged with the responsibility of designing a national civil defense program which would assure the survival of the maximum possible number of the U.S. population under conditions of a nuclear attack.

The Federal government's role in civil defense is one of rendering leadership and financial and planning assistance to the states, counties, and local governments. National civil defense programs are developed in the Office of the Assistant Secretary of Defense (for Civil Defense) and are passed along to the eight Regional Directors, each of whom has a functional relationship to the several states in his region. Each state has a civil defense director, who functions under authority given him by the state legislature. The Regional Directors are responsible for evaluating all requests for assistance made by the State Directors, in accordance with the national objectives of the Office of Civil Defense. The Regional Directors are also expected to supply the State Directors with technical assistance, training and help in administering the Federal funds.

All fifty states have adopted, wholly or in part, a Model Civil Defense Act, which was drawn up by the Council of State Governments. This act makes possible a systematic development of local civil defense organizations.

The government at the local level--county and city--is given the responsibility of organizing and maintaining civil defense in its area. The local officials can either appoint a civil defense director or act in this capacity themselves. The local civil defense director should: (1) organize to achieve a CD capability, (2) work through the existing agencies of local government, (i.e., fire department, police department, civic groups), (3) train the required operating personnel, (4) obtain

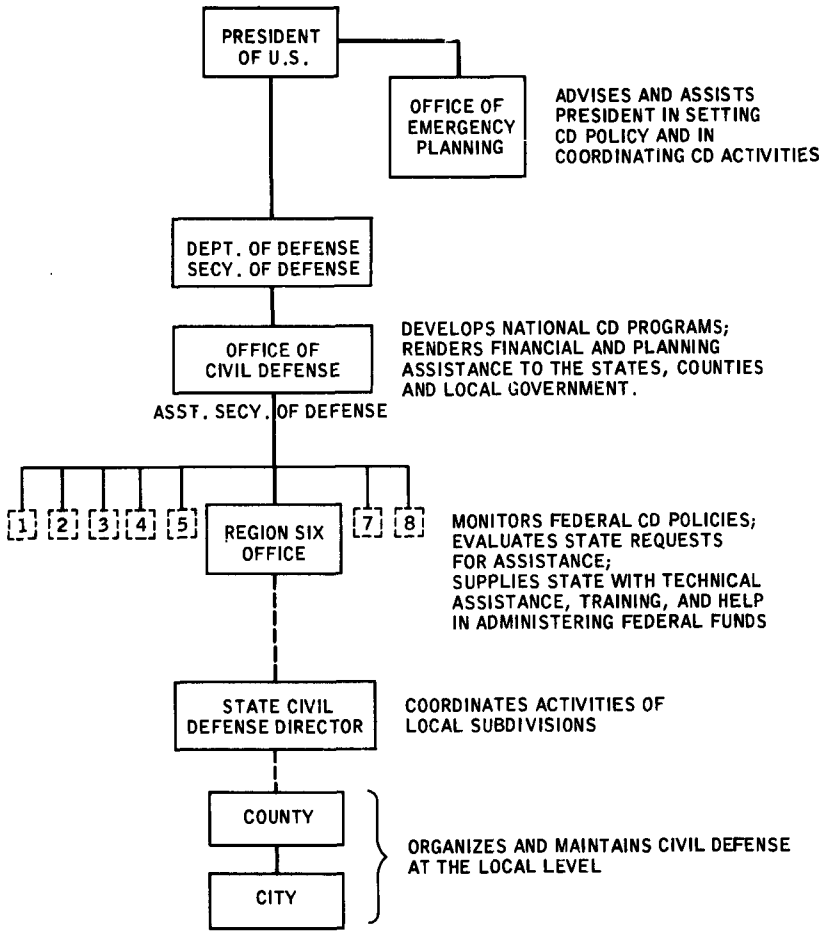
the equipment needed, and (5) impress every citizen that his part in CD is vital. The civil defense organizational ladder as it applies to Lincoln is shown in Fig. 1.

In the Fall of 1961 the Federal Office of Civil Defense inaugurated the National Fallout Shelter Survey. All buildings, tunnels, caves, and mines (excluding single family homes) were to be surveyed. The objective of the survey was to identify potential shelters and mark them for public use. The criteria for selecting existing structures as shelters were that they must (1) provide a protection factor (pf) of 100, (2) allow at least 10 square feet per person, (3) provide at least 3 cubic feet per minute of fresh air per person, and (4) provide capacity for at least 50 persons. If the ventilation criterion could not be met, the space criterion was 500 cubic feet per person, instead of 10 square feet.

Federal, State, and local governments have been given joint but not equal responsibility for conducting the National Fallout Survey. The primary responsibility for leadership was placed in the Office of Civil Defense (OCD) under the Department of Defense. The responsibility for field operations has been assigned by OCD to the Army Corps of Engineers and the Navy Bureau of Yards and Docks. The Corps of Engineers and the Bureau of Yards and Docks are in turn responsible for selecting and contracting with Architectural and Engineering firms to perform the local survey functions. The state coordinates the activities of the local subdivisions. Each political subdivision in turn is to appoint a CD director.

The Phase I portion of the National Fallout Survey was completed on June 30, 1962. In the Phase I portion, the Architects and Engineers (A&E's) made an inventory of the day and night populations and the potential fallout shelters. The Architects and Engineers collected shielding data for machine computation of protection factors for individual buildings. The Bureau of Census and the National Bureau of Standards aided the survey by making their computers and skilled personnel available for the computations.

FIG. 1 LINCOLN CIVIL DEFENSE ORGANIZATIONAL LADDER



The Phase II portion of the survey was scheduled for completion by December 31, 1962. In the Phase II operations the Architects and Engineers identified the existing shelters which offer the recommended protection and provide for the minimum space needs. The Architects and Engineers also estimated the cost and determined the feasibility of upgrading the potential shelter spaces. This cost estimate is to be made available to the individual building owners. The owners may then determine whether or not they are willing to provide the funds to upgrade their buildings to shelter standards.

As acceptable shelter spaces are identified, the local officials contact the building owners for permission to license their respective buildings as shelters. The license, as prepared by the Federal Government, can be cancelled upon 90 days notice by the building owner, and constitutes permission both to mark and to stock the shelters.

The marking of the shelters with official signs is to be done by either the Corps of Engineers, the Bureau of Yards and Docks, or the local CD Director.

All licenses are delivered to the Corps of Engineers, which in turn forwards a notification of each signed license to the Defense General Supply Agency (DGSA) in Richmond, Virginia. The Defense General Supply Agency then forwards forms for requisitioning shelter provisions to local civil defense directors for signature. Upon receipt of the requisitions the DGSA ships the supplies to Federal warehouses which are located in or near most large metropolitan cities. When the locality is within 25 miles of the Federal warehouse, the local government is responsible for transporting the supplies from the warehouse. If the community is over 25 miles from the Federal warehouse, the Federal government will transport the supplies to the shelter curbsite.

In addition to the stocking and marking program, the OCD is actively working through local governments to build programs in shelter management, communications, radiological defense, and emergence from the shelters.

III SUMMARY

In the event of a fallout emergency, the city of Lincoln, Nebraska, has insufficient shelter space with a protection factor of 100 or greater to cover either the daytime or nighttime population. Although only spaces with a protection factor of 100 or greater were originally acceptable in the Federal plan, it has been recognized by the federal government that lesser protection factors could save life under a number of possible situations. Thus, spaces with a protection factor of 40 to 100 were later included in the survey. Even so, more shelter space is required. In some parts of Lincoln, it would be required to use facilities having a protection factor of 20 to shield all of the people. This report (Volume 1) discusses such a plan.

The use of shelters with a range of protection factors down to 20 is acceptable because it is the only option presently available within Lincoln that gives protection to everyone. Even this relatively low level of protection can save life under a number of conditions which one might reasonably anticipate in Lincoln. It is recognized that Lincoln could, however, receive fallout in sufficient amounts to make some of the 20 protection factor shelter unacceptable. One possible remedy is to schedule the use of such shelters, but to provide a post-attack mobility system, to permit the movement of people from areas where protection is inadequate to nearby areas where, because of uneven distribution of fallout, the equivalent protection may be sufficient.

It is recognized at the outset that a mobility system is difficult to organize. Even so, the mobility system and the radio communication system described in sections 9 and 10 in this report should add to the over-all effectiveness of the protection measures. In this context, mobility is not a substitute for shelter but a technique for improving its effectiveness.

The mobility system would buy a margin of safety for people caught in "hot spots." If Lincoln does not receive intense fallout it would be

quite likely that the mobility system would not need to be brought into operation.

A great deal in the way of potentially saving people is bought for the city of Lincoln by reducing the protection down to 20. A little more might be bought by introducing the concept of mobility.

A special supplemental report dealing with methods of assigning Lincoln's population to shelters will follow this report. That study will deal with the step-by-step process by which shelter assignments might be made.

In this interim, standby stage of the national shelter program, Lincoln civil defense officials should continue to develop a public information program, designed to enlist public support and to inform the public with respect to civil defense. Among other things, the public would be assured that the national fallout shelter program is a continuing, upgrading program. It would be explained that civil defense is a local responsibility and will succeed to the extent that individuals contribute their time, talents, and funds. A pamphlet (see Appendix) has been prepared for this purpose. Responsible officials of the city and county governments would also frequently be brought up-to-date on civil defense policies and told exactly what is needed from them in order that civil defense can be made effective.

After a shelter assignment plan has been developed it is necessary to communicate the assignment to the public, along with information on operational activities. Alternatives for communicating this information range from the publication of assignments in the daily newspaper or other public information sources down to individual explanations. This report envisions a plan whereby one person known as a "Shelter Representative" might be assigned to each block or a group of blocks, and would perform the task of telling each block resident about the shelter program and of assigning him to a shelter. It is somewhat analogous to the precinct party worker system used by political parties or the funding raising individual used by community service organizations. It would be difficult to implement at the present state of public support,

but it might be one of the more effective ways of informing the public about the plan.

Experience has shown that at this stage of the development of Civil Defense, the organization of block wardens or shelter representatives for the purpose of teaching others is a long, arduous, and expensive job. Until such time as it is practicable, an integrated public information program should be conducted from headquarters.

A series of maps have been developed (see Sec. VIII) which help to describe the block assignment process and which would be useful in its implementation.

This report outlines the current situation with respect to civil defense in Lincoln, Nebraska. Suggestions are made as to some alternative methods by which the civil defense program might be improved. Basically this report covers the following main topics:

Description of Lincoln, Nebraska

Civil Defense in Lincoln

Planning for Civil Defense in Lincoln

Alternative Shelter Assignment and Upgrading Plans for Lincoln

Assessing the Problem of Assignment

Intra-City and Inter-Shelter Communications

Mobility

The planning method covered in this report is only the beginning for an adequate civil defense plan. If implemented, it could result in saving many lives in the event of attack. A better plan could save more. Hopefully, preparedness will grow. This plan was designed to make growth possible.

IV DESCRIPTION OF LINCOLN, NEBRASKA

Lincoln, Nebraska was one of four United States communities selected in an analysis of community shelter systems. The other communities included Boston, Mass., San Diego, Calif., and the San Francisco Bay Area. The selection of these cities was intended to provide for a wide range of geographical and socio-political considerations.

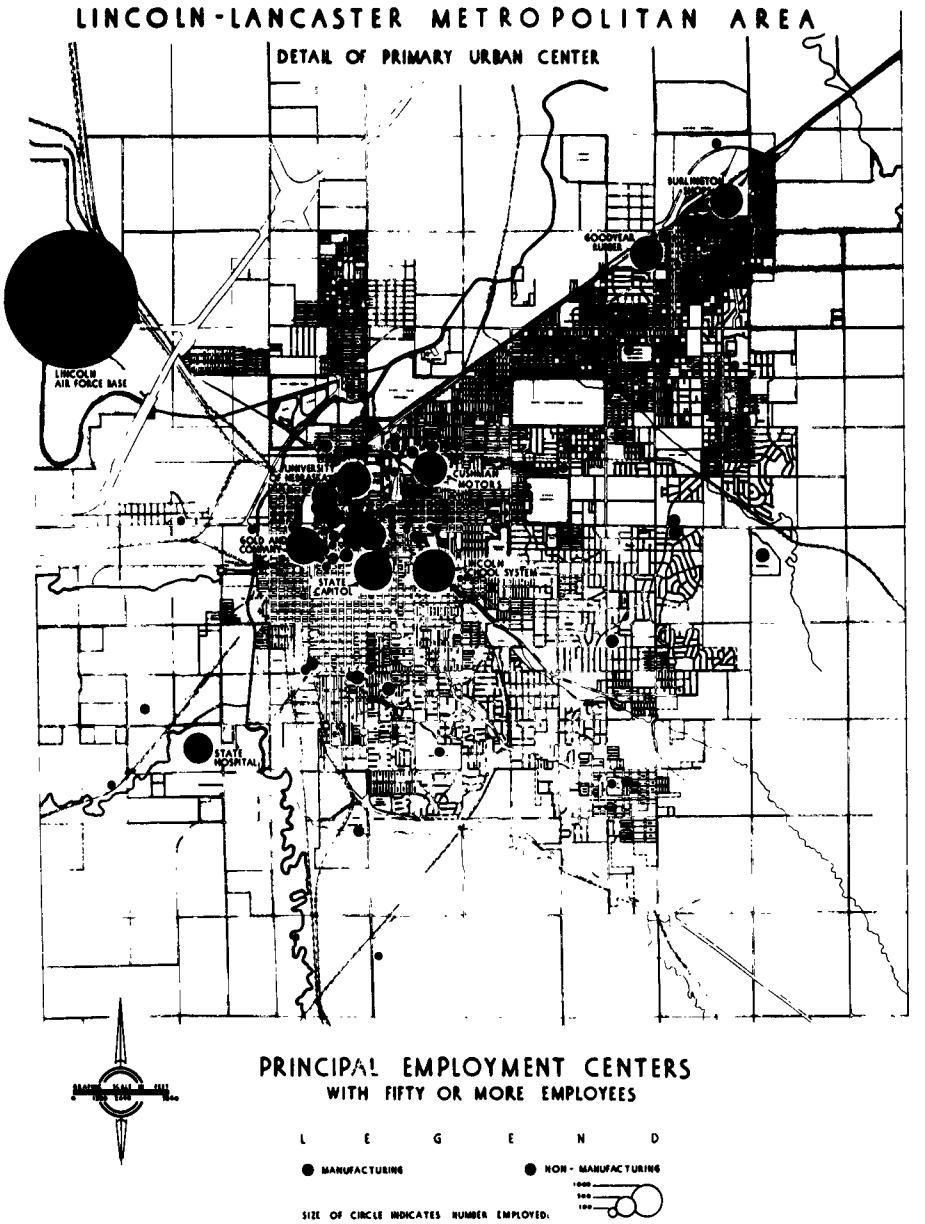
Lincoln is situated near the center of the United States and is the governmental and educational center for the state of Nebraska. Ninety-five percent of the land in Lancaster County, in which Lincoln is located, is in rural use and five percent of the land is in urban use. By contrast, ninety-three percent of Lancaster County's population is in urban areas and seven percent is in rural areas.

Food and kindred products are by far the largest industry for Lancaster County and for the state of Nebraska. Livestock, (mainly beef cattle) and crops of corn, wheat, and oats, make up the major part of the Nebraska food industry.

A. Population

The city of Lincoln has a nighttime population of about 129,000 and a daytime population of approximately 143,000. The corporate area of Lincoln covers nearly 32.5 square miles, which results in about 4000 nighttime residents per square mile. By comparison, the population density for all of Nebraska is about 18 residents per square mile.

Lincoln's population is growing at the rate of about 2-1/2 percent per year and will reach approximately 165,000 nighttime population by 1970. Private dwellings in Lincoln now total about 47,000, having increased in number at the rate of five percent per year for the past ten years. Lincoln's sizable growth, over the past ten years, is almost entirely attributable to the establishment of the Lincoln Air Force Base. Figure 2, which describes Lincoln's principal employment centers, emphasizes the large number of personnel employed at the Lincoln Air Force Base.



SOURCE: Comprehensive Regional Plan for the Lincoln City—Lancaster County Metropolitan Area of Nebraska

FIG. 2 PRINCIPAL EMPLOYMENT CENTERS

Lincoln has approximately 28,000 students in elementary and high school grades. Approximately 69,000 people are employed in Lincoln.

B. Physical Characteristics

Lincoln is primarily a retail center with a scattering of light and medium industry. It is a city of wide streets, numerous trees, and well-kept buildings and homes (see Fig. 3).

The A&E's "Completion Report" on the Phase II shelter survey describes Lincoln as being divided into three distinct physical areas. These are defined as the central business district, the University of Nebraska campus, and the fringe areas of the city. The central business district has the heaviest concentration of potential shelters (Fig. 3). The majority of these structures were built between 1900 and 1935, and include business offices, banks, hotels, and retail stores. The older structures are two- and three-story buildings with full basements, heavy bearing masonry walls, and light wood framing on floors and slabs. The newer two- and three-story buildings are of bearing masonry or reinforced concrete construction with flat slabs or concrete joists and floors.

Buildings on the University of Nebraska campus date back to the 19th century. The floors and roofs of the older buildings are of wood construction. These structures are costly to modify to obtain a protection factor of 100. The later buildings on the campus are steel-reinforced concrete structures.

The fringe areas of the city have few structures with a protection factor of 40 or better.

C. Existing Shelter Spaces

The Phase 1 National Shelter Fallout Survey identified over 195,000 shelter spaces in Lincoln in a total of 380 buildings. Of these, 64,000 spaces possess a protection factor of 100 or greater, and the minimum space requirements of 500 cubic feet per person with no ventilation, or 10 square feet with adequate ventilation. These 64,000 existing

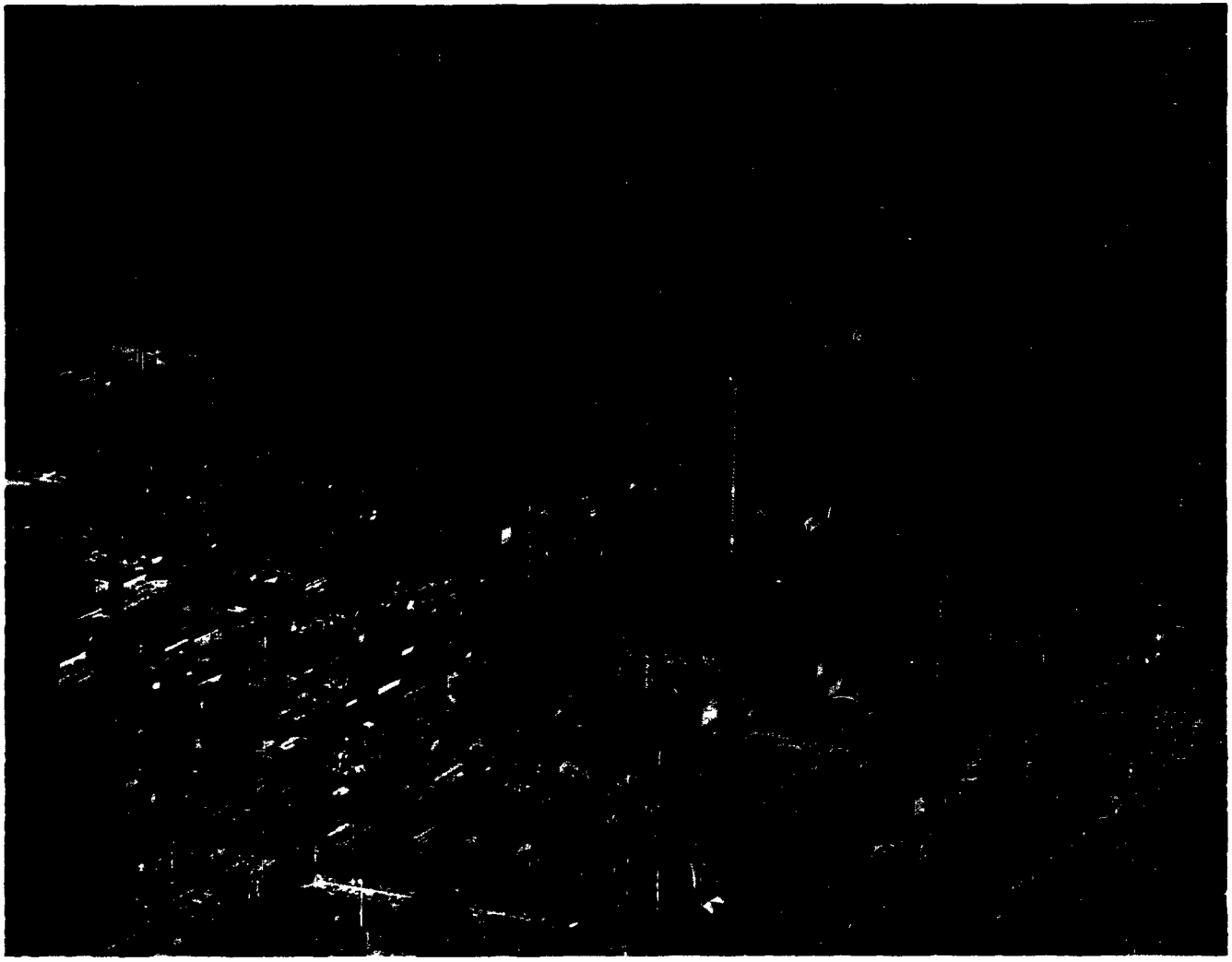


FIG. 3 CENTRAL BUSINESS DISTRICT

shelter spaces, which are in the process of being stocked with Federal supplies, fall far short of those required to house a daytime population of 143,000 and a nighttime population of 128,000.

The Phase II survey points up the fact that approximately 58,000 shelter spaces would become available if shelters with a protection factor of 40 to 100 were included in the survey. The federal government has recently approved the marking and stocking of all facilities offering a protection factor of 40 or greater.

It is estimated by the A&E's that it could cost approximately $1,231,000 to upgrade 31,000 spaces having a pf of 40 through 99, to a protection factor of at least 100. There are about 122,000 shelter spaces available with a pf of 40 or greater, nearly all of which are concentrated in the downtown area of Lincoln. The suburbs have few readily available shelter spaces that offer a protection factor of 40 or greater.

If shelter spaces with a pf of 20 to 40 were to be included in the shelter inventory, then about 100,000 additional spaces would become available. As a result, some protection would be offered to everyone in the suburbs on a more conveniently distributed basis. The effectiveness of this shelter might be improved if combined with a mobility-after-attack system of the type outlined in Sec. X.

In addition to public shelters, about 40 "home shelters" have been built in Lincoln.

D. Threat

The closest military target is the Lincoln Air Force Base, a SAC base, located about six miles northwest of Lincoln. Further away is the SAC base at Omaha, approximately 50 miles northeast of Lincoln. In addition to these are about 20 Atlas and Nike missile sites varying from 25 miles to 70 miles from Lincoln, and in all directions. These sites are hardened.

A number of conditions could prevail in Lincoln following an attack:

1. The city could receive blast damage and no fallout;
2. It could receive blast damage and fallout;
3. It could receive only fallout;
4. The surrounding area might suffer damage, and Lincoln might escape.

A target system around Lincoln was examined in the light of climatological data, to determine under what circumstances any of these conditions might prevail, and to what extent Lincoln would be affected. Weapons in a range of 1 to 10 megatons (MT) delivered on the Lincoln SAC basewere considered. If the weapons were air-detonated, only blast effects would be experienced. If they were ground-detonated, blast could be coupled with a fallout problem. If the SAC base was not a target, only fallout from distant targets would reach Lincoln and no blast would be experienced. If the wind was in certain directions, Lincoln might receive no effects. The plan should be operational to the extent possible under each of these conditions. Let us now examine a few specific possibilities.

Should a 10-megaton weapon be used, a 5-psi overpressure would be experienced 6 miles from the burst, or through the center of town, resulting in maximum destruction within that radius.

The thermal radiation level at 6 miles radius would be more than 200 cal/cm^2, diminishing to 25 cal/cm^2 at 17 miles radius. Ignition of all combustible material might be expected in this area; however, Lincoln lies in a depression in the land, with slopes rising in all directions except to the northeast. A slight shielding effect (due to terrain) should be experienced at street-level in the center of town, and gives some hope of reducing the number of fires. However, the southeast section of town is on the slope facing the rising fireball, and would suffer the maximum effect corresponding to the distance from the burst.

In the case of a 1 megaton weapon at the SAC base, the area of total destruction would be contained in a radius of 2.7 miles, and the thermal radiation of 25/cm^2 in about a 6 mile radius.

A strong program to avoid accumulation of combustible debris in the streets and in the yards would make a significant contribution to the safety of the city from fire.

The fallout threat from 10 MT to 1 MT bombs at Lincoln AFB would depend on the wind direction. If the wind is out of the southeast, there is a good chance that little fallout will reach the city at all from a burst at the base. If the city is downwind of the base, then very substantial fallout covering much of the city must be expected. In the worst case, a 10 MT weapon with 50 percent fission, the maximum reference dose rate of 10,000 Roentgens/hour may be anticipated, leading to an unprotected total dose of 30,000 R. over a two-week period. In the case of a 1-megaton weapon, a narrow band of heavy fallout about 4 to 6 miles wide and about 20 miles long would be deposited downwind of the burst. Within this band would be a reference rate of about 3,000 R/hour, leading to a total exposed dose of about 10,000 R. within the band. Outside of this band the fallout levels diminish quite rapidly, so that heavy fallout on the city would be localized.

The effects from other targets surrounding Lincoln are limited to fallout. Such fallout may be of low or high intensity. The targets are hardened, and a pattern of 20-MT bombs is quite possible. The fission products from a 40-MT burst at a distance of 50 miles upwind from Lincoln could cause reference dose rates in excess of 3,000 R/hour.

It is clear that protection from the worst possible cases is not possible, but protection that is provided will be effective in most instances.

Warning times are variable. In the case of a burst at the Lincoln Air Force Base, the warning may be only a few minutes, in which circumstance the emphasis should be on everyone getting into the nearest, best-covered space, in order to have the greatest chance of surviving the immediate blast and heat. Following the burst, a 30-minute period can

be expected before the fallout arrives, and this period used to find better shelter.

For an attack on a distant upwind target site, say 50 miles away, the warning of arrival of fallout may be 2-3 hours, depending upon wind, allowing a more orderly progression to shelter.

It is clear that the plan to be discussed in this report to utilize existing shelter can successfully meet only some of the conditions described. However by considering each situation and working out related operational actions, the over-all effectiveness of the shelter plan will be maintained regardless of the situation. Thus, much depends on the thoroughness with which civil defense authorities have prepared their plans for the various eventualities, and on the people's familiarity with and cooperation in carrying out whichever contingency plan becomes necessary.

V CIVIL DEFENSE IN LINCOLN

The Phase I and Phase II Shelter Surveys have been completed in Lincoln and the supporting data are in the hands of the Corps of Engineers and the Lincoln-Lancaster County Civil Defense director. Lincoln's progress to date in the National Fallout Survey compares favorably with the progress made in the nation as a whole.

Both the State of Nebraska and the City of Lincoln have formal plans for survival in the event of disaster. Some elements of these plans as they apply to the National Fallout Shelter Survey are discussed in Secs. V-A through I, below.

A. Organization

Lincoln is governed by a mayor-council form of government. The mayor and six councilmen form a seven-man council, which is elected on a nonpartisan ballot by popular vote. The council appoints five directors to head up the following five departments: (1) Public Welfare and Safety, (2) Accounts and Finance, (3) Parks, Public Property, and Improvements, (4) Planning, and (5) Personnel.

Lincoln is the county seat of Lancaster county. Three county commissioners plus ten other officials administrate the county.

The Lincoln city council, together with the Lancaster county commissioners, have jointly appointed the Lincoln-Lancaster Civil Defense Director. The Lincoln-Lancaster CD Director has CD responsibility for the city of Lincoln and all rural areas contained within the county of Lancaster.

The Lincoln-Lancaster Civil Defense Director (City Civil Defense director) has appointed the following aides to assist him: (1) a Deputy Director, (2) a secretary, and (3) five Deputy Assistant Directors for Operations, Intelligence, Administration, Communications, and Support. The Lincoln-Lancaster County Civil Defense Organization chart is shown in Fig. 4.

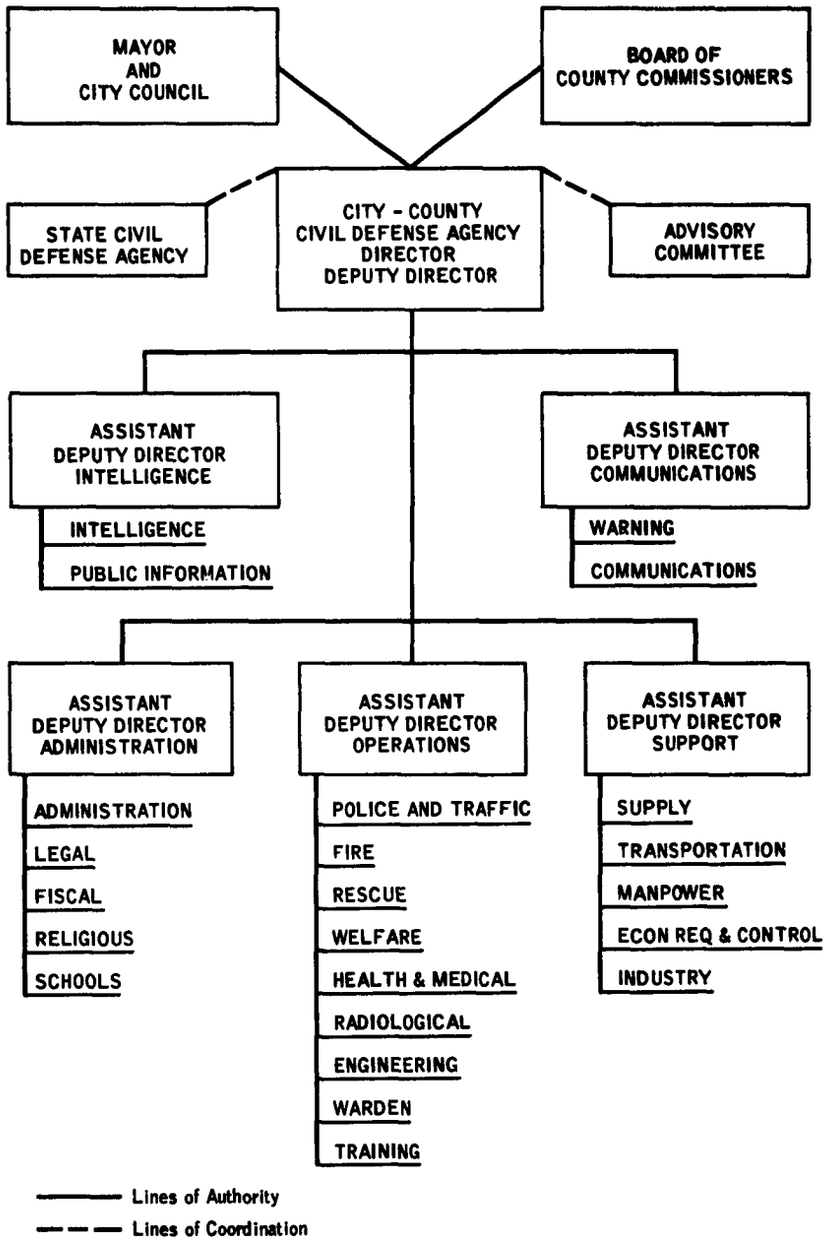


FIG. 4 LINCOLN-LANCASTER COUNTY CIVIL DEFENSE ORGANIZATION CHART

The Lincoln-Lancaster Advisory Committee serves as an important liaison between city and county government in the Lincoln area. The Advisory Committee is composed of fifteen prominent citizens, selected jointly by the Lincoln City Council and the Lancaster county commissioners. This committee meets the first Wednesday of the month and discusses such subjects as financing, shelter licensing, and stocking.

The Lincoln-Lancaster Civil Defense Operating Staff meeting is held each first Friday of the month.

On the state level, civil defense in Nebraska functions under the Adjutant General, who is appointed by the Govenor. The Adjutant General reports directly to the Govenor and is responsible for both state civil defense matters and the state National Guard. The Nebraska State Civil Defense Office assists the city of Lincoln and other political subdivisions in organizing and maintaining local civil defense operations. A deputy State Civil Defense Director reports to the Adjutant General. Reporting to the Deputy State Civil Defense Director are five Assistant Directors for Operations, Administration, Resources, Information, and Government Continuity.

The Region Six Civil Defense Office renders assistance to the Nebraska Civil Defense Office in accordance with national objectives.

B. Finances

Matching funds are provided by the Federal government to underwrite state and local government civil defense expenses that qualify, to the extent of 50 percent of both the administrative and equipment costs. Some equipment items qualify for more or less than 50 percent matching funds. The Federal government grants no matching funds to aid in the maintenance of shelters.

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The proposed 1962-63 budget for Lincoln-Lancaster county civil defense operations is about $33,600. Of this total the Federal government will provide matching funds in the amount of $12,900, or approximately 39 percent of the total.

C. Shelter Licensing

Approximately 380 separate, potential shelters were identified in Lincoln in the Phase I survey. About 171 of these shelters were found to possess a protection factor of 40 or greater and a capacity for 50 or more persons. To date, nearly 150 of these 171 shelters have been licensed.

About 175 building owners in Lincoln have been contacted for license privileges. Most building owners, representatives, or lessees have been courteous and cooperative when approached by Civil Defense officials for permission to license their facilities.

D. Unique Shelter Facilities

The Nebraska State emergency operating center is located underground in a new blast-resistant shelter located on the site of the National Guard Armory in Lincoln. This emergency operating center is designed to house the Governor and his staff, the state legislature, the state National Guard heads, and the State Civil Defense staff. In the event of an emergency, this center would receive instructions from the Region Six and Department of Defense offices, and transmit information to communications centers throughout the state.

Figure 5 shows a typical basement shelter, in which a considerable amount of space is taken up by storage. This is a problem in most basement shelters, and must be considered in making basement shelters operational.

The city of Lincoln's central communications center is located underground in the city's new Irvingdale shelter. The Irvingdale shelter was converted from an underground concrete water reservoir at a cost of $111,000 with Federal financing. The shelter has a capacity

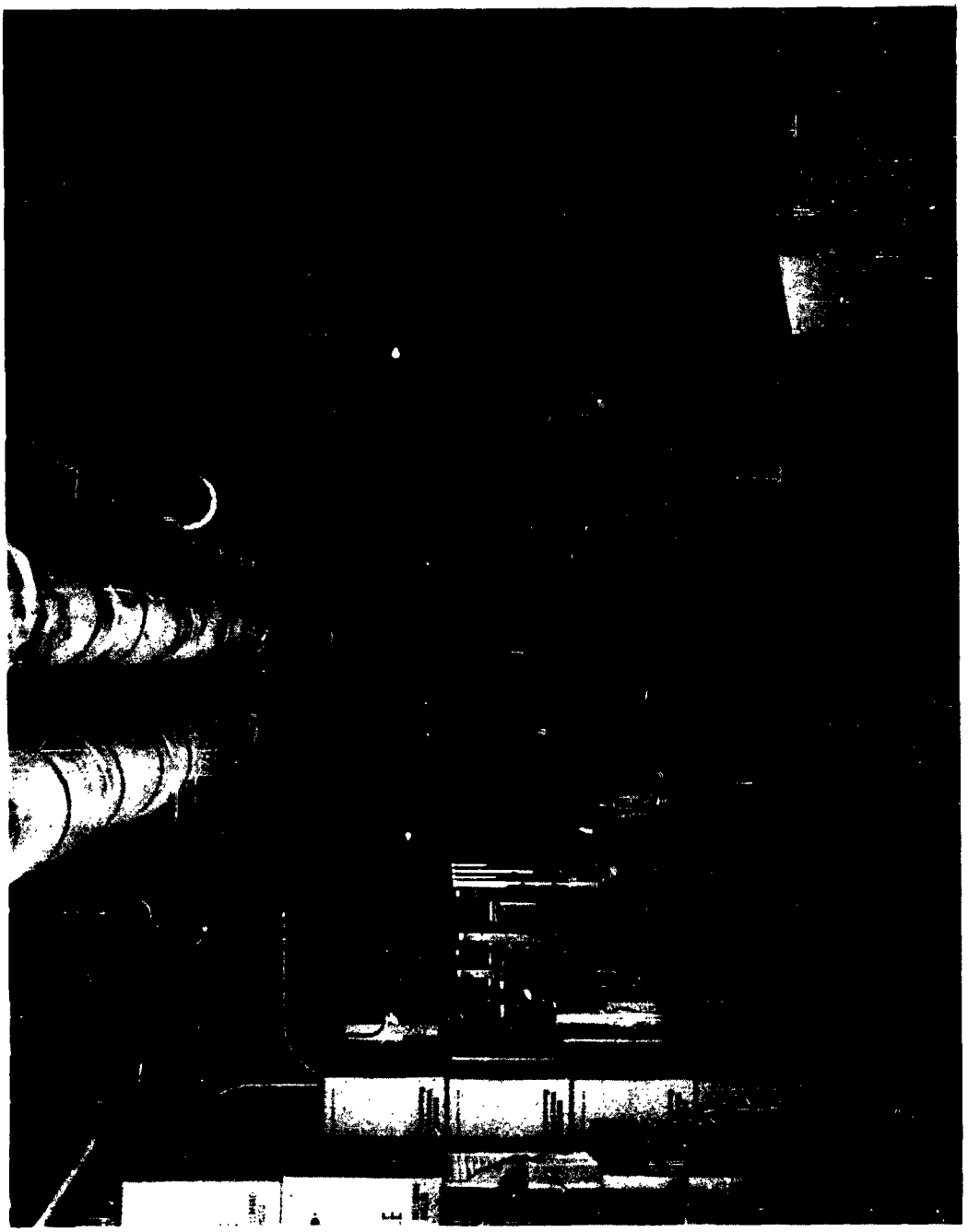

FIG. 5 SHELTER CLUTTER

of 1500, and will serve as a base for radio communications to city shelters in the Citizens Band frequencies. The city of Lincoln and Lancaster county jointly bear the cost of maintaining the shelter. The Irvingdale floor plan is shown in Fig. 6.

One of the larger banks has constructed a shelter in its basement capable of housing 613 persons. The shelter space is available on a first-come, first-served basis. The bank shelter is stocked with blankets and medical supplies and sufficient food supplies to feed the 80 building employees for two weeks. Figure 7 shows a portion of the bank shelter, including some of the stocked shelves.

On the outskirts of Lincoln is the Robbers' Cave. The caverns here were formed by subterranean waters and will shelter about 250 persons. The Robbers' Cave is a tourist attraction in Lincoln and will be stocked with survival rations. Figure 8 shows one of the tunnel branches.

A most unusual shelter is located approximately 45 miles from Lincoln in Elkhorn, Nebraska. The Roberts Dairy Company at Elkhorn has constructed a $35,000 underground shelter for its cows. This facility will provide for approximately 250 cows. The Roberts Dairy Company has announced plans to deliver bottled, sterilized water to its customers, for use principally during an emergency.

Naval ammunition warehouses located in Hastings, Nebraska, about 90 miles to the southwest of Lincoln, are being considered as potential shelter spaces by Lincoln Civil Defense officials. The plan is to use Hastings either as a relocation center following an attack, or as a place where Lincoln citizenry might find refuge during a pre-attack period of tension, if time permitted. These earth-covered munition warehouses are scheduled to be empty by 1966, and then could permit the sheltering of approximately 330,000 persons. At present there are about 165,000 shelter spaces in the Hastings warehouses. Within a 50-mile radius of Hastings there are about 155,000 inhabitants and within 80 miles there are approximately 300,000 persons. Figure 9 shows part

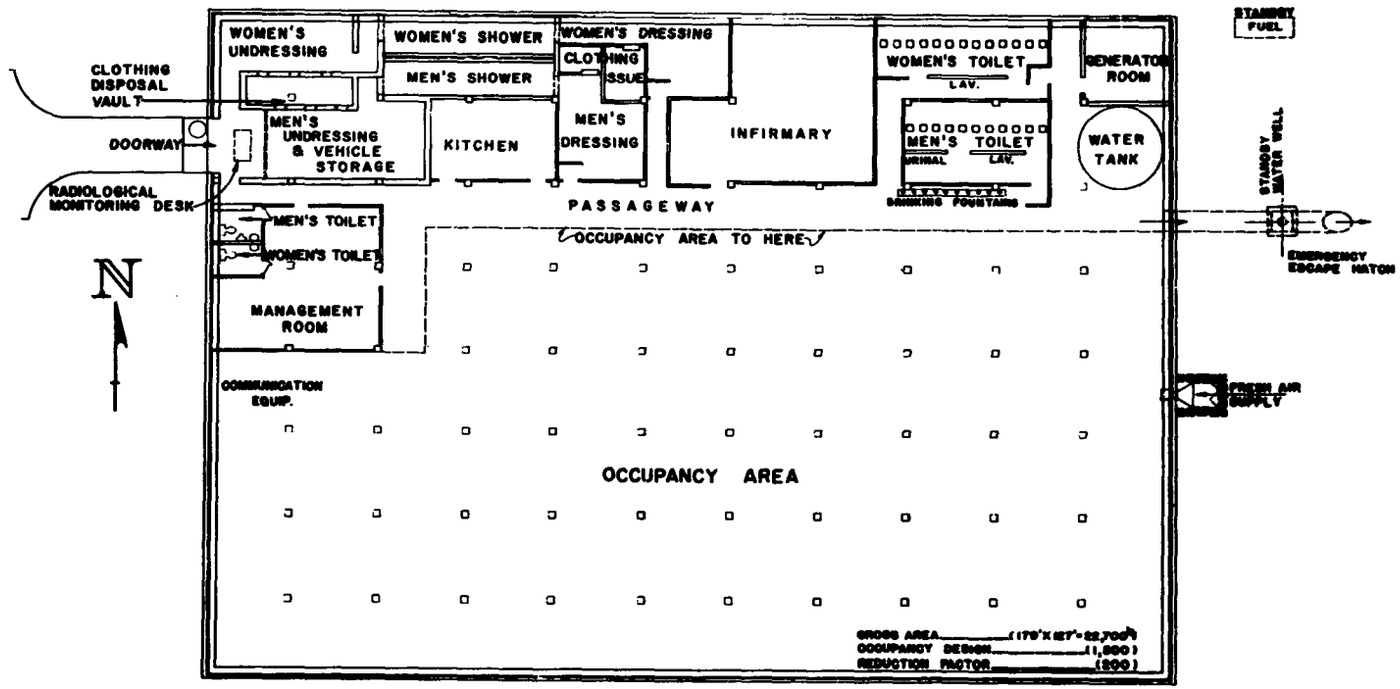

FIG. 6 IRVINGDALE FLOOR PLAN

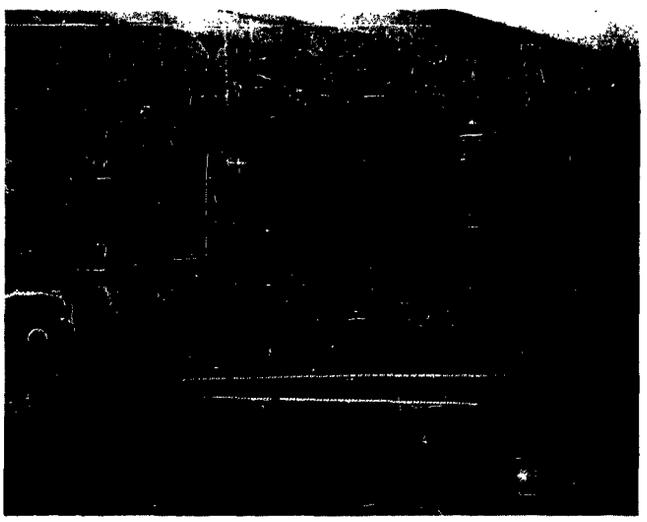

FIG. 7 BANK SHELTER

FIG. 8 ROBBERS' CAVE

of the Hastings munitions warehouse from the air. Figure 10 gives a closeup view of rows of these potential shelters and gives some feeling for their size.

Section VII C of this report discusses in greater depth the problems of evacuating to Hastings.

E. Shelter Marking

The Corps of Engineers has marked about 84 shelters, out of a total of 150 of those licensed. The Corps of Engineers is now out of funds and has withdrawn its crews from Lincoln. The Corps has no plans for marking the remaining 66 licensed shelters.

Initially the Corps was authorized funds to mark only shelters that had a protection factor of 100 or greater. The number of shelter facilities in this category numbers about 84.

Recently the Federal government has authorized the marking of shelters with a protection factor of 40 to 100. However, the Corps of Engineers has not been authorized funds for this work. The marking of the 66 shelters in this category is the responsibility of the city of Lincoln.

The Federal government is furnishing the signs for shelters having a protection factor of 40 to 100 and the materials to fasten these signs. It is the responsibility of the city of Lincoln to furnish the labor required to install these signs on the shelters.

F. Shelter Stocking

The federal stocking of licensed shelters in Lincoln has recently gotten under way. Since the Federal warehouse for shelter supplies is more than 25 miles from Lincoln, the government will pay the costs of delivering the supplies to each shelter curbsite.

About 35 shelters, comprising approximately 15,268 shelter spaces, had been stocked by the end of February, 1963. Nearly all this stocking was accomplished within a period of one month. The stocks are being

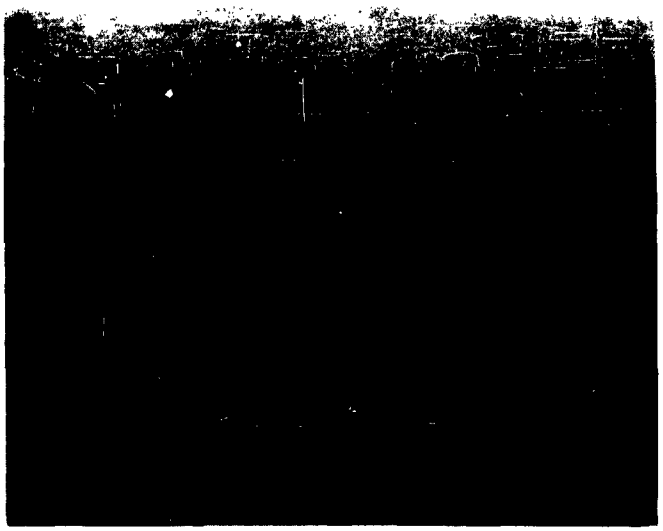

FIG. 9 MUNITIONS WAREHOUSES FROM THE AIR

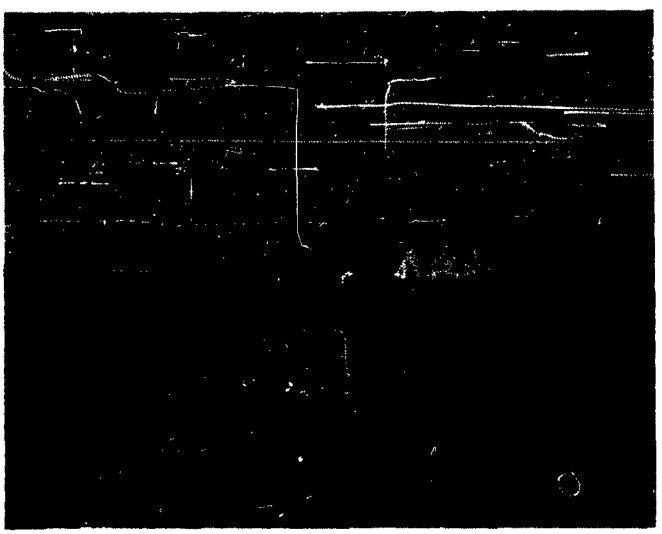

FIG. 10 ROW OF MUNITIONS WAREHOUSES

shipped by the government from nearby Omaha, and located in a central warehouse in Lincoln rather than on the respective shelter curbsites.

The Lincoln Department of Public Works is using trucks and personnel from the Streets Department to move these supplies to shelters. This work is done during the regular working hours and is being financed with city funds.

G. Training

Both the Lincoln-Lancaster County Civil Defense Director and his Deputy Director have attended courses at Battle Creek, Michigan and Alameda, California, in various phases of Civil Defense. The courses have proved very valuable. These courses include training in "Shelter Management, Instruction, Planning and Operations."

Three other Lincoln Civil Defense officials have been trained in shelter management courses at Battle Creek, Michigan. These three shelter school graduates, together with the Deputy Civil Defense Director, are in the process of training other shelter managers for local shelter facilities in Lincoln.

The course consists of a total of 12 hours instruction. The course is structured to provide 6 sessions of instruction, each being two hours in length. As much as possible, the course is given on days of the week and during hours that meet the convenience of the students.

Up to date, a total of about 15 students have been trained in pilot sessions. This training has all been received since January 1, 1963. By the end of 1963, Lincoln CD instructors hope to have trained about 250 shelter managers.

Lincoln officials plan to ultimately train sufficient shelter managers to allow for an inventory of 600 to 800 managers. This inventory would be equivalent to 4 to 5 managers per shelter.

The course will be offered on a continuing basis in the future, in order to train shelter manager replacements to replace those who drop out or move away.

As signed licenses are obtained, the building owner or occupant might be solicited to take (or send some of his employees to take) the shelter management course, and become a civil defense volunteer for this work. This would have several advantages. The shelter manager would be thoroughly familiar with the building; in an emergency he would be acting with full CD authority not as an agent of the owner; and at least during working hours, he would already be there.

H. Survival Rations

Peculiar to Lincoln has been the development (by the Nebraska Department of Agriculture) of survival rations in order to help create a market for Nebraska's grain and dairy reserves. These rations include wheat wafers (known as the Nebraskit), corn wafers, milo wafers, milo-wheat wafers and flavored milk bars.

These rations can now be purchased by the general public.

I. Public Relations

Both the Nebraska state and Lincoln city officials concur that public relations is one of civil defense's biggest problems. They are concerned with how to publicize a disaster plan so as to receive the public cooperation necessary to make the plan succeed.

The Lincoln-Lancaster County Civil Defense Director recognizes the need for effective public relations. Each month he mails a Lincoln-Lancaster Civil Defense newsletter, the "Defender," to 400 civil defense volunteers. Past issues of the Defender have reported on such items as the opening of the Irvingdale community shelter, the development of Nebraskit, and on new appointees to the Lincoln-Lancaster Civil Defense Advisory Committee. Experience demonstrates that Lincoln Civil Defense volunteers are interested in serving for about 18 to 24 months and then tend to become inactive.

The Lincoln Star, a local newspaper, carries a daily column entitled, "What to Do." This column describes events of interest to sightseers along with special conferences and club meetings. One item

appearing daily under "Sightseers" is the following: "Irvingdale Civil Defense Shelter, 18th and Van Doran, tours 2-4 p.m. daily except Monday." Over 3,000 persons have toured the shelter since its dedication April 10, 1962.

Lincoln has groups that actively oppose civil defense. Eighty-one faculty members of the University of Nebraska published a two-column advertisement in the Lincoln Star this summer directed "To the People of Lincoln." The article asserted that the faculty members were "deeply disturbed by current developments involving civil defense in Lincoln." The article proposed to explain that "shelters are not the answer" and that "all sensible Americans recognize that their hope for survival of our democratic life lies solely in negotiation with the Soviet Union."

A student group at the University of Nebraska has also been openly opposed to the shelter program.

VI PLANNING FOR CIVIL DEFENSE IN LINCOLN

Lincoln Civil Defense officials find themselves operating in an interim, standby stage of the shelter program. Their responsibility of sheltering a daytime population of 143,000 is an imposing one in view of the fact that there are only 122,000 spaces with a protection factor of 40 or greater that currently qualify for federal stocking.

This problem could conceivably be magnified because of the relationships between the people of Lincoln and many of the 6,600 civilian personnel of the Lincoln Air Force Base. Providing shelter for the Base personnel is the responsibility of the Federal Government. However, in the event of an attack, many of these people might try to return to Lincoln to rejoin their families (resident in town) or to flee the most obvious local target. Such an attempt cannot be headed off by ukase or by "plan," and no doubt the burden on Lincoln's shelter facilities could be increased by any number up to 6,600. The base is only six miles from Lincoln, no farther from the areas of shelter concentration than some of the outlying sections of the city.

As confirmed in Table I, there are 58,000 spaces having a protection factor of 40 to 99 and approximately 100,000 spaces with a protection factor of 20 to 39.* The sheltering of Lincoln is further complicated by the fact that little shelter space with a pf of 40 or greater is located in the residential, fringe areas of the city. The fringe areas of the city do offer, however, substantial capacities with a pf of 20 to 40. Most citizens would need to converge on the downtown section of the city in order to find shelter space with a pf of 40 or greater.

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* It is to be understood that the 100,000 spaces of pf 20 to 40 is an estimate made by the A&E's at the time of the original Phase I survey. A confirmatory survey would be necessary before these shelters could be marked and stocked.

Table I

INTERIM SHELTER GUIDE

Order of Preference	Protection Factor	Available Spaces	Cumulative
A	100 or Greater	64,000	64,000
B	40 to 99	58,000	122,000
C	20 to 39	100,000±	222,000

Note:

Some sources of additional space:

(1) Add 25%, by crowding

(2) Home shelters: Approximately 40

(3) Use shelters with a capacity of less than 50 people

(4) Use shelters with a pf below 20

(5) Evacuation: 330,000 spaces, ninety miles distant

A. Informing the Public

In order to arouse the public consciousness of the need for concerted action, a program of frank public information paralleling that which Lincoln has had to date would be suggested.

It is a policy question for responsible local officials to decide how much information to give the local citizens about the quality of shelter they will be using. Lincoln's people could be informed inasmuch as there is insufficient shelter with a protection factor of 100 or greater, additional shelter spaces are being provided by marking space with less protection. On the one hand, telling the public of the quality of shelter to which they are assigned could result in an impetus on the part of the public to secure an upgrading of the shelter. This could give the program a boost. On the other hand, it could have a negative psychological impact if the shelters were ever used, especially on those who used the lower quality shelters. These are the factors that must be weighed by the community.

The citizens of Lincoln would be informed that since there are insufficient shelters with a protection factor of 100 or greater, additional shelter space needs to be provided.

Again it is a matter of local policy whether the public should be asked to enhance the program out of local funds. The public could be advised that the quality of their civil defense program will largely depend on the extent to which they participate with their own time, talent, and money in civil defense. They could be told that it is the experience of other communities that a civil defense program is not likely to be successful until the public interest is at a high level.

Section VI E discusses some techniques of informing the public. The public could be informed that shelters with a pf of 40 or greater, though recorded, are only in the process of being stocked. While plans envisioned in this report will utilize some shelter in the 20- to 40-pf category, no Federal funds are now available for provisioning such shelter. Until the shelter can be stocked it should not be marked, as it would not be effective and the whole program could be jeopardized if public attention were drawn to such an obvious defect. Even after the pf-20 shelter is stocked and marked, it should be emphasized to the public that the shelter program is in an interim stage, and that present actions are a step toward a program we are building for the future.

B. Assignment of People to Shelters

In Table I all shelters in Lincoln are listed with an order of preference, according to protection factor. The shelters are graded from A, if the protection factor exceeds 100, down to C if the protection factor is 20 to 40. All shelters with a protection factor of 20 or greater could be marked with the official shelter sign. At present the Federal government is marking shelters with a protection factor of 40 and better.

The population could be assigned by census block, in a manner fully described in Vol. II of this report. (It is partially described in Vol. I, chapter VIII.) Blocks should be assigned to the nearest shelter. In choosing between shelters of various protection factors, the shelters with the highest protection should be filled first. Using these same criteria, the fringe area shelters would be filled before blocks of people in the fringes are assigned to shelters located some distance away.

After the fringe area shelters are filled, the planner can begin to make block assignments to shelters located in the downtown sections of the city. The blocks are assigned within areas bounded by concentric circles which move progressively away from the downtown area. The small-sized shelters might be filled first, leaving the larger shelters to be filled by whole groups of blocks near the city's outskirts. This has the advantage of assigning large groups of people, who are a considerable distance from shelter space, to a common shelter. Flexibility for future assignment is also added by this plan in the event that urban renewal or some other development might create a high density area, providing new shelter as well as the requirement for it.

As often as possible, employees in office buildings should be assigned to shelters located in the buildings in which they work. In the event there is no shelter in their office building, they should be assigned to the nearest shelter. The office employee thus will likely have two shelter assignments, one in the event of a night attack and the other in the event of a day attack.

C. The Planning Staff

The task of assigning a population to shelters and implementing this plan is one of the most difficult that a civil defense staff faces. The problem of shelter assignment is a continuing one, not a "one-shot" effort.

The planners for shelter assignment must be capable of accurately handling a large mass of data. Persons trained in accounting,

engineering, statistics or city planning might be expected to possess this capability. Such people might be found in the city planner's office, or they might be drawn from the outside on a consulting basis for the period of planning. Since operating a system is quite different from planning it, it might be best that operating personnel be separate people from the planners. In this way, the execution of the plan could start as any section of it became ready.

It might be best to set up the CD planning staff separate from the CD operational staff that already exists. If this were done, the operational staff would not be overburdened and would be free to advise and make inputs to the planning staff.

A CD planning staff might consist of, or consult with, many types of people with varied backgrounds and educational levels. The following list includes a few of the kinds of people that either might be on a planning staff or could be consulted in order to make effective shelter assignment plans:

(1) The Lincoln CD director, deputy director and staff
(2) A member or members of the A&E survey team
(3) Corps of Engineers
(4) Regional CD offices
(5) State CD offices
(6) Business leaders
(7) The City Engineer
(8) The county planner
(9) The city planner
(10) The administrator of building permits
(11) A member or members of the following city departments: Fire, Police, Water, Health, and Sewage
(12) A draftsman to make maps and plot layouts
(13) A technical illustrator to prepare briefing charts, diagrams and posters
(14) A photographer to record air photographs and building photographs

(15) Experts in communicating plans to the public from the following industries: newspapers, radio, television and advertising

(16) Ministers and spiritual leaders who will advise the planner and also serve to enlist the services of their congregations

(17) Traffic planner

(18) Leaders from major political parties

(19) Labor union officials.

The above list is suggestive of sources of information and support of the types that would be helpful to a planner.

D. Enlistment of Individual Participation

At present, Civil Defense in Lincoln is directed by a director, a deputy director and a small supporting staff. A force of about 400 citizens currently serve as Lincoln Civil Defense volunteers. This volunteer force brings the important quality of individual participation to the Lincoln Civil Defense program.

Lincoln's civil defense program could be aided considerably by expanding this individual participation to include more of the citizenry. The ultimate goal is to have one volunteer per census block who could be readily identified with, and work with, a small working group residing within the block. About 2700 volunteers would be needed to satisfy this goal. This large corps of workers would serve both to bring individual participation to the Civil Defense program and to enlist added individual participation from the population at large. Those workers would be responsible for pre-in-shelter duties. These workers would play somewhat the same role played by air raid wardens in England during World War II. Among other duties the wardens in England acted to inform the public of Civil Defense measures and to direct them to shelters. In this case, the title "shelter representative" is likely to prove a better title than "warden." "Warden" seems to imply regimentation, while shelter representative gives the image of a coordinator. Alternative titles might include neighborhood coordinator, shelter coordinator and neighborhood representative.

At the outset it should be recognized that a plan of this scale is far beyond the present capability of achievement. At best it would likely take several months, and perhaps years, to organize and train such a force of workers successfully. Such a program would also require substantial funds. It is clear, therefore, that a more modest goal is required for the immediate future. For the present, plans must be communicated by some means through the mass media.

E. Acquainting the Public with the Shelter Plan

Efforts must be begun at once to acquaint the general public with the shelter plan and to bring them up to date as the plan progresses.

One successful method of doing this is through wide distribution of a "Recommended Family Plan" booklet outlining what each family should know and what it should do in an emergency. A pamphlet describing such a plan can be found in the Appendix.

It is recommended that this be printed in lots equalling one month's supply, so that the booklet can be updated and kept current after the first issue. Such a leaflet can be produced for about 1¢ a copy. If printed with smaller type, it might be put on a single sheet. Folded once, the sheet would make an easy-to-handle set of instructions.

The original distribution might be made in several ways. The method that offers best coverage is to get the telephone company to send it out with the new directories. Another way is to have school children carry it home and report back that the parents have read it. Other ways are to send it out with water bills, electric bills, gas bills, etc. None of these systems achieves absolute coverage, and unless care is taken there will be duplication if more than one system is used. All of these systems have been used with some degree of success at various times. A mailing to "Occupant" has not been too successful. Another successful means of getting good coverage is to have the Boy Scouts undertake to deliver to every home and business house, in a single day designated by the mayor for that purpose. This was done in San Francisco, resulting in about 85 percent coverage.

After the original distribution copies should be easily available to the general public. Placing them in public libraries, to be displayed in wire racks with other CD literature, has been successful.

Every effort should be made to publicize this Family Plan and have people talk about it. Television and radio forums, newspaper interviews, PTA Forums--all based on this leaflet--have proven successful.

In San Francisco those calling up and asking for the "Family Plan" (some 50,000 in six months) were asked where they had heard of it. More than 80 percent said they had heard of it in conversation with neighbors. The "back fence" grapevine is still effective.

By concentrating on the simple points contained in the "Family Plan" a great deal can be accomplished at small cost.

F. Stocking of Shelters

Under the present system only shelter facilities having a protection factor of 40 or greater and with a capacity of 50 or greater will be stocked by the Government. Local efforts and expenditures will be necessary for stocking shelters of low protection factors (20-39). When this is done Lincoln will have shelter supplies for its total population. The supplies provided by the Federal Government are sufficient to assure survival through the confinement period. They are austere, however. The citizen could be advised that his stay in shelter could be more comfortable if he were to bring extra personal supplies to the shelter if an alert should sound. Not many citizens would do this, even with encouragement by local officials, but nothing is lost by the effort.

Shelter Representatives might solicit shelter supplies from people in their blocks. Church organizations and other groups might be persuaded to supply supplemental stocks at least for shelters in their immediate vicinity.

G. Licensing and Marking

It is important that Lincoln CD officials secure licenses for facilities having a protection factor of 20 or greater in the portions

of town requiring them. It is not enough to license only those that the Federal Government is currently marking (protection factor of 40 or greater). Only 122,000 spaces can be found in facilities with a protection factor of 40 or greater, while over 142,000 spaces are required for the daytime population, excluding Air Base personnel.

If the federal government will not provide shelter signs for marking facilities with protection factors of 20 to 39, then the city of Lincoln should provide its own signs out of local funds. The costs involved in providing a few signs are negligible alongside the favorable result of providing thousands of the population with protection.

H. Police and Fire Department

During an alert, the 112 commissioned police officers should, if possible, be assigned to streets and intersections in order to provide traffic control. The city's thirty-eight traffic vehicles could be used to take officers to strategic traffic locations out of the downtown business district. The remainder of the officers--approximately 70--would then be assigned to locations near to or in the downtown section of town. At some point during the alert, the officers should then find shelter for themselves. It might be wise to assign each officer to a separate shelter so as to disperse their competence throughout the city.

Lincoln's 154 firemen should be assigned to shelters near the city's eight fire stations. The fire equipment might be needed at any time, before or after the attack. It is important that both the equipment and the trained personnel be located near to each other for ready accessibility.

I. Traffic Flow

Since the shelter assignment plan requires no one in Lincoln to move more than a mile and a half, there is no necessity for most people to drive to their shelters. Nevertheless, during an alert, it is quite likely that some people would attempt to reunite themselves with their families, and would attempt to drive home. This could bring about serious traffic congestion problems. During any daytime or early-evening

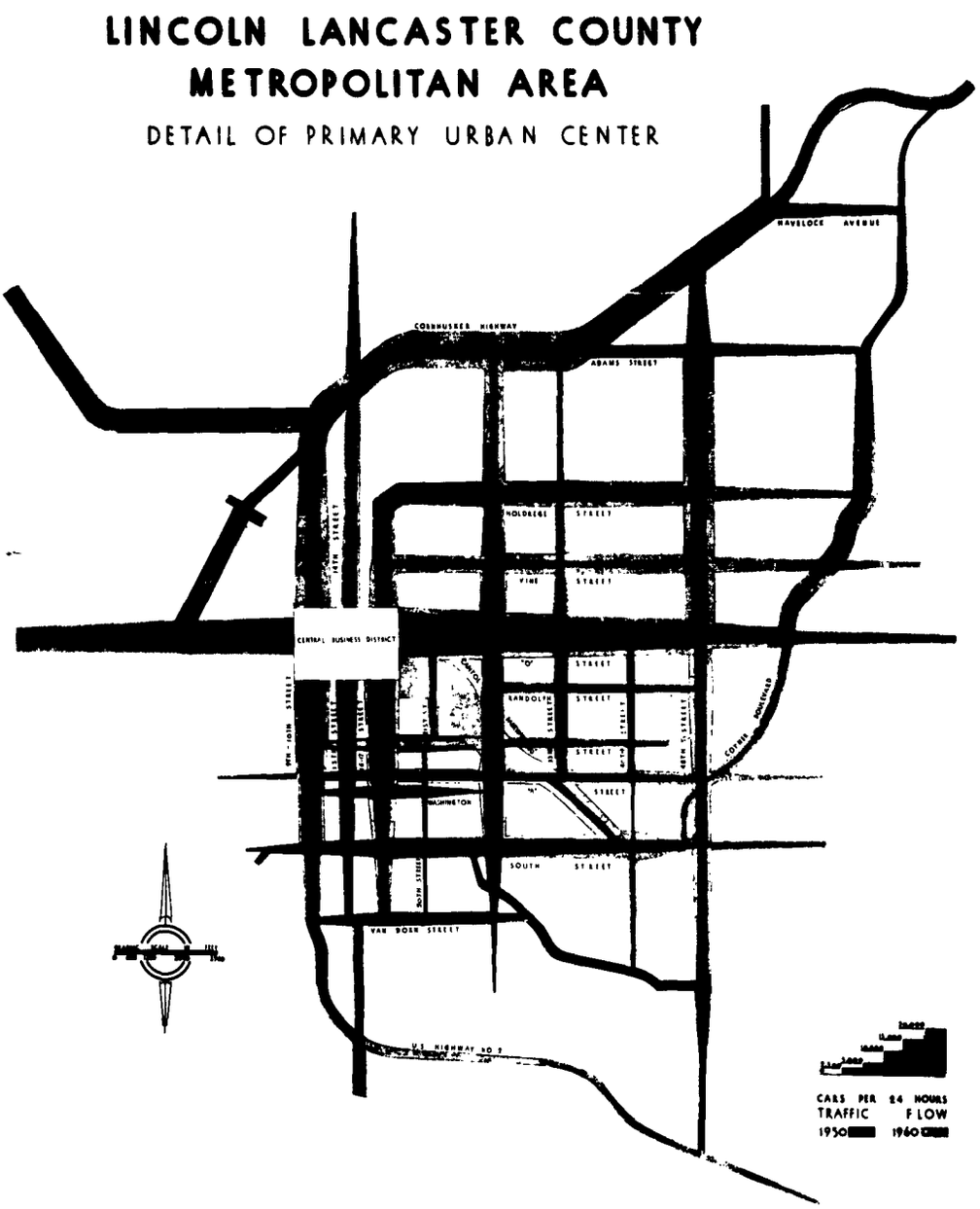
alert, of course, considerable motor traffic would already be on the streets. Police officers should therefore be dispatched to key traffic intersections and near the heart of the downtown business district in order to help the population move in an orderly fashion.

The CD planner needs to provide a careful analysis of the traffic problems in Lincoln. The cost of this is beyond the scope of this study, but engaging a traffic consultant to assess the traffic situation in Lincoln and make recommendations so as to achieve the most favorable traffic flow would be a justified expense. A diagram of the 24-hour traffic flow for the years 1950 and 1960 is shown in Fig. 11. The magnitude of the traffic problem is graphically portrayed in this diagram.

J. Family Regrouping

During a daytime alert, Lincoln's civilian labor force, totaling 60,000, should be encouraged to go directly to the shelter to which they are assigned which is nearest their work. They should not attempt to go home and pick up their families. Their own survival and the survival of many others would be jeopardized if downtown employees were allowed to crowd the streets by driving to their homes during an alert.

Lincoln has little shelter at the schools and needs to develop shelters near or on school property to meet this responsibility. Until adequate school shelters exist, school children should be sent to their homes if the alert is a "yellow alert." Parents should then take their children to the preassigned shelters. Children should be advised of two alternate homes in the neighborhood to which they can go in the event parents are not at home in an alert. The neighbors should be instructed to take the children to their own (the neighbors') shelters. Investigations have determined that ventilation is good enough in Lincoln's shelters to permit housing of at least 25 percent additional people. Therefore, some additional children in the neighbors' shelter would crowd the shelter somewhat, but would not be likely to create hazardous ventilation problems.



SOURCE: Comprehensive Regional Plan for the Lincoln City – Lancaster County Metropolitan Area of Nebraska

FIG. 11 24-HOUR TRAFFIC FLOW – 1950 AND 1960

During a "red" alert, school children might be sent to their homes if they are within ten minutes walking distance. It may be best, however, that they remain at the school under the responsibility of the school officials. This can only be a matter for local decision. Risks accompany either alternative; there is no guarantee of ten minutes' walking time in a red alert.

During a nighttime alert, the family can go as a unit to pre-assigned shelters.

K. Future Shelter Requirements

By 1970, Lincoln can be expected to grow to a nighttime population of about 165,000 and a daytime population of perhaps 183,000. Therefore, an increase of 35-45,000 shelter spaces will be required. Thus, the equivalent of about 45 shelters of 1000 capacity will have to be constructed by 1970, to keep pace with the increased population.

Lincoln officials must determine the short-term economic feasibility of upgrading the 136,000 shelter spaces having a protection factor below 100. There is a need to assess the feasibility of providing blast-resistant shelters of a "splendid" quality in new building construction or in the construction of separate shelters. An incentive program is being considered in the Government; local costs for upgrading will depend ultimately on the disposition of the incentive programs.

The future presents the challenge of supplying more shelters and upgrading those that exist. The shelter program is a continuing one and will require both the long-term attentions of dedicated leaders in civil defense and the support of the local citizenry.

VII ALTERNATIVE SHELTER ASSIGNMENT AND UPGRADING PLANS FOR LINCOLN

Numerous alternative plans might be considered by Lincoln CD officials in their desire to protect Lincoln's population with shelters. A few such alternatives are considered in the sections that follow.

A. First-Come, First-Served Basis

One plan would be to consider using only the 122,000 shelter spaces that have a protection factor of 40 or better. Were this plan adopted, 70,000 to 80,000 individuals would be left without official shelter in a daytime alert.

In this plan the citizens would be informed that there are only so many shelter spaces per census tract (or per census block), with a corresponding number of people to be sheltered per tract (or per block).

One advantage to this plan might result in bringing the lack of shelter space so forcibly to the people's attention that a concerted drive would be made by the citizens to acquire additional shelter space.

Disadvantages to this plan are likely to grow out of a fright situation if families rush to get their children and themselves into half enough shelter space. If assignments are made, the assignment of people to half enough shelters is worse than difficult. It would be most unfortunate to use a partial plan of shelter assignment when Lincoln has sufficient shelter space with a protection factor of 20 or greater, where many more lives could be saved in the event of a fallout situation.

B. Use All Shelters, Make No Assignments

Another plan might be to use all shelters in the city with a protection factor of 20 or greater. This plan would offer ample shelter space to the population but insufficient "high-grade" shelter with a protection factor of 100 or over. In this plan the people would be provided with maps and lists describing all the shelter space in the city.

They would be told which spaces possessed high or low protection factors. No assignment of shelters would be made, leaving the citizens to make their own selection. This is still a "first-come, first-served" option.

This plan has an advantage over the previous plan in that the whole population is provided with and advised of shelter space even though such space may be below a protection factor of 100. In this plan, Civil Defense officials are not faced with justifying the assignment of some to shelters with a high protection factor and others to shelters with low protection factors.

A disadvantage of this plan arises out of the confusion that would occur with most people trying to reach the "best" shelters. Undoubtedly, the convergence of automobiles on the downtown area would tie up traffic and prevent many from reaching any shelter in a reasonable time. Another problem arises in that many without a pre-designated shelter would become confused in an emergency and would not know where to go. A random distribution of people to all shelters better than pf20 would also result in many pf100 shelters being under-occupied.

C. Assign to pf20 or Better Only Where Needed

This would serve in sections of town not easily served by pf100 shelters even when within 1-1/2 miles. The advantage is that everyone would have an assignment, but provisioning logistics problems would be smaller than in alternative (B). The disadvantage is that some people have poorer shelter than others, which may cause non-cooperation.

D. Evacuation For All of Lincoln to Hastings

If time permitted, Lincoln Civilian Defense officials might attempt to evacuate the total population ninety miles to Hastings, Nebraska. The ammunition depot there consists of semi-buried bunkers having protection factors in excess of 1,000. After 1966, approximately 330,000 shelter spaces are expected to be available (see Figs. 9 and 10). This would equal two spaces for every person in Lincoln.

There is one major paved highway to Hastings from Lincoln, and two other less direct but usable routes, one paved and one graveled. If the traffic were one way, and access limited, in an emergency, it should be possible with active traffic direction to maintain an average speed of 25 miles/hour for the trip.

Under conditions of one way traffic, it has been determined in highway studies that drivers tend to space their cars according to the formula

$$S = 40 + .2V + .016V^2.$$

when S = minimum distances between cars in ft (center to center)

V = speed in ft./sec.

at 25 m.p.h. V = 36.6 ft./sec. and the spacing S = 69 feet.

This gives a traffic flow rate of 1910 cars per hour per lane.

If two lanes are used on each of the three roads, and the gravel road is assumed to have half the capacity of the paved roads, then a total rate of 4775 cars per hour could evacuate Lincoln to Hastings.

It is probable that the occupancy would average 3 people per car under these conditions, which gives a departure rate from the city of 14,300 persons per hour. It would therefore take 10 hours to empty the city, plus about 4 hours for the last car to leave Lincoln to reach Hastings. In 14 hours Lincoln could completely evacuate to Hastings. In a specific case only a portion of the population would leave the city, and the time taken would be correspondingly less. If evacuation to Hastings became a part of the civil defense plan for Lincoln, then a further study would be required to determine the effort required to maintain certain services during the evacuation period. These services would include:

(1) Traffic direction and emergency sign posting.

(2) Control of access to evacuation routes along the route.

(3) Fuel supply and emergency road service for vehicles breaking down en route.

(4) Rapid highway clearance in case of accident.

(5) Reception facilities at Hastings to assure rapid dispersal to shelter upon arrival.

It would also be necessary to survey the routes to determine potential bottlenecks which could prevent smooth traffic flow, and to assess the improvements needed to eliminate them.

The advantage of the plan is based on the fact that shelter space with a high protection factor would be available.

The disadvantages of this plan far outweigh any advantage. There are approximately 300,000 people living within a radius of 80 miles of Hastings. Undoubtedly most shelter spaces would likely be filled before Lincoln citizens arrived at Hastings. Such a mass movement would create almost impossible traffic conditions on the county dirt roads. In the event that attack never came, such an evacuation would be costly and would create great confusion and disorder for the city of Lincoln. It is also likely that the city could better recover from an attack if survivors were located in their own Lincoln environment, where they had equipment and surroundings with which they were familiar. The difficult choice here is between undoubtedly good shelter in Hastings, far away, and adequate-to-poor shelter nearer home in Lincoln.

In summary, some citizens might prefer to take their chances for survival by evacuating to Hastings or some other potential shelter area. Although the people have the option to seek shelter where they desire, evacuation is not recommended and should be discouraged.

In a post-attack period, evacuation may be desirable, depending on the extent and intensity of fallout and the location of food and equipment reserves.

E. Evacuation for Part of Lincoln to Hastings

It is possible that some of the population, particularly those living on the Southwest fringes of Lincoln, would prefer to take their chances by evacuating to Hastings, while the remainder of the population would find shelter in the city.

The advantage of this plan is that it would relieve the shelter load on Lincoln itself. This plan also would not dump the complete responsibility for sheltering Lincoln on Hastings. By this plan, the load of traffic (people and cars) would be reduced to some extent in Lincoln.

The disadvantages of this plan develop out of determining who should go to Hastings and who should stay in Lincoln. There is the possibility that no shelter will be available in Hastings when the Lincoln citizens arrive. Roads to Hastings would be filled with cars, and traffic would move slowly.

F. Evacuation to Outskirts of Lincoln

A plan of evacuating all or part of the people to locations 10 to 20 miles from the city seems to offer no advantage. The only motive would be to escape blast effects, but it would not be possible to get far enough away in the short warning times anticipated.

Disadvantages of this plan are apparent in that there are no mass shelters available for the population closer than Hastings. Survival odds are better if people stay in Lincoln in spite of the proximity of a possible target.

G. Upgrade Present Shelter Spaces

If funds were readily available, it would be highly desirable to upgrade shelter spaces with a protection factor of 20 through 99, up to at least 100. (The local A&E has estimated that the cost of upgrading spaces from pf40 to pf 100 would amount to about $4.00 a square foot, or a total of $1.25 million for the 31,000 spaces as first surveyed. An estimated $2.3 million would be required to include the 27,000 spaces later surveyed. No estimates have yet been made for upgrading spaces with a pf of 20 through 39.)

One advantage of this plan is obvious in that, given some time, the total Lincoln population could be treated with equal consideration. The standards for shelter set by the Federal government would be met, resulting in a higher factor of safety to the citizens as a whole. In the long run, this plan would be preferred over previous plans.

The greatest disadvantage in considering such a plan is that it would be most difficult to finance over the short term. State funds are most unlikely. City funds would be almost as difficult to acquire. Building owners are not inclined to "foot the bill." In the interim, while this plan is awaiting disposition, the citizens would have an inadequate shelter plan.

The use of sandbags to increase the protection factor of various facilities is a possible compromise, if permanent construction measures are not available. Sandbags can be used somewhat effectively to cover areaways and basement windows. Sandbags can be used to line the interior surfaces of walls in order to raise the protection factor.

The advantages in using sandbags are that they offer flexibility, are inexpensive, and do offer some protection. Sandbags can be placed in a building at any time and in many locations. The costs of sand and sandbags, of filling these bags, and of placing these bags, are cheaper then many types of construction designed to achieve an equivalent protection factor.

The disadvantages of sandbags are substantial. Sandbags are unattractive and not desirable to be placed in full view, except in an emergency. Sandbags may require bracing, if they are stacked high and are difficult to use as a ceiling protector. The sand is messy and large bags are heavy to move around. If the bags are pre-filled, they soon begin to rot. Sandpiles (for bag filling) tend to blow and wash away. It is not feasible to have sandpiles "everywhere" in town.

Because of their weight, the use of sandbags demands careful judgment. In the event that sandbags are planned for use in a building, it would be advisable to secure a professional opinion (A&E) as to the maximum number of sandbags that could be stacked or distributed over a given area without exceeding the structural design limits of any portion of the building.

The need for careful judgment in the use of sandbags can become critical when sandbags are to be placed on suspended beam floor systems. The recommended design live loads for suspended slabs might range from

50 to 250 lb/sq. ft. with about 125 lb/sq. ft. being common. Since sand weighs approximately 100/lb c. ft., no more than 1/2 to 2-1/2 inches of sand could be loaded uniformly over various suspended slab systems without violating the design code criteria. The danger of overloading further develops when people move into a building to find protection.

In contrast, up to 10 feet of sand (or 1000 lb/sq. ft.) might be safely loaded on top of a 4-inch thick reinforced concrete slab which is poured over a compacted sub base.

In summary, sand or sandbags are easy to think of, but actually difficult to use.

Because of building structural limitations, the use of sandbags should preferably be limited to covering up wall openings (such as area wells, windows and doors) and loading onto non-suspended structural systems.

H. Construction of New Shelters

It would be ideal to have funds and support to build new shelters of the types recommended and in the location where they would be most serviceable. Schools would offer ideal locations for new shelters. The schools are well-located relative to population distribution throughout the city fringe area. The school shelters should be large enough to house both the school children and the adults in the vicinity of the schools. In these shelters whole families could be protected. Children would not need to come home but could go directly into a shelter upon an alert signal.

The disadvantages of building a large number of shelters lie in the costs and the great amount of time required to complete such a project. The costs are actually low on the national scale, relative to the cost of military defense programs. Incorporating 30-psi blast shelter to new buildings was shown, in SRI studies, to cost 3-5% of the total building cost - a percentage comparable with earthquake- or fire-resistant construction costs. However, on the local level, the costs at the moment are too high for local initiative, and in the absence of Federal incentive

programs. An interim shelter program is needed during the present standby stage.

I. Use of the Data Processing Equipment in Shelter Assignment

The use of data processing equipment in recording shelter assignments could be most useful.

The companion report, Vol. II, titles "A Shelter Assignment Procedure" treats this subject in some depth.

VIII ASSESSING THE PROBLEM OF ASSIGNMENT

Although suggestions can be made with respect to methods for developing a shelter assignment plan, nothing can replace the importance of judgment on the part of the person making shelter assignments. The main purpose of this report is to provide some quantitative bases for judgment. No city's problems can be solved at a distance or by some non-local authority. The purpose of a document such as this is to discuss the range of problems and a range of possible solutions. The following discussion merely calls attention to some of the matters a planner must think about previous to the actual assignment effort. Vol. II deals with actual assignment.

The use of shelters with protection factors of 20 to 100, in addition to those of 100 and above, makes it possible to place all of Lincoln's population under cover. Using shelters of 20 to 100 protection factor serves to disperse shelters more evenly throughout the city, so that most people are no more than a mile and a half away from a shelter in the daytime. The use of shelters with a protection factor of 20 to 100 also provides an excess shelter capacity which is essential to a successful shelter assignment program.

It is to be understood that shelters with 20 to 40 pf are vulnerable under conditions likely to occur in areas of heavy fallout concentration. In general, such areas would not be large, and the use of low-category shelters can be recommended provided there is some method of evacuating people from areas that receive excessive fallout. The mobility-after-attack system discussed in Sec. X outlines such a method. Mobility is a possibility for improving the operation of a survival system, though it is no substitute for adequate, high-protection factor shelter.

Because of population shifts, there should be separate shelter plans for daytime and nighttime assignment. The criteria for assignment will require that people be assigned to shelters nearest to them,

and also to shelters with the highest protection factor. The local planner will have to make decisions as to which of these criteria should dominate in a given part of the assignment task.

There are many methods by which a CD planner may assign a population to shelters. One method of approaching the problem of assignment is outlined in the paragraphs that follow, and the sequence of primary steps is depicted in the working diagram of Fig. 12.

A separate and supplemental report ("A Shelter Assignment Procedure," Vol. II of this series) is being issued which describes a specific assignment plan by block. This supplemental report will describe and suggest solutions for many of the problems connected with shelter assignment, and will point up some of the ways whereby a computer will prove useful in the assignment process.

The supplemental report, however, takes up where this discussion leaves off, so that it omits the preliminary items discussed below, and deals immediately with the actual process of assignment.

A. Map of Shelter Locations

Experience in this study indicates that a map of shelter locations is about the first tool to be prepared in approaching a shelter-assignment plan. A map of Lincoln, at least 30 by 30 inches, complete with census tracts and blocks is the basic map with which to work. The shelters could be located on the map with either colored dots or pins. The dots might be in three different colors, each color indicating a separate grade of shelter. As an example, the following colors might be selected:

(1) Orange for shelters with a protection factor of 100 or greater.

(2) Yellow for shelters with a protection factor of 40 to 100.

(3) Green for shelters with a protection factor of 20 to 40.

It has been found effective to use a basic map with the tracts and blocks outlined in black. Three transparent acetate overlays can then be used to locate the three types of shelters (see Fig. 13). The first overlay is placed over the basic map, with the orange dots representing

WORKING DIAGRAM

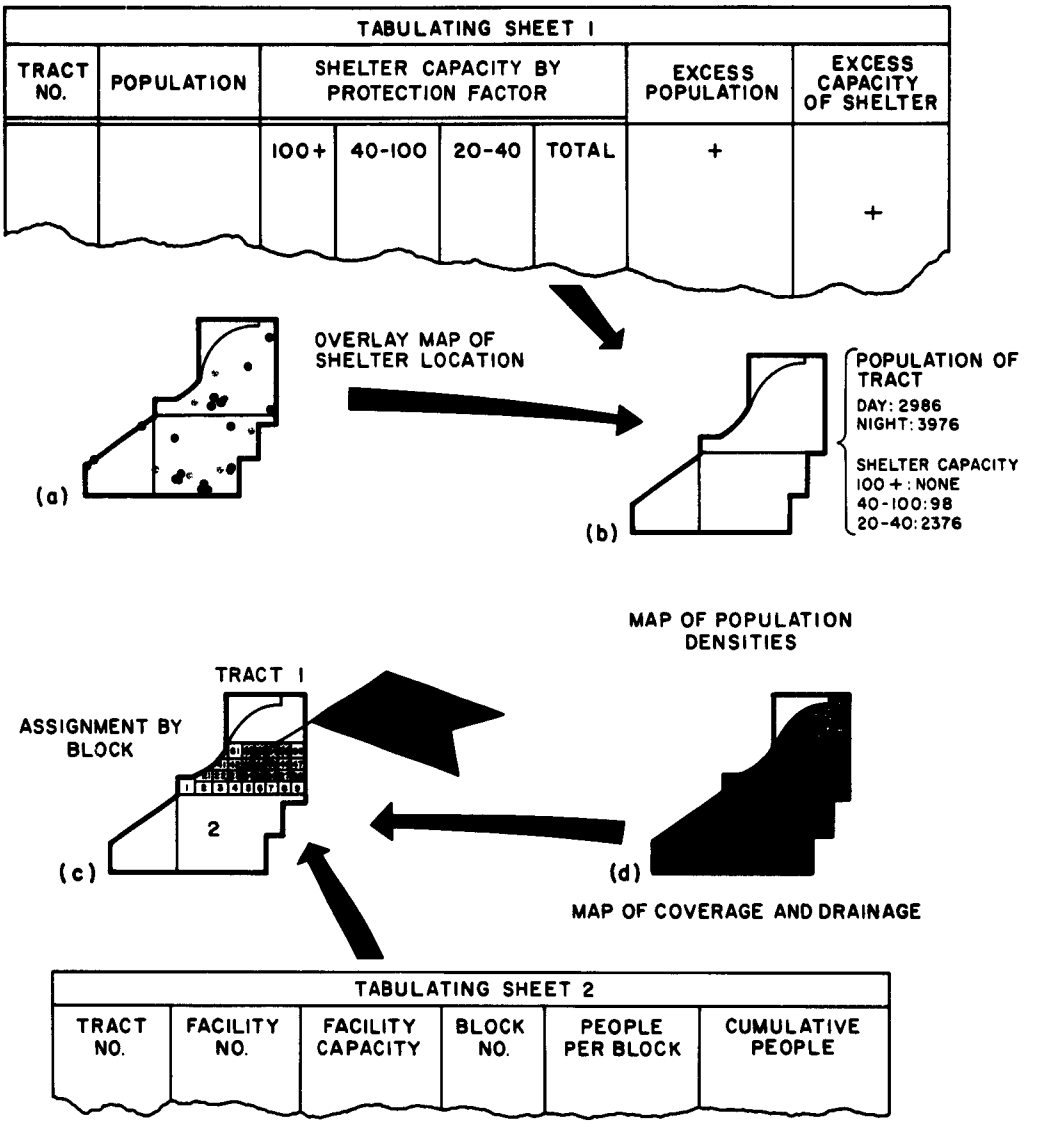


FIG. 12 WORKING DIAGRAM

shelters with a protection factor of 100 or greater. The shelters with a protection factor of 100+ are followed by the second overlay, which locates shelters having a protection factor of 40 to 100, using yellow dots. Finally, the shelters having a protection factor of 20 to 40 are located on the third overlay, using green dots. The three overlays help greatly to simplify the interpretation of numerous dots piling up on each other, particularly in the downtown district where shelters are numerous. The overlays also help to assign shelters on a basis of order of preference (see Table I), since, wherever there is a choice, high-protection shelter would be chosen over low-protection shelter.

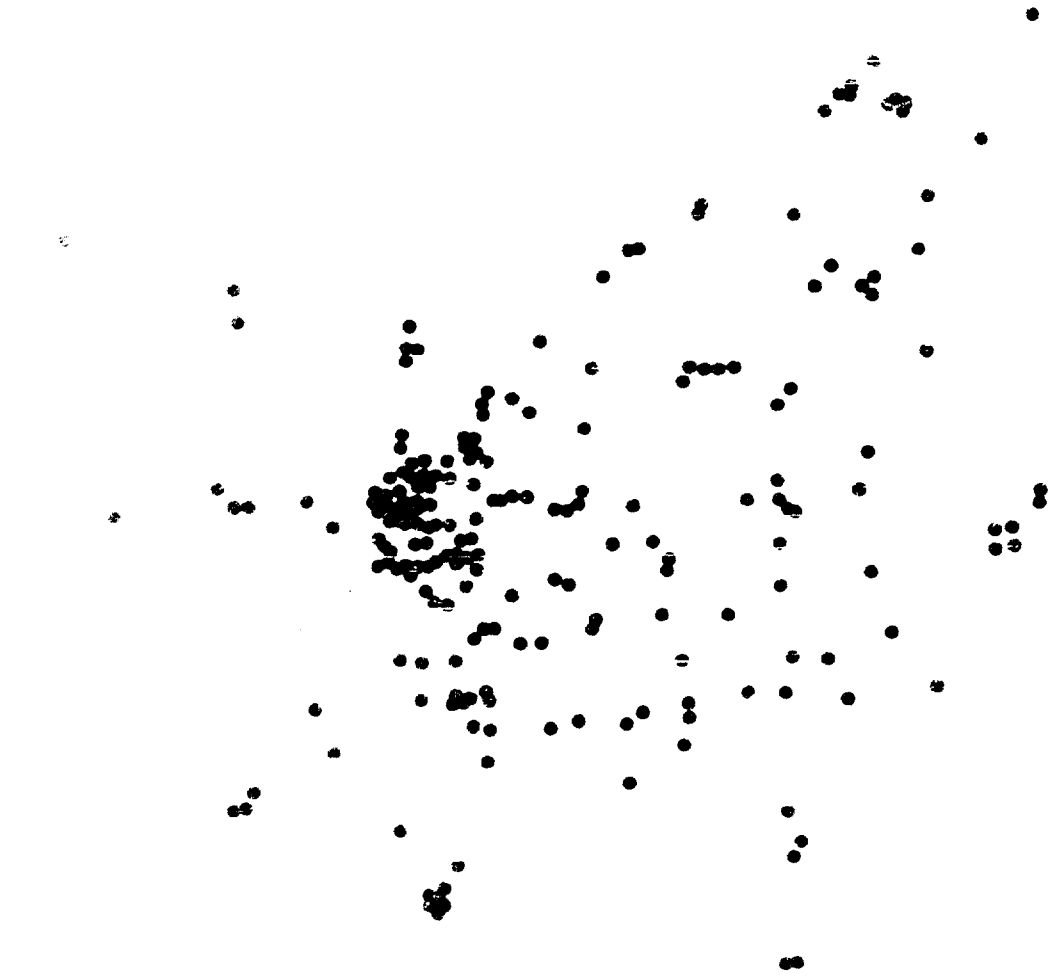
This map can serve as the basic reference throughout the shelter-assignment process. It is best to locate the map on a stand or on a wall. By referring to the map, one can keep the "big picture" of the city and its shelter distribution well in mind.

B. Map of Population Densities

A second map of census tracts might be secured for the purpose of recording populations and shelter capacities by tract. This map need not include the census blocks, but only the tract outlines. The day and night populations for the respective tracts can be recorded in pencil. A sample of such a map may be found in Fig. 12(b). On a full-scale map, the population could be recorded within the tract. Also, the total capacity of all shelters could be written in colored pencil within each tract outline. The total capacity for shelters with a protection factor of 100 or greater might be recorded in orange; yellow could represent a protection factor of 40 to 100, and green could reflect a protection factor of 20 to 40.

C. Map of Coverage and Drainage

Before making actual shelter assignments, it would be important to visualize the degree to which Lincoln's population is covered by shelter and the extent to which some movement of people may be required from one tract to another. At this step, a third map of census tracts should be obtained for the purpose of making a Map of Coverage and Drainage

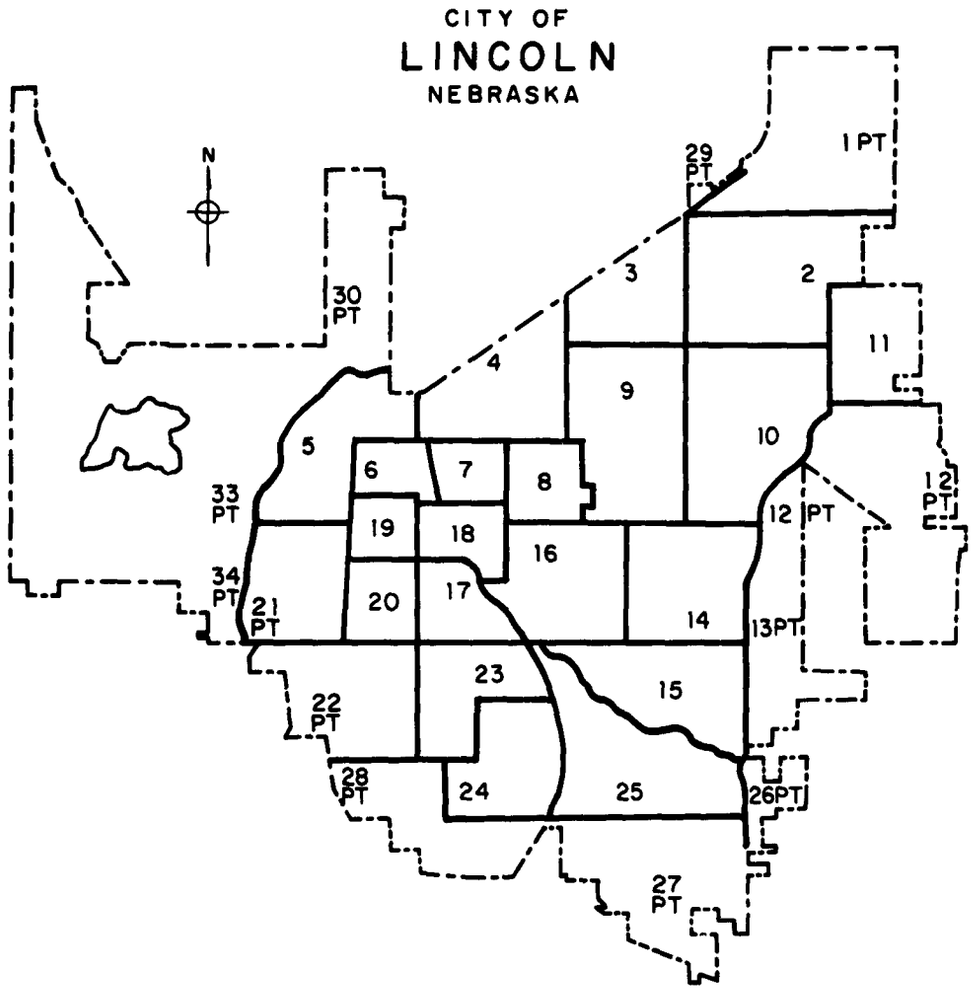


20 to 40 Protection Factor

Cummulative total	
Shelters	380
Spaces	195,000 +

	Cumulative total	
40 to 100 Protection Factor	Shelters	151
	Spaces	55,000

100 and greater Protection Factor { Shelters 84 / Spaces 64,000



Note:

City tracts only, not blocks, appear in this figure. City blocks, however, must be used in the actual planning necessary in order to locate the shelters.

FIG. 13 MAP OF SHELTER LOCATIONS

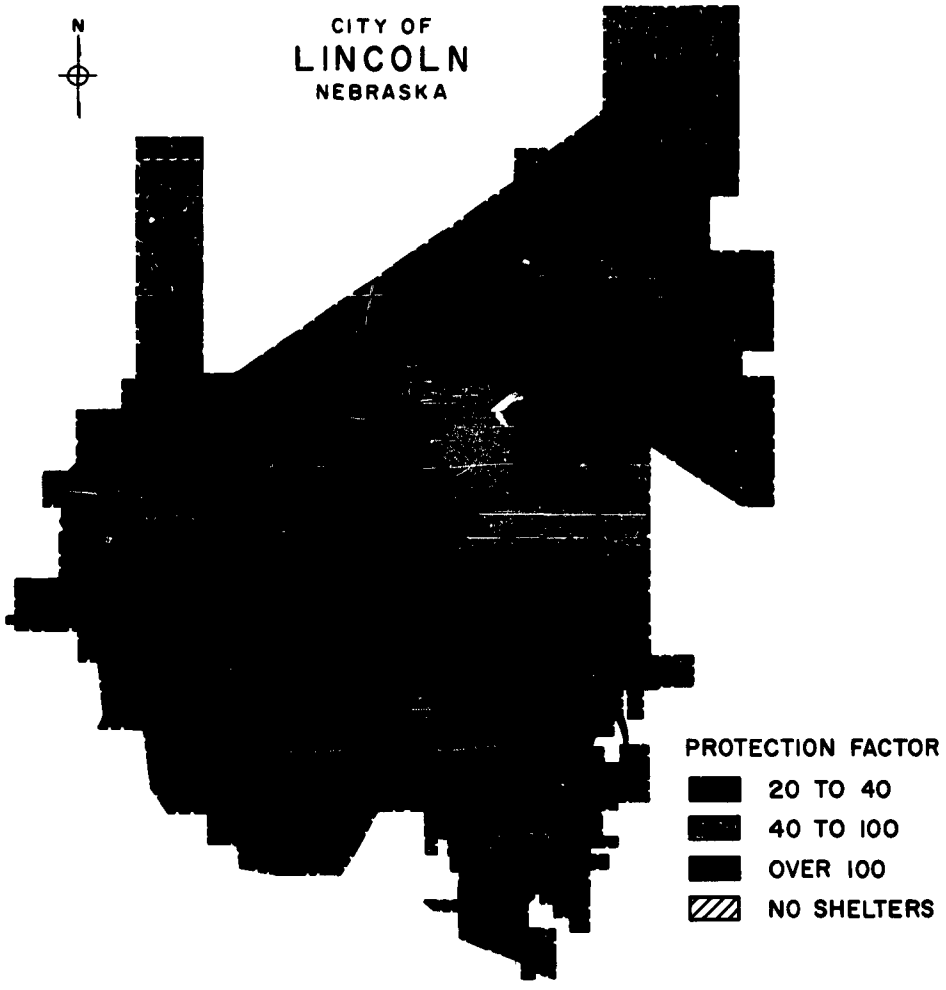
[see Fig. 14 and example shown in Fig. 12(c)]. It is preferred that this map not contain the census block outlines, but only the tracts. This map would be prepared by referring to the data found on the Map of Population Densities [Fig. 12(b)]. The Map of Shelter Locations (Fig. 13) would also be very helpful in preparing this map. The area-extent of each color in Fig. 14 indicates the percentage, in each tract, of shelter of the type represented by that color. The black arrows indicate the directions of movement from tracts with no shelters (or minimal shelter) to the nearest tract in which adequate shelter is available. It would be helpful to learn to what extent there is either an excess of people or an excess of shelter per tract. By assessing this problem, a planner could get some feel for the need to move people from one tract to another.

It is suggested that a separate tabular sheet be first prepared (refer to Tabular Sheet 1 in Fig. 12). The following eight column headings should appear across the top, running from left to right:

(1) Tract number
(2) Population
(3) through (6). Shelter capacities
    (a) Protection factor of 100+
    (b) Protection factor of 40 to 100
    (c) Protection factor of 20 to 40
    (d) Total for all protection factors
(7) Excess population
(8) Excess shelter.

Four additional column headings might also be added to the previously mentioned eight, for a total of twelve columns. These four columns would record the percentages of the population covered by each type of shelter within each tract. The four columns would represent the percentage of the population covered by:

(1) Shelters with a protection factor of 100 or greater
(2) Shelters with a protection factor of 40 to 100



NOTE: The color in the cross-hatched areas indicates the protection factor of shelters obtained in the unhatched areas.

FIG. 14 MAP OF COVERAGE AND DRAINAGE

(3) Shelters with a protection factor of 20 to 40

(4) The total percent of the population covered by all types of shelters.

Under the first column entitled "Tract Number," the total number of tracts within the city should be recorded numerically from top to bottom. Tabular Sheet 1 would be filled in from the data found in the Map of Population Densities.

The tabular sheet would then become the basic work sheet for calculating the data used in preparing the Map of Coverage and Drainage, Fig. 14. Each census tract becomes a separate box graph. The area within the tract would represent a 100-percent population for the tract. (The accuracy of a planimeter is not necessary in determining the exact area of coverage within each tract.) Each census tract would be filled from the bottom up like a bar graph, to the extent that its respective population is provided with shelter. If a census tract had no shelters within it, then the bar graph (or census tract area) would record zero. This means that the planner must look to another tract for protection for the people of this tract.

If a census tract had an excess of shelter capacity within it for the tract population, then the bar graph (or tract) would be filled completely with the appropriate color or colors.

If a tract had three qualities of shelters within it, then the tract could be filled from the bottom up with "shelter coverages" by order of preference. The percentage of tract population covered by shelters with a protection factor of 100 or greater would be shaded in orange. Above the orange, would be the percentage of shelters with a protection factor of 40 to 100 indicated in yellow. Finally, the color green would be added to chart the percentage of population covered by shelters with a protection factor of 20 to 40.

Within each tract the respective excess population and excess shelter capacities would be recorded in pencil (not shown in Fig. 14). Bold arrows in black are next drawn in, pointing from a tract that is partially sheltered to the nearest tract in which shelter space may be

acquired. As shelter space is acquired in a neighboring tract the unsheltered areas are colored in according to the type shelter acquired. (This is illustrated in Fig. 14. In practice, an overlay might contain the arrows and the acquired shelters.)

The arrows are only indicative of the need for moving people from one tract to another. The position of a particular arrow does not imply that people are to be moved only from the specific place within a tract touched by the arrow to the specific place in a nearby tract touched by the same arrow.

The Coverage and Drainage maps offer one method by which the planner can then view the city in total and ascertain the extent of coverage. By color he can also quickly determine the quality of protection and the dispersion of same throughout the city.

Equally important, the extent to which the movement of people may be required between tracts can be readily assessed.

D. Assignment By Block

While this subject is covered in detail in Vol. II, "A Shelter Assignment Procedure," it would probably be helpful to discuss it briefly (and partially) here.

For this step it is suggested that a fourth census tract map be obtained, with the blocks numbered and outlined. In addition, a booklet of census populations by block, as prepared by the U.S. Department of Commerce, should be secured.

The map should be placed flat, preferably on a surface of fiberboard into which pins may be inserted. Each shelter facility might be located on the census block map with a "pennant flag" attached to a stick pin. Each pennant could bear the shelter number, the shelter capacity, and the quality of shelter. The quality of the shelter could be represented by the color in the pennant. An orange-colored pennant would represent a shelter with the protection factor of 100 or greater. Yellow and green pennants would be used to represent protection factors of 40 to 100, and 20 to 40, respectively [see Fig. 12(d)].

A tabulating sheet should be prepared with six columns (see Tabular Sheet 2 in Fig. 12). The columns should be titled with the following headings moving from left to right:

(1) Tract number
(2) Facility number
(3) Facility capacity
(4) Block number
(5) People/block
(6) Cumulative people.

Assignments should be made in the periphery of the city first in order to place people in the fringes in the shelters nearest to them.

By residential or census blocks, people are then assigned to downtown shelters. The smallest shelters are filled first, leaving the larger shelters to be filled by large groups of blocks near the outskirts of the city. Using the downtown area as the focal point, the blocks are assigned within areas bounded by concentric circles, radiating progressively outward from the downtown area.

Census blocks are assigned to the shelter nearest the location of the block, which may or may not include or be adjacent to the shelter. If a choice exists between two or more shelters of different qualities of protection in the same general area, the shelter with the highest category of protection is filled first. Actually, the process begins with a shelter location, and nearby blocks of people are assigned to it, in a consistent, objective manner, until its capacity is reached.

The facility numbers and capacities are recorded in the data sheet per tract from data generated by the Phase I and Phase II surveys. Assignments are then made by block, or smaller cells, by referring to the census population booklet. It may be found necessary to resurvey the block populations for both day and night readings, since the census recorded only the resident population. The blocks are selected from areas immediately near to or surrounding each shelter. Blocks of people are assigned per shelter until the cummulative total of people in the blocks equals the shelter capacity. The shelters with

the highest protection factor will be filled first. As the blocks are assigned, the appropriate blocks on the census map are shaded in. As the shelters are filled, the "pennant flag" stick pins may be removed from the map.

A supplemental report discusses an alternative method by which the shelters are recorded in color on the block map and are checked off with a pencil as the block assignments are made. (See Vol. II.)

As backup data, the names and addresses of all facilities within a block must be generated. These data are kept by the CD director but are not used directly in the assignment process. Some form of records should be kept. As a suggestion, a card file might be kept by the CD director which keys each individual to an address, a block number, a tract number, a shelter facility number, and a shelter address. It would seem sufficient to keep three sets of these cards. One set might be indexed by tract and block number, a second set by facility number and a third set by individual's name. If desired, punch cards could be used and data generated for quick review. This is discussed in the supplemental report.

E. Suggestions in Adopting A Shelter Assignment Plan

The Assignment-to-Shelter plan discussed in this section is only one plan or method of assessing the problem of assignment. Conceivably, many variations from the plan described herein might be used. The purpose of this section is to present a methodology by which a planner might proceed to make assignment and to point up the kinds of problems that a planner is confronted with in making assignment.

The shelter plan described in the preceeding paragraphs is based upon the concept of cells. The planner starts with one large cell, such as is defined by the complete city of Lincoln in the Map of Shelter Locations. The census tracts then become smaller cells within the city of Lincoln, as depicted in both Fig. 12(b), the Map of Population Densities, Fig. 14, and the Map of Coverage and Drainage. The next smallest cells are outlined as blocks in the Map of Census Blocks.

Individual office buildings, to which resident employees are assigned, become still smaller cells. The smallest cell, or grain size, is represented by the resident population, as listed by name on the backup data sheets.

The concept of cells offers the planner an orderly way of assessing the "big picture" and then moving along systematically to smaller, more localized problems. The concept of cells helps to uncover problems, but not necessarily to solve them. The planner and his staff are of course the problem solvers.

While proceeding with this methodology, the planner needs to watch for and solve special problems. For example, some institutions, such as hospitals, may not wish to accept licensing and stocking as public shelters because the shelter facilities in their buildings may barely be adequate for their staffs and patients. This should be no obstacle, since hospital staffs and patients are also members of the public, and the assignment process follows a procedural rule that people in a building having shelter will be assigned to that shelter. If the normal inhabitants of a building are so numerous as to fill the shelter facility completely, the planner must find another facility for sheltering "outsiders," just as he must with any other shelter facility. Nothing in the Federal shelter program should be interpreted in a way that results in large numbers of people going without shelter: technicalities concerning the identity of "the public" should not stand in the way of getting facilities licensed, stocked, and marked. The same reasoning applies to boarding schools and colleges, power plants, telephone offices, and other facilities that present special problems. However, if a shelter facility must be reserved this way for the normal inhabitants of the building, then the facility, its number of shelter spaces, and its people ought to be subtracted from the working totals, and the assignment process should be continued as if they "did not exist." For this reason, it may be best to assign these special problems first, before going on to the assignment of the community at large.

As previously mentioned, the planner may find it expedient to resurvey the night and daytime population by block. The census data provides the resident block population, but does not take into account, by block, the nighttime and daytime shifts in population. The Architects and Engineers survey of population was by census tract and was not reduced to a grain size as small as a block. The planner should have expert help in administrating such a survey and might consider soliciting the services of qualified university personnel or a consulting service.

The nighttime population by block could be taken from the 1960 census. These block data might be updated by referring to the records of building permits issued since 1960. The 1960 block populations would then be changed in accordance with the construction changes occurring within the respective blocks. Also, nighttime block data should be checked for currency as to hotels, motels, theaters, and other nonresident population concentrations.

The daytime populations by block could be approximated by multiplying each nighttime block population (or census block population) by a ratio which relates the daytime tract population to the nighttime tract population. These ratios result from the nighttime and daytime population data developed in the A&E's survey. (The local planner should consult the local A&E firm used in the survey to ascertain the method by which daytime data were originally derived. Vol. II of this report discusses ways of deriving and checking daytime data for the block level.) The nighttime block populations would be multiplied by ratios resulting from the respective tracts in which the blocks are located.

The planner might also decide whether he needs to resurvey some of the shelter facilities. In this event, it might be best to secure help from the architectural and engineering firm that made the original Phase I and Phase II surveys. The A&E need not resurvey every shelter, only those that are suspect. At a minimum, it will be necessary to review for accuracy the data resulting from the Phase I and Phase II

surveys. Some discrepancies in these data have already been discovered. Shelters with protection factors of 20 to 40 in particualr deserve special review.

F. Implementation Of Shelter Assignment Plan

A shelter assignment plan is of little value until it is put into use or implemented. The problem of implementing an assignment plan might well prove to be the most challenging problem that the CD staff faces. A plan will not be perfect at its inception and will need be improved and upgraded regularly, say every six months. New shelter assignments will need to be made from time to time as people move in and out of a location. The planner is not finished, once a complete assignment is made. An assignment plan is a growing plan and will require the continuing services of a planner and his staff, although the staff may be smaller for the upgrading work than the original staff making the full assignment.

Once again, the need for effective public relations and individual participation as outlined in Sec. VI becomes evident. The successful implementation of a plan will require patient, careful explanation of the plan to the people. Many kinds of questions will be raised and all are worthy of an answer. Basically, the people should be told about the CD Program and given the reasons for the assignment ground rules.

IX INTRA-CITY AND INTER-SHELTER COMMUNICATIONS

A. Introduction

The importance of communications during and following a nuclear attack is easily established. Any scheme or plan for survival is highly dependent on effective command, control, and communications. All civic echelons, from national to city or rural area, should have a workable civil defense communications plan that will afford transfer of required information with a high degree of reliability.

A warning, either Strategic or Tactical,* or both sequentially, will be disseminated to a city through established communication facilities.**

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* A Strategic warning may be issued from verified information of an enemy's intent to attack or from an accumulation of numerous interconnected actions interpretable as indicating a potential enemy's probable intentions to attack the U.S. This type of warning will be disseminated to the State by the Department of Defense (via SCAN**) through the Regional Office of Civil Defense, as a defense readiness condition. The State, in turn, will disseminate the warning to its respective counties, cities etc.

A Tactical warning will be issued from the result of the knowledge of a probable attack after it has been launched. The Tactical warning may be issued from a maximum time of several hours before the effects of the attack are realized to a period of 30 minutes or less (an attack could come without warning), depending on whether manned bombers or missiles are used by the enemy. A Tactical warning will be disseminated on the National Warning System (NAWAS) to the State warning centers and on State Warning Nets to their respective counties and municipalities.

** NACOM I--National Communications System No. 1: Wireline communications system linking DOD-OCD to the eight Civil Defense Regional Offices and the 50 states.

NACOM II--Radio backup to the NACOM I System. Presently available at National Headquarters, most Regional CD offices, and 23 state emergency headquarters. (cont'd.)

This report, in keeping within the scope of the shelter assignment study, will be confined to intra-city (Lincoln, Nebraska) shelter communications.

B. Present Status of Intra-City Communications for Lincoln, Nebraska

Lincoln has formulated a "proposed" communications service plan in the event of a disaster or a nuclear attack. At the present time, most of this "proposed plan" is in effect. The Emergency Operating Center (EOC) is located in the Irvingdale community shelter in the south-central part of the city (18th and Van Dorn Streets). Communications equipment (transmitters and receivers, including 6-meter Gonset transceivers) are installed in a mobile unit (modified bus) which has a trailer-mounted 10-kw generator. This mobile unit is located (parked) in the Irvingdale shelter. When in the shelter, the mobile unit can operate from the shelter's electrical power.

Weekly drills are conducted using the radio equipment in the mobile unit, and 6-meter Gonset transceivers located at four fixed locations--three hospitals and a bank building, all within the city. The radio equipment in the mobile unit is capable of communicating with the Lincoln Police and Fire Department network, the Sheriff's network, the State CD network, and RACES.

Fixed radio equipment is to be installed in the EOC shelter. The mobile unit could then serve as an alternate mobile civil defense EOC. During drills, the Communications Chief (volunteer) and four radio operators report to the EOC. Four operators also report to each of the four fixed radio locations. All radio personnel are licensed radio amateurs.

SCAN--Switched Circuit Automatic Network: Communications Link between National and Regional Civil Defense Offices.

NAWAS--National Warning System: Full period (continuous, hotline) circuit for Headquarters of the North American Air Defense Command (NORAD)--subordinate NORAD Regions to OCD Headquarters, key Federal facilities and 449 warning points throughout the U.S.

The communications personnel will be trained in radiological monitoring. The Radio Amateur Civil Emergency Service (RACES) plan (frequency allocation, power, procedures, etc.) is used by Lincoln for primary emergency communications purposes. The City also plans to use Citizens Band (CB) radio for communicating between shelter locations and to augment the RACES network. The City has five CB transceivers at the present time. In the event of an attack, Lincoln would be warned by telephone from the State EOC. Additional communications backup is provided by the Sheriff's radio network.

Figure 15 shows the present emergency communications radio network for the city of Lincoln. The present communications plan provides communications to four semi-stocked shelter areas from the Irvingdale Community Shelter, the EOC. The three hospitals have a total of under 2,000 spaces and each has a pf (protection factor) of 40 to 100. The bank has space with a protection factor of 100 plus, for 613 persons. For the present number of semi-stocked shelters, the present communications facilities of telephone, RACES, and CB radio appears adequate; however, protection (stocked and equipped shelter space) which is available for only two percent of Lincoln's population, is not adequate.

C. Proposed Communication Plan for the City of Lincoln

1. Communications Network

From the above section, it is axiomatic that a large number of shelters are needed in order to provide protection for the entire population (see Sec. X). With a large number of shelters, properly equipped with communications facilities, a communication network (an extension of the present network) would be required. A survival plan incorporating the principle of mobility (transferring shelterees to areas of lower radioactivity levels) is dependent upon the efficient interchange of radiological information, as well as the necessary logistical command and control functions.

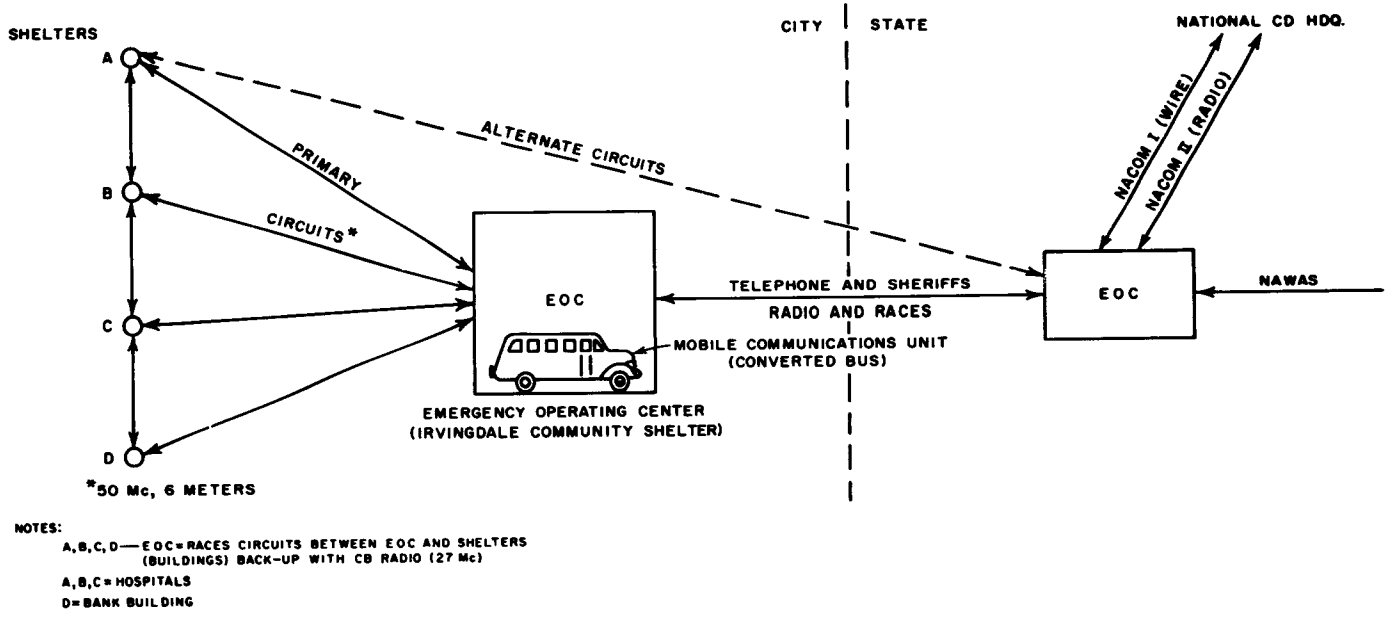


FIG. 15 RADIO NETWORK FOR THE CITY OF LINCOLN – PRESENT

Figure 16 shows a suggested plan that could provide the needed command, control, and communication for the city's shelters. The EOC (communications-equipped fixed station) would communicate with the Control Centers A, B, . . . The Control Centers, in turn, would communicate with a prescribed number of ancillary shelters, a_1, a_2, . . . The Control Centers would relay the required radiological and other pertinent information to the EOC. The EOC would evaluate and execute any predetermined plan for mobility and also disseminate CD information to the Control Centers.

In the event that the City Primary and Alternate EOC's were inoperative, the State EOC (located in Lincoln) might assume command control functions. Alternatively, a local Command Center could assume the EOC function. In the event that a Control Center was inoperative, an adjacent Control Center, through the direction of the EOC, would adopt the satellite shelters assigned to the inoperative Control Center.

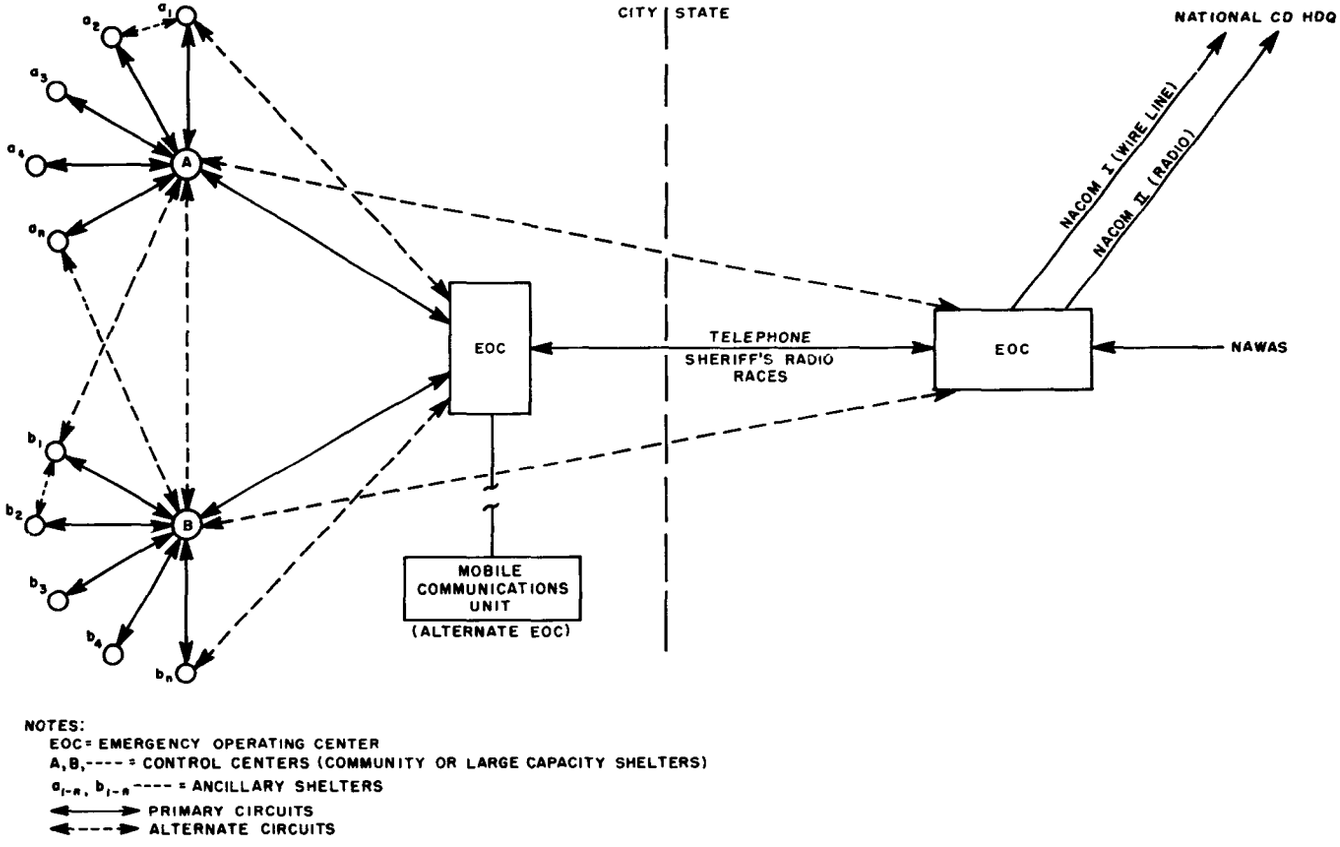
Shelters a_1, a_2, . . ., would communicate between each other only by the direction of Control Center A, or in the event that "A" is inoperative.

The rationale for the Control Centers is primarily threefold: (1) to incorporate a method of organizational (echelon) control, (2) to shorten the lines of communications which permit the employment of simpler and less expensive radio equipment, (3) to shorten the logistical lines between shelters.

Given that telephone communications were unavailable for use, radio communications would be the primary means of intra-city shelter communications.

2. Communications Facilities and Equipment

As indicated in Table I, Lincoln has a total of approximately 380 shelters with protection factors of 20 or greater, capable of sheltering about 195,000 persons. To provide effective command control communications for 380 shelters, a plan as outlined in Sec. IX-C-1, above, would be required. If 20 shelters were selected as Control Centers (A, B, . . .), approximately 18 satellite shelters (a, b, . . .) would report to each Control Center.



NOTES:
EOC = EMERGENCY OPERATING CENTER
A, B, ---- = CONTROL CENTERS (COMMUNITY OR LARGE CAPACITY SHELTERS)
a_{1-n}, b_{1-n} ---- = ANCILLARY SHELTERS
⟷ PRIMARY CIRCUITS
⟷ ALTERNATE CIRCUITS

FIG. 16 RADIO NETWORK FOR THE CITY OF LINCOLN – PROPOSED

The present RACES radio equipment in Lincoln is capable of operation in the 2-, 6-, and 10-meter bands. As discussed above, more of this same type of equipment would be needed, particularly for the Control Centers.

For communicating between Control Centers A, B, and the ancillary shelters a, b...., the use of some type of Citizens Radio Service (Citizens Band--CB) transceiver might be employed. Since most of the existing CB radios operate in Class D (between 26.965 and 27.255 Mc), this particular band (11 meters) would be used. For communications between shelter sites A and a (a distance probably less than a mile), a plate-power input of about 3 watts should be sufficient. The communicating range is dependent upon the type of equipment used, transmitting power, operating frequency, surrounding terrain, amount of interference, type of antenna used, and the relative height of the antenna with respect to the receiving antenna. The required power and antenna type should be determined by actual field tests.

Class D, CB transceivers may be operated with a legal maximum plate-power input of 5 watts, and only in the AM (amplitude modulation) mode, with radiotelephone. CB transceivers with a single channel and fixed-tuning with squelch and noise-limiting may be purchased for about $125.00. There are a number of CB transceivers on the market that could now be incorporated into an improvised communications network for inter-shelter communications.

A transceiver designed specifically for inter-shelter communications could be developed and incorporated into the national CD survival plan. This would require an extensive development and field testing program. However, specially-designed equipment would ultimately have many advantages over any existing equipment. It could be designed for the specific need and for the shelter environment, and could have greater efficiency (especially in power consumption, etc.) than present equipment, the design of which presumes "unlimited" power sources, or "unlimited" battery-charging capability.

At the moment, no Federal matching funds are available for Citizens Band equipment, and OCD and FCC plans do not now allow for Citizens Band operation in post-attack emergencies. It is recommended that no significant local expenditures be made for radio equipment without Federal guidance.

For radio communications, it is suggested that three different frequency bands be employed, as listed below:

Terminals	Frequency (Mc)	Wavelength (meters)
State EOC--City EOC	146, 50, 28	2, 6, 10
City EOC--Control Centers (A, B,..)	50, 27	6, 11
Control Centers--Ancillary Shelters (a, b,...)	27	11

Primary frequencies between terminals are underlined.

Radio interference due to the effects of fallout, for short-range communications (up to 10 miles), is probably slight. Available guidance* is limited to propagation information for long-range communications where the skywave mode of operation (repeated reflection of the radio signal by the ionosphere and the ground) has been investigated. For intra-city use, the longer the wavelength, the better the radio communications could be expected to be. Low- and medium-frequency ranges (30 kc to 3 Mc) would be more reliable; however, the antenna and power requirements would be more demanding than at the higher-frequency ranges. Some signal attenuation could be expected from heavy fallout concentrations; however, for the short distances involved, and with ground-wave travel, and for communicating within Lincoln, the power of the CB (or equivalent) and RACES radio equipment should override these effects.

For transmission between the ancillary shelters a and the Control Centers, a solid whip antenna could be mounted on the outside of the shelter (building, etc.) with a coax lead-in to the shelter site.

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* S. Glasstone, Ed., The Effects of Nuclear Weapons, U.S. Atomic Energy Commission (U.S. Government Printing Office, Washington 25, D.C., 1962).

(A quarter-wave antenna for the 27-Mc, Class D, CB radio would be approximately 9 feet in length.) Some "emergency" antenna provisions should be available in the event of blast or thermal damage to the outside antenna. Given that the shelter is located below the ground level, a soft-capped pipe could be installed through the ground sidewalk, etc., so that an auxiliary solid whip antenna could be "pushed through" the pipe from the shelter. In this case, a shorter antenna (less than 9 feet) with base-loading, could be used. The Control Centers could have high-gain (a) vertical-ground-plane, (b) three-element beam, or (c) coaxial antennas, with auxiliary antenna as described above. Vertical polarization of antennas would be used for all stations. (Similar considerations apply for the design and other requirements of VHF or UHF antennas.)

The Control Centers should be stocked with heavy-duty type rechargeable batteries for power (communications) requirements. The wet-cell type of battery (possibly nickel-cadmium wet cell) could be sustained by a trickle-charge from a battery charger on commercial power facilities. Hand generators could also be located in the Control Centers for power to maintain the storage batteries.

The satellite shelters could have portable power packs (12v dc nickel-cadmium) also maintained by trickle-charge. The smaller-size ancillary shelters could have power packs (wet or dry cell) that would be replaced on a scheduled basis by a CD maintenance group. With fully transistorized transceivers the power requirements for some of the communications equipment would be minimal.

3. Use of Commercial Telephone Facilities

Under certain national attack situations, the city of Lincoln would not be hit by a nuclear weapon or be in a direct path of significant (immediately harmful) fallout. If such is the case, adequate shelter communications could be obtained with the use of the City's commercial telephone plant, provided that the shelters are equipped with telephone sets with connections into the existing plant. The

telephone subset would not necessarily have to be permanently located in the shelter itself (building basements, etc.) but could, in the event of an attack warning, be "unplugged" from an existing in-use station and carried into the shelter. Extension jacks for this purpose must be installed beforehand, but this is easily arranged through the Lincoln Telephone and Telegraph Company. (Unit cost: $15.00 per jack.)

The City EOC should have a number of unlisted telephone numbers, known by the shelter managers or listed in the shelter management manuals. Special provisions may be made by the telephone company in the central offices to prevent "lock-up"--a condition resulting from the over-use of the automatic switching facilities, with the resultant blocking of traffic. Not to make provisions for the use of the existing telephone facilities would be overlooking the "obvious" as a means of communicating.

X MOBILITY

The following discussion results from preliminary investigation of possible options for the local planner who, as in Lincoln and elsewhere, must be concerned with remedies for the lack of high-protection factor shelter spaces, and their poor distribution through the city. The option considered here is mobility, in which people would be removed from low-protection factor shelters in high-intensity fallout areas and shifted to shelters of higher protection factor (or to areas of lower fallout intensity, or both) before they have received a total radiation dose large enough to cause serious effects. Mobility would require detailed and flexible planning beforehand, a certain amount of equipment (including vehicles and prefabricated vehicle-shielding kits), and reliable command-and-control communications.

While mobility could not be a permanent substitute for adequate shelter for everyone, located so as to be easily reached by everyone, it shows some promise as an interim preparedness measure that might be had early and fairly cheaply. This preliminary study is only for evaluation of the concept, and indicates the need for further study before any mobility plan could be implemented.

A. The Case for Mobility

It has been shown that there are insufficient shelters of adequate protection factor (100+) to house the population of Lincoln. It has also been shown that the shelters are concentrated in the downtown area and are not easily accessible to the suburbs. By adding in the shelters with protection factors of 40 to 100, some improvement is noted, but the problem of concentration remains, and shelter is not immediately available for everyone.

It is clear that by reducing the protection factor criteria the available space increases, and due to the types of construction existing in an area like Lincoln, at 20 pf the number of shelters increases very

rapidly and is spread out fairly evenly over the whole city. For this part of the country then, 20 pf is found in a standard of building that is not limited to downtown areas.

Based upon this finding, it becomes inevitable that if the population is to have shelter in existing buildings, the 20-pf range must be included.

An analysis of the radiation strengths and patterns likely to occur in Lincoln indicates that 20 pf is a satisfactory shelter. However, it is very likely that relatively small areas will have fallout levels that render 20-pf shelters inadequate.

As an example of this situation, at a point immediately downwind of a burst of 2 megatons, and at a distance of about 5 to 10 miles, the occupants of 20 pf shelters will be subjected to a total dose of over 600 R in the first 4 days. In the case of larger bursts the coverage of this high intensity fallout will be extended.

This section of the report is devoted to analyzing one possible solution involving a planned, post-attack evacuation system, and to determining the general usefulness of a mobility system capable of operating in substantial levels of fallout radiation.

In this solution to the problem of shelter for everyone, the essential feature is that organization is being used in place of concrete. It will later be shown that organization is also cheaper. This is an important factor, since it takes time to get large amounts of money committed to the shelter program.

Since organization is required, there is no gainsaying the need for its proper constitution and training if it is to function easily in an emergency.

The organization is divided into three parts: the shelter system, the communications system, and the transportation system. Each of these systems is the responsibility of a designated official who will be stationed at the operating center and will assume, in an emergency, the functions described below.

(1) Shelter System--Monitor Controller. This task will be to plot radiation levels throughout the area and determine the need and deadlines for evacuation. He will receive requests from shelters for various services. He will pass requests for action to the mobility group controller who will order the movements.

(2) Mobility System--Mobility Group Controller. His task will be to get the various system vehicles operational as quickly as possible and to send them out in response to requests from the Monitor Controller. He will organize, and put into operation, patrol vehicles which will tour the area as required, meeting the needs for special services and functions.

(3) Communication System--Communication Controller. The task here is to provide the shelter system with the means of communicating with the operating centers, and the mobility system with the means of communicating throughout its many units.

B. Organization

A general organization layout is given in Fig. 17.

1. Shelter System

All the available shelters in Lincoln should be eventually developed and marked. This will give over 200,000 shelter spaces scattered throughout Lincoln, easily accessible to all persons regardless of where they may be, day or night. All the shelters should be stocked in the following manner:

(1) 100-pf shelters and above--A full two weeks supply of food, water, medical supplies and RADEF and radio receiver and transmitter.

(2) 40-to-100-pf shelters--One-week supply of food and water and medical supplies. RADEF equipment, and at least one radio receiver.

(3) 20-to-40-pf shelters--Four-day supplies, no RADEF, at least one radio receiver.

2. Monitor Shelters

On the basis of one or two per census tract, certain shelters with 100 pf are to be designated MONITOR shelters. If any tract lacks such shelter, then either a 40-pf shelter could be used or a small 3-man monitor shelter could be built at very low cost. It will be seen that these monitor shelters play a vital role in establishing radiation levels

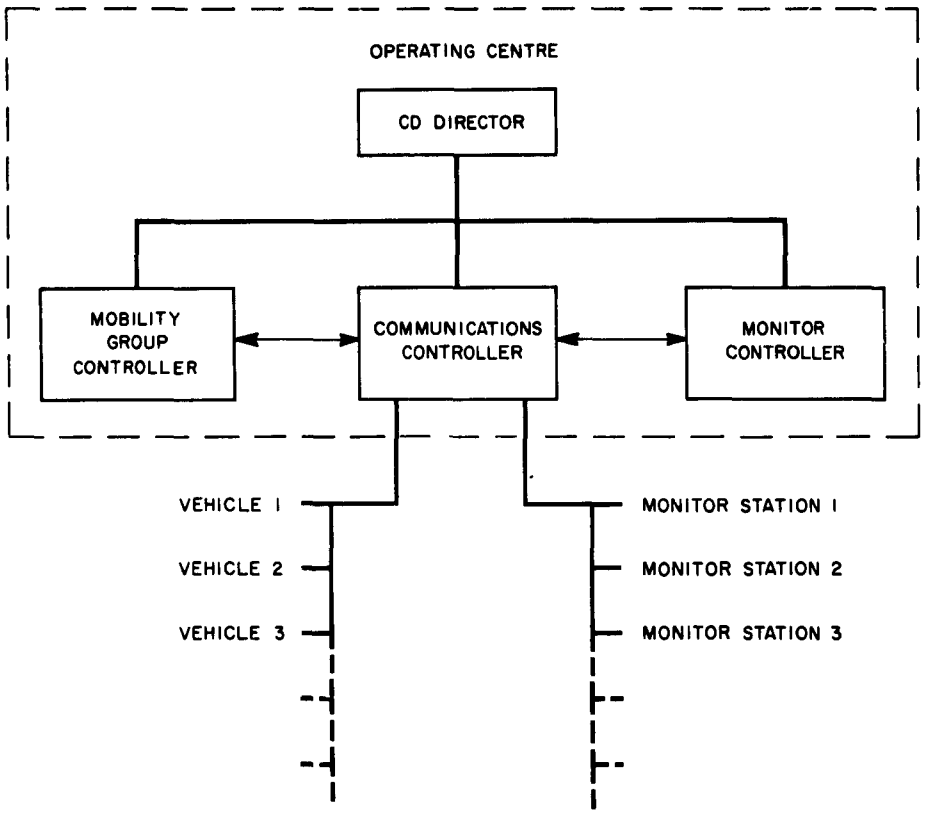


FIG. 17 ORGANIZATION OF MOBILITY SYSTEMS

throughout the area. Monitor shelters have to be manned by an experienced crew to read radiation levels and communicate by radio to the operating center. Monitor shelters have to be calibrated. It is considered too hazardous for personnel to carry a radiation meter probe outside the shelter under intense radiation conditions. In order that radiation measurements will be meaningful when taken inside the shelter, it is necessary to have derived a suitable attenuation factor, which is multiplied by the meter reading to give the outside radiation.

Calibration consists of having the probe located in a suitable place in the shelter, and taking all readings with the probe in this location.

The attenuation factor is derived by having a known radiation source, placing it at a number of locations outside the shelter and noting the readings.

Specially built shelters could easily incorporate an outlet through which the probe could be pushed, thereby alleviating the need for calibration.

Monitor shelters each have an area which they cover, and it is assumed that conditions are uniform throughout the area during the early period after an attack. Later it will become possible to identify special points such as pockets of intense radiation within an area.

C. Communications

Communications is the second essential part of the organization. This is covered in Sec. IX of this report, and the system outlined there is adequately suited to the needs of this organization. It is desirable for all shelters to have radio communication equipment and in that case the monitor shelters will assume the control center role. The shelters in each area would report their findings to the monitor shelter; the monitor shelters in their turn will report to the operating center the conditions they find from their own readings, except that any wide variation reported by the shelters in their areas would also be passed on.

D. Transportation

The third essential part of the organization is the transportation section.

The control of the transportation section would be done in the operating center, but the units would be dispersed throughout the area in order to make them as invulnerable as possible. The vehicles are divided into two categories:

(1) Patrol and service vehicles
(2) Evacuation vehicles.

1. Patrol and Service

The patrol and service vehicles will provide the following services:

(1) Inspection of damage

(2) Fire fighting and road clearance

(3) Location of radiation hotspots, and confirmation of monitor shelter readings

(4) Movement of doctors and other specially skilled personnel to needed locations

(5) Movement of medical and urgently needed supplies

(6) Law enforcement.

The types of vehicle useful for the above tasks are discussed below. How much each community is willing to acquire is a decision to be made at the local level. For Lincoln, a series of recommendations is made here which may be used as a guide for other communities.

For the patrol and service function, a vehicle the size of a three-ton delivery truck is recommended. It should have a protection factor of about 20 for the crew. Trucks can fairly easily be modified by sandbagging the inside of the body, using a wood framing to support the sandbags. A more convenient vehicle is the BRINK's truck, which can be improved quite easily. In each case the crew needs most of the protection. The vehicle must be fitted with two-way radio (similar to that used by taxicabs) for its link to the operating center.

For Lincoln, three such vehicles are considered adequate. As a planning measure, three vehicles could be bought from army surplus and modified, or three privately owned vehicles could be earmarked by arrangement with the owner, and a kit procured to enable rapid modification when necessary. In the meantime, these vehicles could continue about their normal business.

In addition to road vehicles, helicopters or light aircraft would be extremely useful in determining hotspots of radiation and spotting damage quickly. At 1000 feet the protection factor offered by the altitude is 28. A light airplane or helicopter could, carrying

radiation-detecting equipment, fly a pattern over a selected area and rapidly determine radiation hotspots as well as note damage.

The most suitable source for such vehicles should be the Civil Air Patrol, who have training in this type of flying.

All aircraft with radios could be linked to the operating center. It is clear that aircraft having little or no protection factor should operate from areas of very light or no fallout. While it is considered that only one such aircraft would be needed for Lincoln, and for only a few hours at that, the planning should include several aircraft at different, widely dispersed, airports so that at least one could be called upon, it being located in an airfield free from fallout. Such an aircraft could service several areas, limited only by its range of operation.

2. Firefighting

Under conditions of severe fallout, firefighting is impractical, but under light fallout where exposure for two to three hours is permissible, then the fire services can operate. No special protection is necessary in the vehicles, but protective clothing should be provided to personnel.

3. Road Clearance

The obvious vehicle is the bulldozer. Such vehicles are available with armored cabs, being used by the army. The simplest solution would be for the local National Guard or a city highway department to have a number of such vehicles attached to its establishment. Also necessary is the transporter, which must have an armored cab. An estimated protection factor necessary for the bulldozer is 20, and for the cab of the transporter, 5, unless it stays with the bulldozer during the operation, when 20 would be necessary. These protection factors are fairly easily achieved for the vehicles mentioned here; they presuppose short operating times for any one driver, with frequent relief and rotation.

If the National Guard is not to be used, an arrangement could be made with construction contractors to provide bulldozers. Armored cab kits which could be fitted very quickly to bulldozers for use in an emergency could be prefabricated and stored in suitable places.

For Lincoln, a minimum of two such vehicles are considered to be necessary. The cab kits should have two-way radio included, linked to the operating center. The organization should provide for several drivers per vehicle, each to operate it for short shifts.

The object of road clearance in the initial stages is only to clear major access ways into and through the city to provide a means for the evacuation and patrol vehicles to get to the shelters. The particular roads to be cleared first, and particular shelters to be reached first, depend on the decision of the control officer, who balances need against factors such as fallout intensities and possible operating time (to avoid prohibitive dose rates).

4. Evacuation

The evacuation vehicle may be a converted bus or large truck. The protection factor needed is about 5 for the driver and about 3 for passengers. The conversion process can be done very quickly.

In the worst case of fallout predicted for Lincoln, a fleet of 20 vehicles of 50-person capacity is required. For the short journeys envisioned, 50 people could be carried in a bus or large truck. Buses seem preferable to trucks because entry and egress are so much easier. The radiation protection is provided by sandbags, bricks or similar material used to line the sides and floor of the vehicle and retained with wood framing.

For Lincoln, an emergency fleet of three vehicles should be acquired and modified, and kits procured to modify as many more as are needed up to a total of 20. The modified vehicles should be stored in three separate places, preferably under cover, and the other vehicles should be obtainable and modified in an emergency, by prior arrangement with their owners. It would be ideal if the bus company would agree to store

the kits and provide the buses where necessary, and have a work cadre trained to modify the buses rapidly. This work could all be taking place in the depot, under cover, and in the public parking places (such as the Car Park building which has a protection factor of 40), while the fallout was coming down or being awaited.

Essentially, the buildings selected for storing and modifying buses should be where large shelters such as bus depots, carpark buildings and disused water storage tanks have been found. It must be possible for the vehicles to have access to the inside of the building so that modification can proceed under cover.

Such facilities should have sandbags, timber, nails, hammers, and saws stored and ready to be used in modification. If a standard, uniform vehicle such as a single bus type were used, the conversion kits (sandbags, timber, etc.) could be completely prefabricated, but tools and extra materials should be on hand for quick modification for use in other vehicles. Additionally, there should be trained personnel capable of directing a crew of people in how to do the work.

Once the buses were modified and sent on a mission, they would not come into the building again, since they would have picked up radioactive particles which must not be introduced into shelters.

The conceptual design analysis to establish the feasibility of modifying vehicles indicates that a bus or truck will need about 5000-7000 lb. of protective material added to provide a protection factor of 5 for the driver, and 3 for the passengers.

This is equivalent to a 1/4-inch thickness of lead sheet around the passengers and a 1/2-inch thickness around the driver. Alternatively, 2 and 4 inch thickness of brick, concrete, sand or plaster, suitably retained, would be equivalent.

Another alternative would be 8 thicknesses of 20 ga. steel corrugated sheet around the passengers, and double this around the driver. Several ideas have been suggested. One involves spraying concrete onto the surfaces of vehicles, using expanded metal as reinforcement.

It would seem that the simplest and least permanent modification to a bus, that is inexpensive and can later be removed, is to use sand in small bags, retained with plywood framing, with possibly some lead sheeting to add protection around the driver.

More detailed work is necessary to establish optimized designs for different type vehicles, which would give more protection factor, or reduce the added weight. Factors which can be used to advantage are the inherent protection afforded by the structure of the vehicle and selective protection of certain parts of the body of the driver and passengers.

In the case of the vehicles for the patrol and service function, approximately the same weight is necessary to provide protection for the cab.

Further analysis is necessary to determine the operating limitations of modified vehicles in respect of speed, grade climbing and braking ability. Also simple, temporary modifications could be devised to be included in the conversion kit to improve suspension, braking, and power, so as to permit higher weights to be added in protective material and obtain better a protection factor.

E. Operation

Having described the general organization of the mobility system and its interrelation with the shelter and communication systems, an example of the system in operation will be given.

It is to be assumed that the downtown area of Lincoln is directly downwind of a 1-megaton explosion at the SAC base.

Prior to the burst there may have been 15 minutes or more warning. The monitor shelters should have been manned, and it will be assumed that all but one or two have been. In the period following the burst there will be about 20 minutes before the fallout arrives in appreciable quantities, and a further readjustment of people may take place in this time.

At the time the fallout arrives, the following should have been accomplished:

(1) The operating center is manned and the controllers are ready, and establishing contact with the vehicles and monitor shelters under their control.

(2) The vehicle garages are manned by personnel preparing the modified vehicles for the road and organizing crews to modify further vehicles. The modification kits are brought out and people are already filling sandbags. The buses that will be later used for evacuation are allocated and put under cover in the shelters where they will be modified.

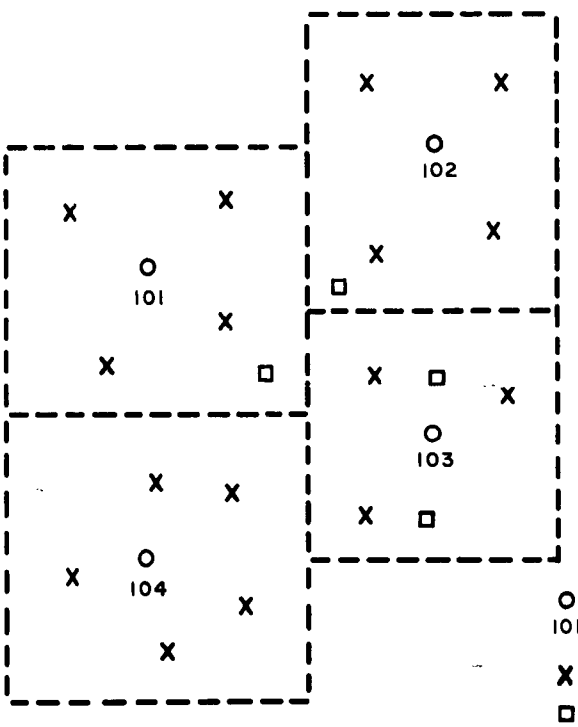
These requirements assume a local operating center in city hall, a police headquarters, or comparable location easily accessible to qualified personnel, so that the center can be manned immediately or is manned at all times as part of a normal peacetime procedure.

As the fallout descends, the monitor shelters would start sending in local radiation level readings. The radio operator at the operating center would broadcast a time check and instruct each monitor shelter to respond to a roll call of shelters. Each shelter would respond with radiation-level reading and the time the reading was taken. There would be about 40 monitor shelters in Lincoln and each roll call should be completed in five minutes. These roll calls would become a routine operation, at first conducted every 15 minutes; later, when all the fallout has been deposited and a maximum level has been reached, the time interval would stretch out to 30 minutes, and later to one hour. After the first 18 hours or so, readings would be called only twice per day.

The information received at the control center would be passed to the Monitor Controller who would set up a Radiation Monitoring Chart shown in Fig. 18. Additionally, each reading would be checked against a Radiation Level Checking Chart, Fig. 19. The dose rate and time after burst can be compared, on this chart, with two pre-calculated reference lines which, if exceeded, indicate the need to evacuate 20 PF and 40 PF shelters to prevent the ultimate product of dose rate and time from exceeding 200 R.

RADIATION MONITORING CHART

SHELTER NO.	ADDRESS	READINGS RECEIVED. BURST TIME 1---- 2---- 3---											
		1	2	3	4	5	6	7	8	9	------	19	2
		time / dng											



O SHELTER WITH 101 RADEF EQUIPMENT

X SHELTER OF 20 PF

□ SHELTER OF 40 PF

USE OF CHART AND AREA PLAN

1. Each monitor shelter is listed by nu
   appropriate sign and area covered o
2. Other shelters are marked as shown
3. Each reading as it is received is en
4. Each reading is compared to maxim
   is exceeded, 20-pf shelters need ev
   shelters need evacuation.
5. Maximum time limit before evacuati
   and is entered in the last column of
6. Total dose levels at Peak, P + 24 h
   overall situation and need for medic

NOTE: Area sizes are determined by lo
and ease of evacuation. A suit

FIG. 18 AREA PLANS SHOWING MONITORING SHELTERS WITH AREA COVERED BY THEIR RADIATION LEVEL READINGS

BURST TIME 1---- 2---- 3---								MAX.D/R REACHED	TIME TO MAX.D/R	TOTAL DOSE AT:			EVACUATE BY
5	6	7	8	9	------	19	20			PEAK	P+24HR	P+2 WKS	

USE OF CHART AND AREA PLAN

1. Each monitor shelter is listed by number and address on monitoring chart and marked with appropriate sign and area covered on area plan.
2. Other shelters are marked as shown on area plan.
3. Each reading as it is received is entered on the chart with time and level of radiation.
4. Each reading is compared to maximum level chart (Fig. 19). If the 1500 UTRDR line is exceeded, 20-pf shelters need evacuation. If the 3000 UTRDR line is exceeded, 40-pf shelters need evacuation.
5. Maximum time limit before evacuation is determined from total dose charts (Figs. 20, 21, and 22), and is entered in the last column of chart.
6. Total dose levels at Peak, P + 24 hours, and P + 2 weeks is also entered to determine overall situation and need for medical supplies, etc.

NOTE: Area sizes are determined by local conditions having regard for population density and ease of evacuation. A suitable distribution would be 2 or 3 per standard location tract.

SHELTER WITH RADEF EQUIPMENT

SHELTER OF 20 PF

SHELTER OF 40 PF

G. 18 AREA PLANS SHOWING MONITORING SHELTERS WITH AREAS COVERED BY THEIR RADIATION LEVEL READINGS

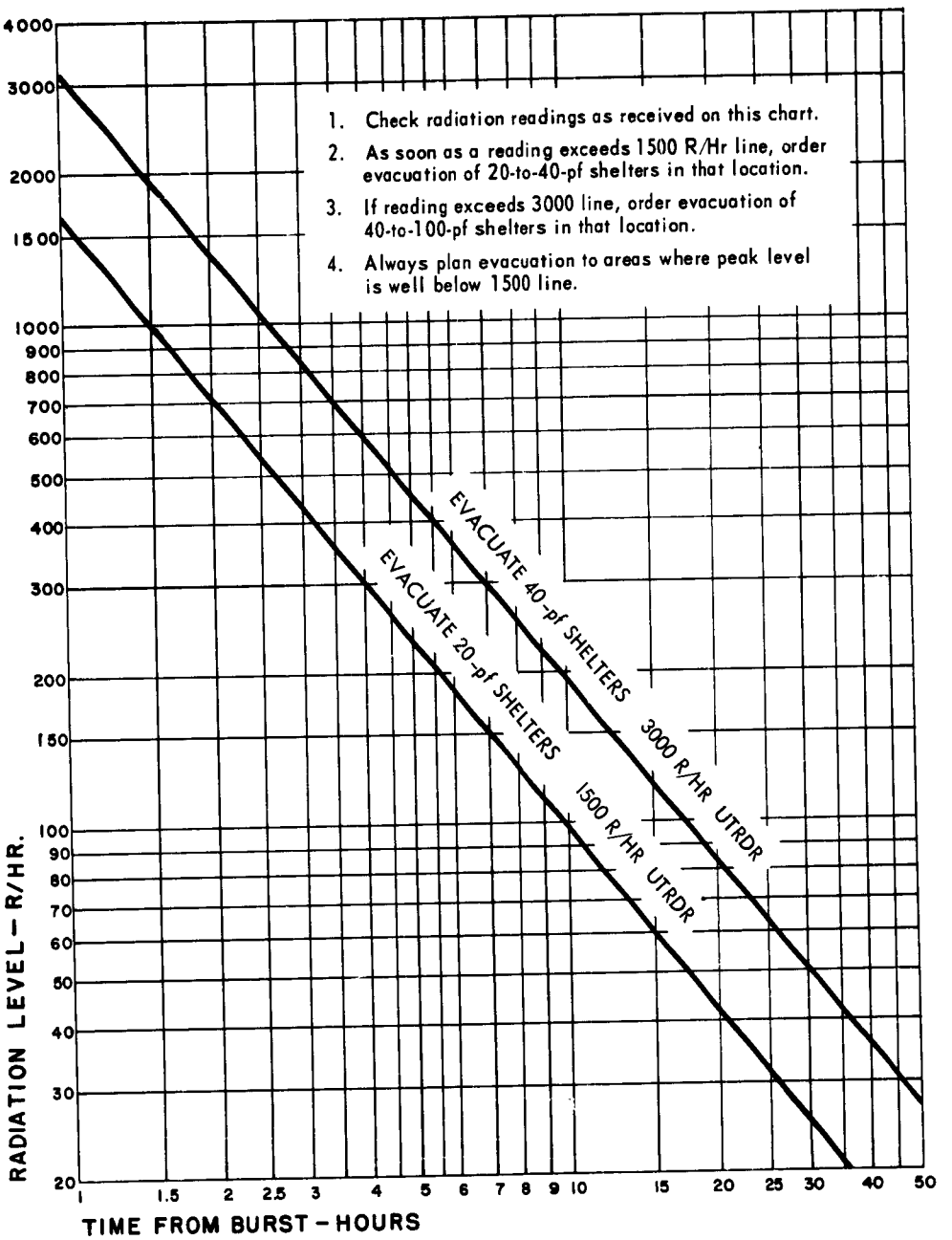


FIG. 19 RADIATION LEVEL CHECKING CHART

From the Radiation Level Checking Chart a need to evacuate certain locations early would become apparent immediately. As the information on the Monitoring chart built up, it would be seen where the radiation levels have reached peaks, indicating that all the fallout has been deposited. By reference to the total radiation dose tables (Figs. 20, 21, and 22), the controller would determine those shelters which need to be evacuated and by what time, to prevent the occupants exceeding a tolerable dose accumulation of 200 R.

In the case we are describing, radiation levels in Lincoln would build up rapidly. In a belt almost five miles wide, the outside radiation levels would climb to over 1000 R/hr before they leveled off, and it would become apparent that in a small area in the center of town all shelters below 100 pf would need to be evacuated. In a larger area all shelters less than 40 pf would need to be evacuated.

All shelters needing evacuation would be marked on a map with a red marker and a small tab indicating the time lag permissible before a dose of 200 R was absorbed by the occupants.

The Mobility Group Controller could, by reference to the map, determine the number of evacuation vehicles he would need and the most economic (in exposure time) routes for the vehicles to follow. He would also, from the Radiation Monitoring Chart, determine the best reception areas for evacuated people. With more than 50,000 surplus spaces in the area, this should not present a serious problem.

When all the fallout was down and radiation had reached its maximum values in the areas to be evacuated, the first vehicles would be sent out.

The patrol vehicles and the light aircraft would be called out, and reports would come in of some buildings on fire and a number of roads impassable due to debris. The bulldozer would be sent out to clear the roads first, and as soon as information came in that access was possible, the first buses would go out to evacuate those in the 20-to-40 pf shelters. As the vehicles approached each shelter, the shelters would be told by radio to get ready to move. As the bus drew up outside the

DOSE IN ROENTGENS - RATE IN R/HR.

UTRDR	Time to Deposit All Fallout	Max Dose Rate Reached	Total Dose at Peak D/R	Total Dose at Times Following Peak (Hours) Peak+2	P+4	P+8	P+24	P+48	P+4 da.	P+2 wks.
5000	2	2250	2250	4860	6260	8260	10,260			16,750
	4	1000	2000	3460	4300	5560	8000			
	6	600	1800	2800	3460	6660	6800			
	8	417	1670	2360	2920	3920	5220			
3000	2	1350	1350	2910	3750	4960	6150			
	4	600	1200	2070	2580	3330	4800			
	6	360	1080	1680	2070	2670	4080			
	8	250	1000	1420	1750	2350	3130			
1500	2	675	675	1220	1880	2480	3080			
	4	300	600	1040	1280	1660	2400			
	6	180	540	840	1040	1340	2040			
	8	125	500	720	880	1180	1560			
1000	2	450	450	970	1250	1650	2050	2500	2650	3350
	4	200	400	690	860	1110	1600	1950	2200	2600
	6	120	360	560	690	890	1360	1660	1860	2260
	8	83	332	472	582	782	1042	1420	1620	2120
300	2	135	135	291	375	495	615	750	795	1005
	4	60	120	207	258	333	480	585	660	780
	6	36	108	168	207	267	408	498	558	678
	8	25	100	142	175	235	313	430	490	640
100	2	45	45	97	125	165	205	250	265	290
	4	20	40	69	86	111	160	195	220	220
	6	12	36	56	69	89	136	166	186	190
	8	8	32	47	58	78	104	142	162	180

FIG. 20 MAXIMUM DOSE RATE AND TOTAL DOSE OUTSIDE

DOSE IN ROENTGENS - RATE IN R/HR.

UTRDR	Time to Deposit All Fallout	Max Dose Rate Reached	Total Dose at Peak D/R	Total Dose at Times Following Peak (Hours) Peak+2	P+4	P+8	P+24	P+48	P+4 da.	P+2 wks.
5000	2	113	113	243	313	413	513	625	663	793
	4	50	100	173	215	278	400	498	550	650
	6	30	90	140	173	222	340	415	465	570
	8	21	83	118	146	196	261	358	408	533
3000	2	68	68	146	188	248	308	376	398	473
	4	30	60	104	129	166	240	292	330	390
	6	18	54	84	104	134	204	249	279	344
	8	13	50	71	88	118	157	215	245	320
1500	2	34	34	66	94	124	154	188	199	236
	4	15	30	52	64	83	120	146	165	195
	6	9	27	42	52	67	102	125	140	170
	8	6.5	25	36	44	59	78	108	123	160
1000	2	23	23	49	63	83	103	125	133	168
	4	10	20	35	43	56	80	98	110	130
	6	6	18	28	35	45	68	83	93	113
	8	4	16	24	29	39	52	71	81	106
300	2	6.8	6.8	14	19	25	31	38	40	50
	4	3	6	10	12	16	24	29	33	39
	6	1.8	5.4	8	10	13	20	25	28	34
	8	1.3	5	7	9	12	16	22	25	32

FIG. 21 MAXIMUM DOSE RATE AND TOTAL DOSE INSIDE 20 pf

DOSE IN ROENTGENS - RATE IN R/HR.

UTRDR	Time to Deposit All Fallout	Max Dose Rate Reached	Total Dose at Peak D/R	Total Dose at Times Following Peak (Hours) Peak+2	P+4	P+8	P+24	P+48	P+4 da.	P+2 wks.
5000	2	57	57	122	157	207	257	313	332	397
	4	25	50	87	108	139	200	249	275	325
	6	15	45	70	87	111	170	208	233	285
	8	11	42	59	73	98	131	179	204	267
3000	2	34	34	73	94	124	154	188	149	237
	4	15	30	52	65	83	120	146	165	195
	6	9	27	42	52	67	102	125	140	172
	8	7	25	36	44	59	79	108	123	160
1500	2	17	17	33	47	62	77	94	100	118
	4	8	15	26	32	42	60	73	83	98
	6	5	14	21	26	34	51	63	70	85
	8	4	13	18	22	30	39	54	62	80
1000	2	11	11	24	31	41	51	62	66	84
	4	5	10	17	21	28	40	49	55	65
	6	3	9	14	17	22	34	41	46	56
	8	2	8	12	14	19	26	35	40	53
300	2	3.4	3.4	7	9.5	12	15	19	20	25
	4	1.5	3.0	5	6	8	12	15	16	19
	6	.9	2.7	4	5	6.5	10	12	14	17
	8	.7	2.5	3.5	4.5	6	8	11	12	16

FIG. 22 MAXIMUM DOSE RATE AND TOTAL DOSE INSIDE 40 pf

building, the people would transfer to the bus and be taken away. At destination, the bus would have a change of driver and be ready for another mission.

During such an exercise the shelter occupants would get about 160 R during the wait to be rescued. If they were to be left there over two weeks, the total dose would exceed 400 R. Upon arrival of the bus they will pick up a further 3 R transferring to the bus and about 15 R leaving the area. The driver will pick up about 15 R in getting to the area of evacuation, he will receive about 50 R making a pickup and a further 15 in getting out of the area. Whether it would be necessary to have any one driver make a second trip would depend upon the needs of the time.

As time passed, more buses would be added to the fleet and the evacuation rate would accelerate. In about 24 hours all of the 20-to-40 pf shelters, containing 20,000 people, would have been evacuated and a further 10,000 people in 40-to-100 pf shelters would need to be moved from a small area in the middle of town. By 36 hours from the arrival of fallout all the evacuation that is necessary would be completed.

Then would come the task of sending more supplies to unevacuated 20-to-40 pf shelters which would be continuously occupied for two weeks. In the original stocking they had supplies for only four days. The service vehicles would now begin the redistribution of supplies from shelters that have a surplus to shelters that have insufficient. At this stage too, some effort could begin in uniting families and moving doctors and technicians to needed locations.

In the aircraft survey, certain areas will have been found to be particular hotspots, not consistent with the rest of the plotted fallout distribution. These areas will need evacuation also.

F. Public Education

The question of keeping roads clear during an emergency is a complex one. There are plans in being and orders have been published that provide limited access to most main roads in an emergency. It is the

mission of the Police and other authorities to maintain clear roads. Right now, however, no one really knows what people will do if a warning sounds and an immediate attack is expected.

There might be a rush for families to try to reunite, and by so doing, instigate a solid jam of vehicles, which will then be abandoned, leaving the roads completely blocked.

There seems to be no simple answer to this problem, but it is considered that the root of the problem lies in public uncertainty as to what to do. When people do not know how other members of their families will fare, and when they do not know where shelters are, the urge to try to reunite is much greater than when they know that their families have a place to go and a plan to follow.

It is considered that with a shelter plan that can accommodate everyone, as outlined above, it will be possible to engage in a serious public education program that will effectively say, when the alert warning goes:

(1) Go to the shelter nearest where you happen to be. They are clearly marked and stocked.

(2) Do not try to find or join your family immediately. There isn't time. Your duty is to survive now so that you can provide for your family, and help save others, later.

(3) As soon as the attack is over we will move people out of unsafe areas into safe areas, and reunite families.

(4) The roads must be kept clear. Do not leave your car or truck in the road. Pull off onto the sidewalk or shoulder.

(5) THE ROADS MUST BE KEPT CLEAR.

It is considered that the mobility plan as developed herein will contribute greatly to the saving of every person from the effects of fallout. Such a plan would also reduce the incidence of hysterical or self-defeating behavior (such as helping create a traffic jam) and help maintain a cohesive community and the structure of society.

Furthermore, it will permit the maintenance of law and order at all times and reduce the sense of isolation of shelters by providing a physical contact, and the knowledge and confidence that help will be forthcoming if it is needed.

G. Costs

If there is to be an attempt to provide safety for every person in Lincoln from fallout, then shelters of at least 100 pf must be provided.

An estimate was made by the Architects and Engineers of the cost of upgrading existing shelter spaces to 100 pf and the cost of so upgrading some 31,000 shelter spaces was found to be $1.25 million. This would give only 95,000 spaces for a potential requirement of 145,000. If this additional shelter space could be built at, say, $50.00 per space, the additional cost would be a further $2,500,000, giving total building and conversion cost of $3.75 million. In the absence of incentive programs, it is impossible to predict when such amounts of money will become available.

If the mobility concept is adopted, the vehicle inventory would cost about $50,000, and the modification kits a further $50,000. In view of the extra facilities necessary, an additional cost of some $50,000 is envisioned, giving a total bill of $150,000. Organization, training, and maintenance of the program would add further costs, but the total amount involved would be an order of magnitude smaller than for upgrading and would be easier to obtain in the reasonably near future.

It remains to be decided whether Civil Defense and the people are willing to accept a heavy financial burden ($3.75 million in Lincoln) in order to have "good" shelter for everyone. To date the costs have seemed prohibitive. The mobility concept herein presented reduces the cost to a more readily acceptable sum ($150,000 in Lincoln), but places a substantial organizational requirement on the civil defense system. Such an organization is, however, not exceedingly complex and is somewhat comparable to the organization of the fire fighting services, many of which are organized on a voluntary basis throughout the nation.

It is suggested that the mobility concept is superior to the present situation of insufficient shelter and no immediate means of providing sufficient shelter. While it is no substitute for adequate shelter, mobility can at least augment the shelter that exists. Mobility permits the community to start down the road to recovery immediately after an attack, by avoiding the demoralizing effects of isolation in shelters and by introducing a community activity dedicated to the principle of saving lives. A capability for some post-attack mobility would be useful even if shelter spaces of a protection factor higher than 100 were immediately available for all the people of Lincoln.

APPENDIX

RECOMMENDED FAMILY PLAN

APPENDIX

Office of the Mayor

Lincoln, Neb.

RECOMMENDED FAMILY PLAN

A Message to the People of Lincoln Nebraska

In these times of international tensions, it is only prudent that the individual and the family plan to meet whatever situation may develop. We do not take out fire insurance because we expect our house or car to be destroyed--we take it out so that should this occur we will mitigate our actual loss. A few hours of preparation and planning can make the difference between survival and personal catastrophe should disaster strike.

Whatever the disaster--natural (such as tornadoes), accidental (explosions, for example), or deliberate (enemy attack), be ready, know what to do for your survival and safety.

Our Civil Defense organization is here to help you in any community emergency but Civil Defense is essentially self-aid when disaster strikes. You must know what to do and be prepared to act. Therefore, I urge that all citizens study the following pages carefully.

Let us identify the dangers, determine how best to meet them, then with confidence and faith meet the future with the same courage and determination that our forefathers have made the hallmark of this nation.

_____

Mayor

BASIC INFORMATION

Civil defense is the preparation of the civil population and civil government for participation in the nation's efforts to survive the gravest danger it has ever had to face. The Lincoln-Lancaster County Civil Defense was set up to cope with any kind of disaster, natural or war-caused. We have a complete operational plan. It is based on existing services within the city government and the American Red Cross.

The Federal Government has completed a survey of existing buildings to determine the degree of protection they will afford. The information has been given the Lincoln-Lancaster County Civil Defense Director. This office is engaged in getting the owners of buildings having a good protection factor to agree to their use as a public shelter. Where such an agreement is signed by the owner, the Federal Government will make available essential emergency supplies of food, containers for storing water, sanitation equipment, medical supplies and radiological detection equipment.

As these shelters become available, they will be made a part of our shelter system and you will be informed. Unfortunately, there are not enough qualifying shelters for all of our people. This just happens to be a fact--no one is responsible for this fact. We must all do everything to provide additional qualified shelters.

People living near these shelters will be assigned space in these shelters to the full capacities of the shelter. A working map of the city showing the areas assigned to specific shelters will be available in the Civil Defense Office. A duplicate map will be on display in_____. This duplicate map will be

updated as the work progresses. Progress reports will also be made via newspapers, radio and television.

As an interim measure:

(1) Watch for shelter signs in the neighborhood where you live and where you work.

(2) Where no shelter has been designated, select the most substantial building in the vicinity.

The power of nuclear weapons is indeed tremendous and if you are near the point of impact there is no practicable defense. The size of the area totally destroyed will depend on the size of the weapon used. But no matter what the size, there will always be a much larger surrounding area where taking the proper steps will tremendously increase your chances of survival.

A modern steel-framed or reinforced-concrete building will offer some protection from blast, heat, and ratioactivity close to the impact area. Farther away, less substantial structures become effective shelters.

Fallout is potentially more dangerous to human life than blast and heat for the simple reason that it covers an area perhaps many times larger than that affected by blast and heat. Protective measures against the hazards of fall-out are much simpler and more effective than those against blast and heat. All that is needed is heavy material between you and the radioactive dust. Further, except in the immediate vicinity of the explosion, a matter of one to six hours will elapse before the radioactive dust descents, depending on the wind and the distance from the explosion.

Information is available in the Civil Defense Office and in all branch libraries which will enable you to select a good shelter or to improvise one in your home. This and information on all subjects relating to Civil Defense are free for the asking. Call, write, or telephone Lincoln-Lancaster County Civil Defense, _____ St., telephone _____.

RECOMMENDED FAMILY PLAN

IT IS ONLY PRUDENT TO PREPARE FOR POSSIBLE DISASTER

1. Teach each member of your family the action to take in event of attack or warning of impending attack. Assign specific duties and hold family practice drills. Adult members should take a First Aid and Basic Civil Defense Course. Learn the two CD air raid signals. If, contrary to our recommendations, you plan to evacuate, know the siren signal, where you are going, your route, and means of transportation.

2. Choose the best available shelter in immediate neighborhood for you and your family. If none is available select the strongest part of the interior of your home as a shelter area, out of direct line with doors and windows, and with minimum danger of flying glass and debris. There should be two outside exits. If not, take precautions against possibility of debris blocking the single exit. Equip shelter with first aid kit, flashlight with extra batteries, a whistle, canned food, bottled or canned water, a self-powered radio, and other emergency necessities.

   Also, know the best shelter where you work.

3. Reduce fire hazards. Trash piles, rubbish, etc. that accumulate around the home increase the danger of fire.

4. Select a relative or friend in a rural community to act as a clearing point for information on the family. After disaster, register all information about your family with civil defense authorities.

5. Attend civil defense classes. There is no charge or obligation. LEARN NOW! Call _____ for details.

EARLY DISPERSAL
(No Siren Signal)

Our Government . . . Federal, State, or Municipal . . . should it foresee a serious threat of enemy attack, may recommend dispersal (evacuation) several days ahead of time. No siren would sound but information would be given by all public information sources.

Dispersal is voluntary. Leave the city with your family, going either to a destination you have prearranged or to a destination designated by civil defense authorities. You will probably remain there for some time.

ALERT SIGNAL

A 3 to 5 minute steady, continuous sound of sirens means attack probable. Time before attack cannot be determined. We recommend you go to the best shelter available in the immediate neighborhood with necessary supplies such as water, food, blankets and special medicines as you are able to carry. Tune battery-operated radio to 640 and 1240 on radio dial for information and instructions.

If, contrary to our recommendations, your decision is to leave the city, make certain you have made prior arrangements for a place to stay and go there immediately.

TAKE COVER SIGNAL

A warbling tone of 3 minutes duration means attack imminent.

Take best available shelter. If indoors, close doors. Draw blinds and draperies. Leave electrical and gas appliances as if you were leaving home for a day and going downtown. Tune radio to 640 or 1240. DO NOT USE TELEPHONE.

ATTACK - NO WARNING

(Very brilliant flash or heavy shock)

Drop to floor, get under bed or heavy table. If these are unavailable, stay on floor against wall, out of line of glass, shielding face and head.

ACTION AFTER ATTACK

Remain in shelter. Keep house closed tight. Nail blankets or heavy coverings over broken doors or windows. Put a damp handkerchief over nose and mouth to help prevent entry of dust. If exposed in the open after the explosion, change clothing and wash thoroughly all over, including the hair....Keep radio tuned to 640 or 1240 for instructions. Don't leave shelter until you are sure your area is safe. Contamination by fallout is possible without visible evidence of moisture or dust.

OTHER DISASTERS

The Lincoln-Lancaster County C.D. plans for your safety not only in event of enemy attack but under other forms of disaster. All of these other types have been experienced in Lincoln or its neighboring areas. Know what to do for your safety.

Explosion

"Take Cover" instructions prevail. Don't be a "sightseer". Inquisitive onlookers often gather by hundreds, even thousands. This obstructs fire, police, and medical aid.

Fire

Prepare Home Fire Plan. Instruct family.

Notify the Fire Dept. immediately. Send alarm from nearest Fire Alarm Box. Dial the Fire Dept. number_____and give address and exact location of fire. (If you do not know where nearest Fire Alarm Box is, find it NOW before need arises.)

Evacuate all persons in the building. Close all openings, doors, windows, etc. to prevent fire spread.

Before you open a door, feel it with the palm of your hand. If the door feels hot, the hallway or room is already filled with deadly heated gases. If you are caught in dense smoke, remember that the best air for breathing is nearest the floor.

Do not burden yourself with personal belongings. Many serious casualties result from attempting to save possessions.

Do not re-enter the building for any reason until permitted by the Fire Dept.

Lincoln-Lancaster County Civil Defense

_____ _____Street, Lincoln, Nebraska

Telephone _____ _____

Submitted:_____ _____ Director

Approved:_____ Chairman-Board of County Commissioners

:_____ Mayor

Date: _____

STANFORD
RESEARCH
INSTITUTE

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CALIFORNIA

Regional Offices and Laboratories

Southern California Laboratories
820 Mission Street
South Pasadena, California

Washington Office
808 17th Street, N.W.
Washington 6, D.C.

New York Office
270 Park Avenue, Room 1770
New York 17, New York

Detroit Office
1025 East Maple Road
Birmingham, Michigan

European Office
Pelikanstrasse 37
Zurich 1, Switzerland

Japan Office
911 Iino Building
22, 2-chome, Uchisaiwai-cho, Chiyoda-ku
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