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Strategic Considerations in Planning a Counterevacuation

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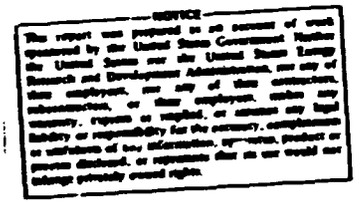

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ABSTRACT

The Soviet Union has highly developed plans to evacuate their population centers in a nuclear confrontation. Their plans include construction of expedient shelters in the outlying areas and continued operation of their essential industry by commuting workers. If they should successfully implement their plan, a subsequent nuclear exchange with the United States would cost them far fewer casualties than they suffered in World War II. Without a corresponding evacuation, the US could lose from 50 to 70 percent of its population. This asymmetry in vulnerability, if allowed to persist, would seriously weaken the bargaining position of the US President. To restore the balance, a great reduction in vulnerability can be achieved most economically by planning a US counterevacuation as a response to a Soviet evacuation.

Russian historical experience with murderous invaders, most recently in World War II, has made authoritarian defense measures involving civilians and property in peacetime quite acceptable in their culture. In the US, wide-scale use of private property and civilian participation in defense activity are not feasible until the development of a grave crisis. Hence US evacuation plans must differ in several important respects from the Soviet plans. However, this preliminary study indicates that the US has ample material resources to move and shelter its population at least as effectively as the Soviet Union. Perhaps the most critical disadvantage of the US is in morale, as evidenced by the widespread misconception that effective survival measures are not possible.

Due to the US automobile inventory, the US has a 10-fold advantage in passenger transportation. With adequate planning, this will permit most cities to be evacuated in one day, compared with three days for the Soviets. The large Soviet weapon inventory and smaller area of the US make the fallout problem more acute for the US, and the construction of high-protection factor, expedient shelters more necessary. There are ample supplies of tools and construction materials to accomplish this.

Private ownership of housing, especially rural, is a disadvantage to a US evacuation. It could nucleate resistance to the evacuation. Unless redirection of food distribution to the rural area is clearly evident to the host population, legitimate concern for its future safety

could seriously raise the level of force engendered by this resistance. Socio-economic and racial tensions could further exacerbate the situation unless government authority is maintained by its manifest competence, and perception of the external threat is kept high.

The Soviet provision for maintaining essential production by a commuting work force will require that the US have comparable plans to mitigate the economic effects of the evacuation. Otherwise extension of the evacuation more than a few days will put great economic pressure on the US to the disadvantage of its bargaining position.

The disciplined Soviet population and authoritarian government make feasible cycling the Soviet plans. One or two false alarms would seriously degrade the effectiveness of US plans. One way to prevent this is to design the US plan for one time only. Then advantage can be taken of the change thereby produced in the political climate and national priorities to build a shelter system that, with only tactical warning, will give protection comparable to the Soviet evacuation and will permit operation of the economy during a crisis. This will require that the US recognize, as does the Soviet Union, that protection of its productive population is part of its strategic deterrent.

CHAPTER I. INTRODUCTION

This report is concerned with guidance for planning an evacuation in response to a Russian urban evacuation. While the life-saving potential of the plans is the principal motive for the evacuation, the crisis-management aspects of the evacuation are extremely important in some situations.[1,2,3,4] The evacuation itself is a diplomatic and military tool in a confrontation. Based on experience of the 1960's with superpower confrontations which did not lead to war, we consider an evacuation not leading to a war more probable than one that leads to a war and vastly more probable than the "attack out of the blue" that preoccupied planners in the 1950's.

The strategic situation of the 1970's is vastly different from that of the 1950's and early 1960's, during which the US enjoyed massive superiority in weapons. Today the Soviets have a clear superiority in numbers and payload weight of their missile force.[5] More significantly they have developed a well organized plan to evacuate their cities, reducing the vulnerability of their population to our nuclear weapons to less than a tenth of the vulnerability of our unevacuated population to their weapons.[6,7,8] In a nuclear exchange, the Soviets would lose less population than they lost in World War II.

From their experience in that war, the Soviets clearly understand that nuclear war does not mean the end of mankind, or even the civilization of the participants, if prudent precautions have been taken to protect their populations from its effects.[9,10] Furthermore, they recognize that the labor force of a country is the foundation of its strategic strength, and that passive measures to protect this force are an essential part of the strategic defense. One finds, throughout Soviet literature on the subject, repeated reference to the statement by Lenin:[6]

> "The primary productive factor of all humanity is the laboring man, the worker. If he survives we can save everything and restore everything . . . but we shall perish if we are not able to save him."

Restoring the strategic imbalance by adding to the US Strategic Offensive Forces is precluded by the agreements of SALT I. However, there is absolutely no restriction on passive defense. Furthermore, the emphasis placed on evacuation by the Soviet government to its own people make it highly likely that we would have at least three days in which to carry out our own evacuation.

Unfortunately, it appears that plans to make use of that time must be extremely austere and can use only resources at hand at the time of crisis. Despite the Russian superiority in strategic missiles and their planned ten-fold advantage in population vulnerability, the political realities are such that additional support for Civil Defense in the US is unlikely at the moment. The proposed FY-75 budget for DCPA was $83 million,[11] 0.10% of the total Defense budget and less than 2% of the US budget for Strategic Defense systems. The Soviet budget for Civil Defense is variously estimated to be 30 to 50 times the US CD budget.

However, even with these restrictions, plans capable of saving scores of millions of lives are possible. Our knowledge of weapon effects, and also of shelter technology (some of it adapted from the Soviets) is more sophisticated than it was 10 years ago. We now know how to improvise very high protection-factor shelters with excellent habitability in no more than 48 hours, using a wide variety of available materials and measures at hand.[12,13]

One of the best and cheapest defenses against nuclear weapons is distance, the purpose of evacuation. Here we have one clear advantage over the Russians, our mobility.

Seven Problems for a US Evacuation Plan

In considering the strategic aspects of a counterevacuation plan, one must be aware of the ways the opponents could neutralize it, and of the ways it could fail from inadequate consideration of human nature. One must avoid critical weaknesses which could make it ineffective, either deliberately or by default. We recognize seven major possibilities. These are listed briefly below, and the method of avoiding each is discussed in detail in the following chapters.

Problem Number One: Politics.--As mentioned above, in the present political and economic climate in the United States, it appears that any plan which requires participation or involvement of the general public before the development of a crisis would require a substantial amount of re-education of the public. Any plan should, at least in its initial phases, involve only the present cadre of cognizant Civil Defense professionals. Ideally it could be implemented within the present DCPA budget. Practically it should require only modest (small multiple) increases in the DCPA budget.

Problem Number Two: Threatening the Survival of the Evacuees.--Any plan which under some reasonably likely off-design circumstances may decrease the survivability of the evacuees is to be avoided. A past example was the planning for movement of people into the center of cities for fallout protection, where they would be more likely to be exposed to blast and fire. Another example of a faulty evacuation plan is one that fails to make provision for adequate fallout shelter or water supplies for the evacuees.

Problem Number Three: Threatening the Survival of the Host Population.--A plan that appears to threaten the survivability of the host population may provoke resistance, which could delay and disorganize the evacuation. An example of such a plan is one that makes no provision for the necessary additional food supply in the reception areas.

Problem Number Four: Unresponsiveness.--If the plan does not make maximum use of the available resources for movement and shelter construction, or cannot for other reasons respond in a timely manner to Soviet moves, a very unstable situation can result in which the vulnerability of Russian population is decreased significantly faster than that of the US population.

Problem Number Five: Lack of Durability.--The plan must be designed so that the evacuated posture can be maintained at least as well as that of the Russians. For example, if the Russians keep their critical

industry going and the US does not, the US posture will become less tenable with the passage of time due to economic pressures.

Problem Number Six: Vulnerability to False Alarms.--The well-disciplined Soviet population can be repeatedly ordered to evacuate. After one or two false alarms, the US population will simply ignore the next warning to evacuate. The US evacuation plan must be designed to cope with this asymmetry. Our proposed solution is a one-time-only evacuation, followed immediately by a permanent shelter construction program.

Problem Number Seven: Disadvantageous Prospects for Long-Term Survival.--If the prospects for the long-term survival of the evacuees are questionable, the legitimate question can be raised by the US population, "Why escape the direct effects of an attack only to die of starvation (or exposure, or leukemia, etc.)?" There must be assurance that, if there is a nuclear exchange, the plans and resources exist to (1) restore essential food production and distribution and (2) restore a meaningful economy and standard of living.

The United States has great advantages over the Soviet Union in food reserves and agricultural productivity that will survive any attack. These, coupled with credible plans to keep our productive population healthy and overcome industrial bottlenecks, will assure our own population of their survival and the Soviet Union of our industrial recovery. The latter should be an additional disincentive for the Soviet Union to allow a crisis to escalate to an attack.

CHAPTER II. CASUALTY REDUCTION

One necessary criterion of any plan to counter the Russian evacuation plan is that it must reduce the vulnerability of the US population to all weapon effects to a level comparable to that of the Russian population in their evacuated posture. To the extent that the vulnerabilities are not comparable, the plan does not counter the Russian plan. This imposes some difficult requirements on the US. As will be seen below, the Russians have at least a 2-1/2 times greater advantage in megatons and the US has only one-half the area of the Soviet Union, giving the US what is potentially a much worse fallout problem.

Blast Threat

A comparison of the US and Russian strategic forces assembled from unclassified sources[5] is presented in the Table of Appendix A. The Soviet strategic missile force has about 2200 warheads with a total yield of about 4900 megatons and can cover about 59,000 mi^2 with 15 psi. This corresponds to about 4700 megaton equivalents.*

In Fig. 1 are plotted the fatalities that would be inflicted vs megaton equivalents rank ordered by population density for several mean lethal overpressures.[14] In addition, dashed lines are shown for a population evacuated to a uniform density of 100 people/mi^2 sheltered at 15 and 30 psi, assuming the weapons were targeted on the evacuated population. We consider these estimates pessimistic. Aside from any moral consideration, we consider such retargeting unlikely because it would leave the industrial assets virtually untouched. Furthermore, the 10 to 15 percent of the population on-shift and maintaining services in the evacuated areas provides potentially as many casualties as the very low density evacuated population.

*The megaton equivalent of a weapon is the ratio of the area it would subject to a given overpressure to the area a 1-megaton weapon would subject to the same overpressure.

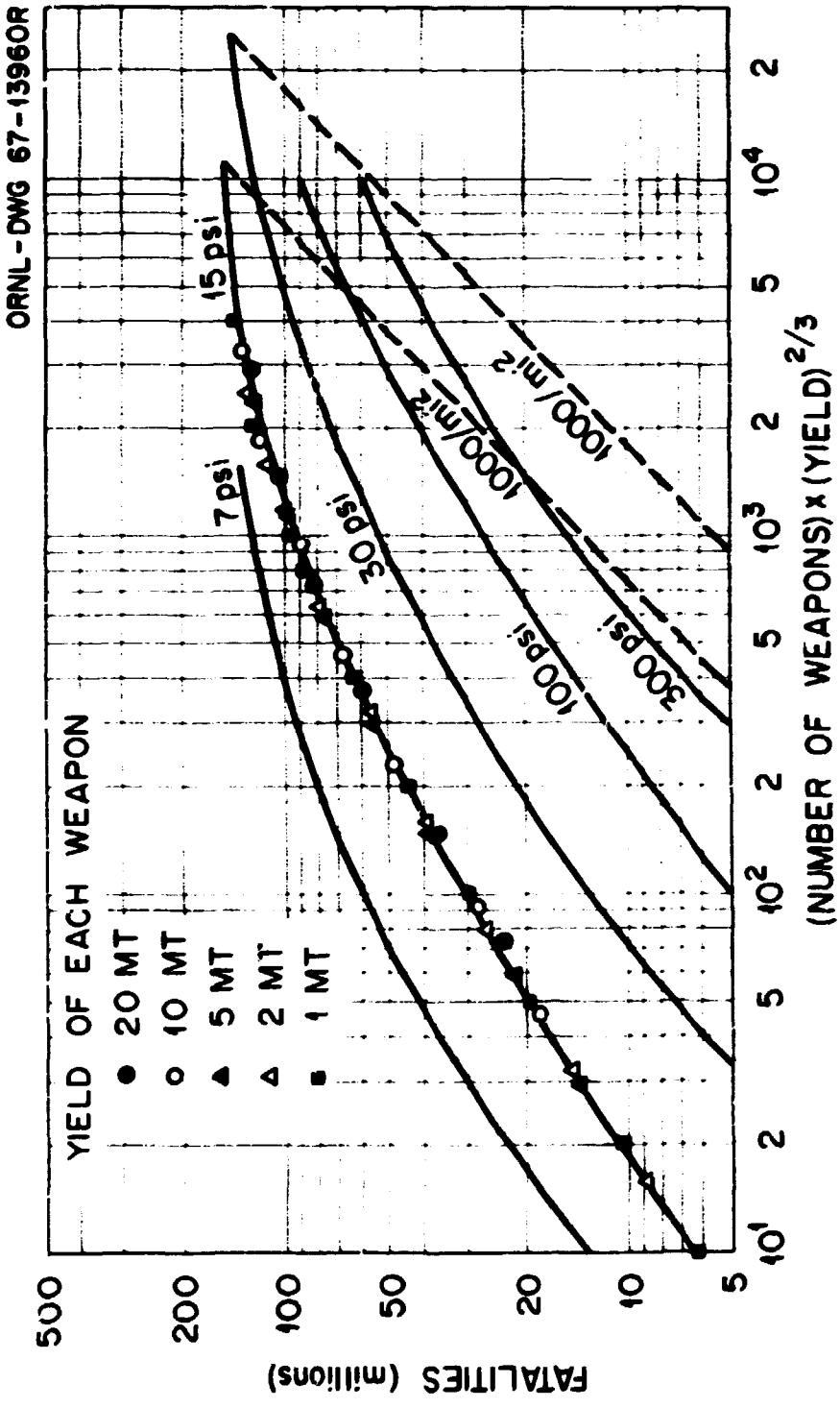

Fig. 1. Fatalities vs megaton equivalents.

Fallout Threat

Much more uncertainty exists about the fallout-caused fatalities than about those caused by blast due to the former's strong dependence on burst height and meteorology. Some broad rules-of-thumb can outline the threat.

If one makes the common assumption that the Soviet force consists of something over 8000 megatons of 50 percent fission weapons with a total reliability of 60 percent, then one might expect an attack of 5000 megatons to arrive. If one-half of these are ground bursts, then a curve of percent area covered vs 1-hour reference dose rate shown in Fig. 2 can be obtained from the Miller Fallout Model.[15] This would result in lethal radiation doses to unprotected people in about 25 percent of the area of CONUS, and to people in PF-20 shelters in about 5 percent of the area.

Unfortunately a large part of these areas are in the highly populated northeast. Since it is impossible to predict with sufficient accuracy the meteorological conditions that determine fallout deposition, there is a potential hazard of unacceptable radiation levels everywhere. It is clear that fallout shelter should be constructed everywhere. No portion of the country can be sure of negligible fallout. In studies reported elsewhere, it is clear that very high protection-factor shelter (i.e., PF of several hundred) can be improvised from materials at hand anywhere it is possible to dig.[12,13] In contrast to blast, it is at least theoretically possible to protect everyone from fallout.

Areas to be Evacuated

The purpose of the evacuation is to protect people from weapons effects, especially blast. Areas should be evacuated if there is a reasonable probability that they will be subjected to a higher blast overpressure than the resistance of the shelter that can be improvised in the time available with the materials available.

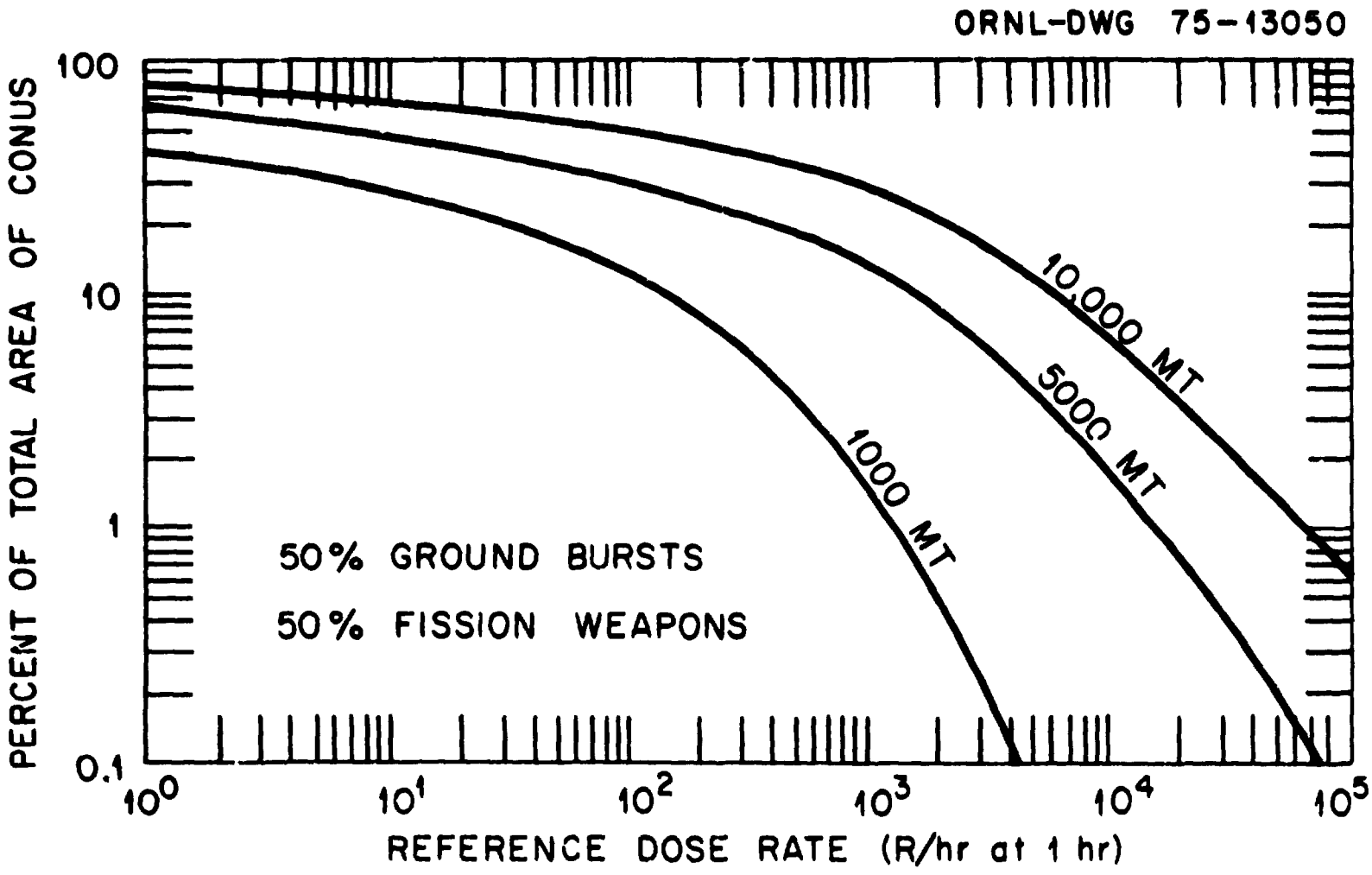

Fig. 2. Fraction CONUS enclosed within center vs reference dose rate.

Obviously we cannot know Soviet target plans, but they make no secret of their concept of strategic war.[10] Their philosophy, unencumbered by such grotesque concepts as "Mutual Assured Destruction," is simply to fight and win the war. Their targets are the enemy's (1) Military Forces, (2) Communications and Transportation, and (3) Industry.

Since, on the scale of multi-megaton blast effects, our industry is largely co-located with our population, large population concentrations are also usually industrial concentrations. If we assume that about 25 percent of the Soviet strategic force is targeted against US industry and assume 15 psi as the criterion for irreparable damage, about one-half of the US population will be in the target areas. Not all these will be struck due to various malfunctions--a reliability figure of 60 percent is often used. However, all persons who cannot be accommodated in sufficiently hard blast shelter must be evacuated since there is no way to predict which delivery systems will malfunction, even if the targeting were known.

Population density alone is probably a poor criterion for evacuation. The cumulative population living in areas where the density is below a given density is plotted vs this density in Fig. 3.[16] If one assumed the more densely populated areas containing 50 percent of the population were to be evacuated, areas with more than 1000 people/mi^2 would be evacuated. We know of more densely populated suburban areas that are not near any important targets. Conversely there are many very important military targets surrounded by a population of very low density.

The Office of Business Economics (OBE) areas surrounding population centers are the logical reception areas for urban evacuees (see map, Figure 4). These are the areas that trade with the population centers, and the road net is structured accordingly. With the exception of New York, distributing the OBE population over the OBE area will get the average population density below 1000 people/mi^2 (see Table B-1, Appendix B). The New York population must be distributed over the Binghamton, Albany, and Wilkes-Barre OBE areas to get below 1000/mi^2.

War games are an unreliable means to assess risk because the Soviet strategic force contains relatively few warheads at the present time,

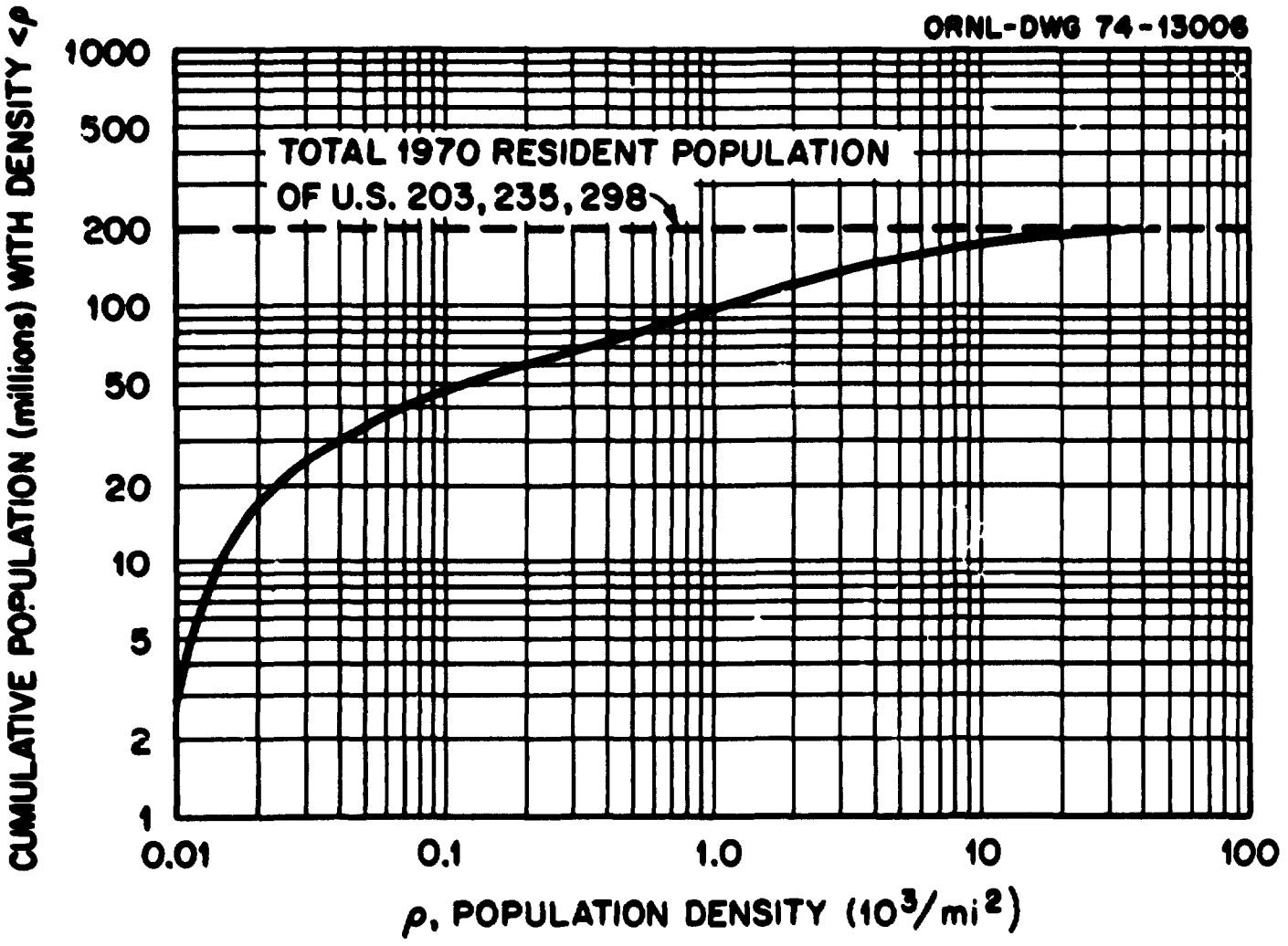

Fig. 3. Cumulative population less than a given density vs density.

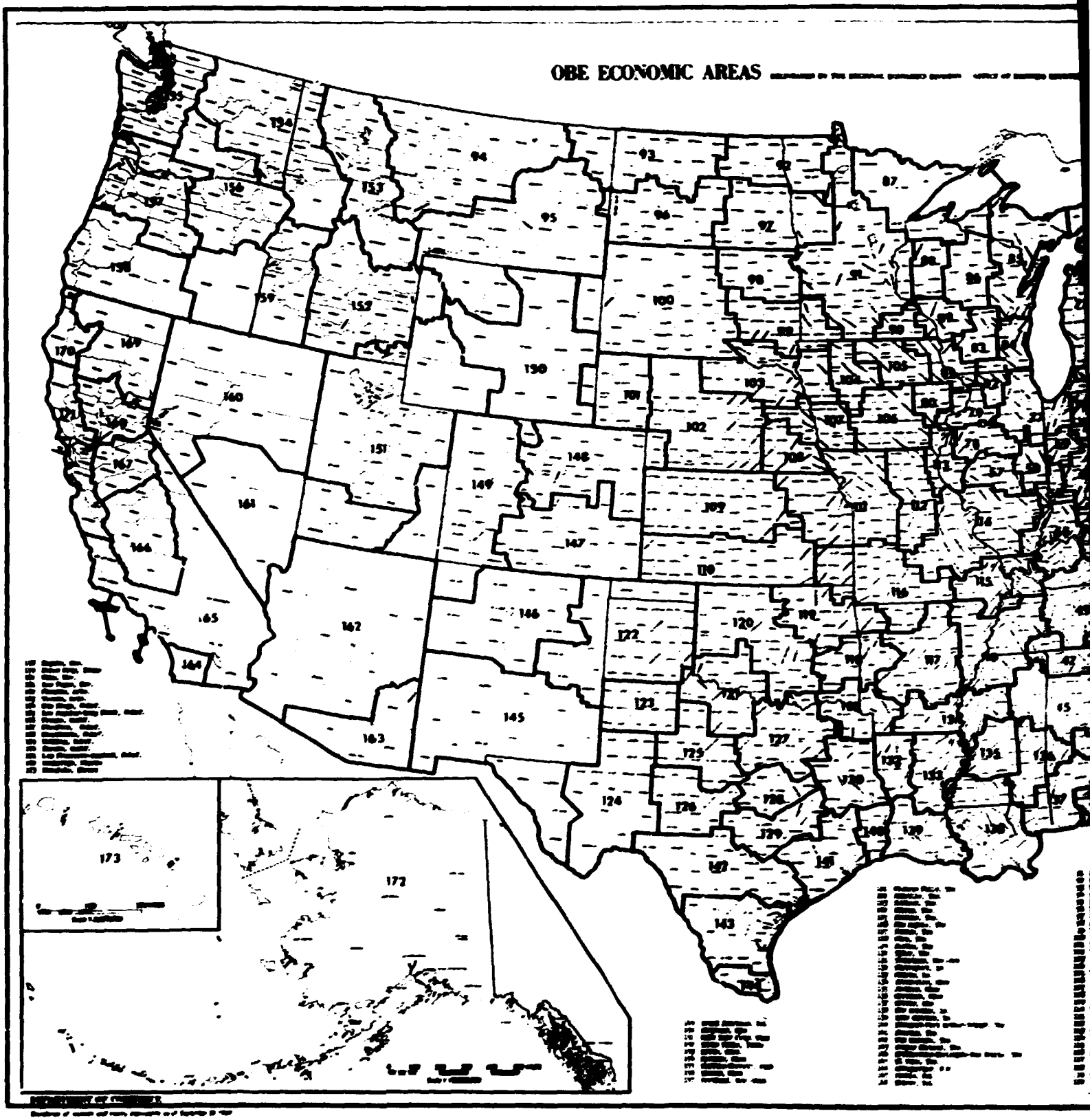

Fig. 4. OBE economic areas.

conomic areas.

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and that number is almost sure to increase significantly. The trouble with war gaming is that targeting stops when the known supply of warheads is expended. The risk is then very dependent on assumptions as to target priorities.

A more conservative risk assessment for an area might be obtained by noting the proximity of any important military, communication, or industrial targets, and assuming a much larger number of Soviet warheads is available to attack them. The surrounding area, with consideration for missile accuracy, is considered to be at risk and would be evacuated to the point where the hardness of available shelter exceeded the expected overpressure. This approach gives a patently reasonable criterion for evacuation.

Unfortunately, there will be a temptation to set the overpressure criterion for evacuation very low--as low as 2 psi. This will result in a very large fraction of the population of the highly urbanized United States being evacuated. This will result in very severe logistics problems in the reception areas, very high hosting ratios, and severe transportation problems for any plan to keep essential industry operating.

By taking advantage of the inherent blast hardness and wide adaptability of expedient shelter designs discussed below, areas threatened by overpressures of 5 or even 10 psi can remain unevacuated. The number of evacuees would be reduced by a significant factor. The load on the reception areas and hosting ratios would be enormously reduced.

Protection Available

Designs for a family of expedient shelters have been developed which permit evacuees and the host population to construct very good protection against anticipated weapons effects. Designs are available for most of the different soil and weather conditions and materials availability likely to be encountered in the United States. These shelters and their construction procedures are discussed elsewhere.[13] They are summarized in the table below.

TABLE 2.1. PROTECTION AVAILABLE FROM EXPEDIENT SHELTER

Shelter Type	Applicable Site	Fallout* Protection Factor	Blast Resistance (psi)	Construction** Time (hr)
Door-Covered Trench	Stable Soil	200+	5-6	12
Log-Covered Trench	Stable Soil	200+	15-?	36
Wire-Catenary	Stable Soil	200+	15-30	36
Small-Pole	Unsaturated, Unstable Soil High Blast Threat	500+	30-80	48
Israeli	Free Running Soil	500+	20-40	36
A-Frame	High Water Table	20+	20-?	48
Basement	Cold Climate Low Water Table	10-20	2-3	6
Improved Basement	Cold Climate Low Water Table	40-200	10-30	24-72 (est.)

*With entrance kept clear of fallout.

**Tested construction times by rural and small town residents using hand tools.

The basements and improved basements have the advantage of being weatherproof. They are generally available where winters are severe. They would see maximum use in the unlikely event of a winter evacuation.

Forty-seven percent of the total US population can be accommodated in rural residential basements* in their OBE area at a loading of 40 persons per basement. If an average loading of 100 people per rural basement is accepted (average basement area is 1200 ft^2), 70 percent of the US population can be accommodated (see Table C-1, Appendix C).

One serious disadvantage of depending on such basements is that a great amount of labor is required to improve significantly their radiation and blast resistance. Their presence would provide a temptation to local planners and evacuees to forego construction of the much better covered-trench shelters.

A system having the advantages of both buried shelter (good protection) and basements (comfort) might be achieved by building expedient buried shelters connected to basements. Then the living space in the basement could be used up to the moment tactical warning of an attack is received. In the case of areas subjected to fallout only, the space in the basement would be usable for increasing intervals after a few days.

The connection of the shelter and the basement would be easy for basements constructed from concrete blocks. Poured concrete basements would require use of a basement window, or door for direct access to shelter.

The small-pole shelter, when made with green poles, with adequate cover of dry earth, is extremely blast resistant in addition to having a very high radiation protection factor. It could be very useful in areas likely to be attacked. Where the poles are available and soil conditions permit, it would be effective expedient protection also for the on-shift workers. In this case, usually the poles would have to be brought into the plant from the evacuation reception areas by the commuting workers.

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*As used here rural basements refer to basements in single family dwellings in rural areas as reported by the 1970 Census.

The timber resources of the US are extensive. Thirty-two percent of the US population lives in OBE areas where less than 1 percent of the standing timber is required to build small-pole shelters for the entire population. Seventy percent of the US population lives in OBE areas where 10 percent or less of the standing timber would be required (see Table D-1, Appendix D).

The covered trench shelters can be constructed rapidly. The wire-catenary and door-covered shelters are for use in areas where trees are not available. The covered A-frame shelter is for use in regions of high water table.

The door-covered-trench shelter is potentially the most available single shelter type for evacuees. Interior doors are available in virtually every residence in sufficient number to shelter the occupants and are quite portable. Properly constructed, this shelter provides fallout protection in excess of 200, good weather protection, and surprising blast protection. (One such shelter survived 6 psi in the "Mixed Company Event.") They are the most rapidly constructable of all the high PF shelters.

CHAPTER III. SUPPLY PROBLEMS

In most concepts of urban evacuation, the ratio of evacuees to indigenous population (hosting ratio) is usually in the range of from 2 to 3. The sudden change in population will severely strain most, if not all, systems supplying necessities to the reception area. In particular, unless plans have been made to reconfigure food distribution, the existing retail food supply to the reception areas will be clearly inadequate. Rural residents may well perceive the migrating population to be a threat to their existence unless some means of supplying the evacuees become evident. These problems and possible solutions will be discussed in this chapter.

Water

In most populated areas of the US there is a plentiful supply of water. Most US families use between 100 and 150 gallons per person per day under normal conditions. In such areas the evacuees may be expected to use the water facilities of the host population. Most rural water treatment facilities can supply three times the resident population for a period of 2 to 3 weeks if non-essential water usage is curtailed.

In some areas of the country, water is in chronic short supply. Evacuees from cities such as Albuquerque, Phoenix, and Tucson may have to haul their own water if adequate supplies are not available in the accessible reception areas. Water containers are essential. A large water container may be improvised by simply lining a trash can with one or two large plastic bags, taking care to be sure that the diameter of the plastic bag is greater than that of the can.

In arid areas it is prudent to allow a minimum of a gallon per person per day for drinking and minimum hygienic washing. A family of four would require about 60 gallons for a two-week supply. This can be contained in two large lined trash cans.

Water can be treated by adding to each barrel a few ounces of a strong household bleach solution which contains hypochlorite.

Cities with average annual precipitation of less than 16 inches per year are listed in Table F-1 in Appendix F. Some of these cities have abundant water supply despite the low annual precipitation because of the proximity of large dams and lakes, such as Boulder Dam near Reno, and Garrison Dam near Bismarck. However, these dams may well be targets themselves.

Food

Surveys by the USDA have shown that the typical home has about one week's supply of food on hand. In addition, retail stores and wholesalers have about three weeks' supply of available food on hand, as shown in Table 3.1. Food stocks in processing and in cold storage can provide further food supplies, depending on season and location.

One of the simplest and most direct ways of solving the food problem in the country for the first few days after an evacuation would be to have the city evacuees carry their food out with them. During the crisis buildup, the public could be encouraged to stock up with the two-week emergency supply as recommended in the USDA Home and Garden Bulletin No. 77 (Appendix G).[17]

A number of these bulletins should be stored by the local CD directors to be distributed through various media when the need arises. The pamphlet can be reproduced in the local newspaper as part of the pre-evacuation crisis activities.

One desired effect of exhorting the populace to stockpile during an emerging crisis is that the retail stores will be cleaned of non-perishable food. When the evacuation occurs, the evacuees should take their food stockpiles with them. The wholesalers and retailers can then start implementing plans for establishing and stocking market outlets in the reception area.

About 22 million (approximately 33%) American homes have freezers.[18] Per capita ownership in the rural areas is greater than in the urban areas, although the actual number of freezers owned is about the same in each category. Food stored in freezers can amount to anywhere from

TABLE 3.1

DAYS[a] OF FOOD AVAILABLE BY CIVIL DEFENSE REGIONS FROM HOMES, RETAIL FOOD STORES, AND WHOLESALERS, 1963 AND OTHER FOOD STOCKS[b] JANUARY 1, JULY 1, 1963

Region	Home	Retail Food Stores	Wholesalers	Other Food Stocks January 1	Other Food Stocks July 1
	Days of Food				
One[c]	7	10	12	33	25
Two[d]	8	10	9	27	24
Three[e]	7	9	12	54	40
Four[f]	8	11	9	56	45
Five[g]	8	10	9	51	44
Six[h]	10	11	11	100	63
Seven[i]	8	11	9	73	36
Eight[j]	10	13	8	187	60
United States	8	10	10	56	38

[a]Based on a caloric intake level of 3000 calories per person per day.

[b]Refers to stock in food processing and cold storage plant inventories.

[c]Maine, Vt., N.H., Mass., Conn., R.I., N.Y., and N.J.

[d]Penn., Del., Md., Ohio, Ky., W. Va., and Va.

[e]Tenn., N.C., S.C., Miss., Ala., Ga., Fla.

[f]Mich., Ind., Ill., Wis., and Minn.

[g]Ark., La., Texas, Okla., N.M.

[h]Mo., Iowa, Kans., Nebr., S.D., N.D., Wyo., and Colo.

[i]Ariz., Utah, Nev., and Calif.

[j]Mont., Idano, Oreg., and Wash.

Source: Adapted from United States Department of Agriculture, Economic Research Service, Food Supplies Available by Counties in Case of a National Emergency, Agricultural Economic Report No. 57 (Washington: Government Printing Office, July 1964), pp. 110-210.

a week to several months supply. Evacuees with large amounts of frozen food may be able to trade it for non-perishable food the first day or two in the reception area. Frozen food can be transported on a day-long trip without a freezer and without spoiling for a few days if there is a large bulk of the food (20 or more pounds) and if it is well insulated. Large polyurethane foam picnic baskets or styrofoam works well for this purpose. Excellent insulation can be improvised from blankets or crumpled newspapers and plastic bags or film.

At the reception areas the evacuees may have to live on the food they brought with them until the retail stores in the vicinity have a chance to get extra supplies. There will be some evacuees who will not bring food and may not have money to buy it. Some mechanism to provide for them must be established. A special government-sponsored credit system to be operated by local authorities might be established to cover this situation.

The evacuees should attempt to build up or maintain their two-week inventory of food in case there is an attack which would confine them to their shelters due to fallout radiation. It will be necessary to redirect the normal supply/distribution system in order to provide more rapid replenishment of stocks in evacuation areas so evacuees can build up their emergency reserve.

General transport mobilization orders[19] and emergency food orders[20] exist for the post-attack situation, but not for a pre-attack crisis. These documents should be revised to cover a massive evacuation situation.

If an attack occurs while the US is in an evacuated posture, there may be serious food shortages in some localities, not because of a general food shortage in the country but because of an unbalanced distribution of stockpiles. Evaluation of the effectiveness of the US transportation system in alleviating the distress areas is difficult because the entire system of communications, petroleum supply, roads and warehouses may be damaged to greater or lesser extent by the nuclear attack. Studies by Garland[21] indicate that pre-attack redistribution and storage of wheat to prevent local shortages in a post-attack situation would cost anywhere from $65 million up to $1 billion, depending on the degree of preparation desired.

If an evacuation were forced on the US population and an attack did not occur, certainly Garland's $1 billion program for wheat relocation should be strongly supported.

CHAPTER IV. RESPONSE TO SOVIET ACTION

For a US evacuation plan to function as a crisis-management tool (and a deterrent) as well as a means of reducing casualties in the event of war, it must be responsive to Soviet plans as well as actions. It must, of course, on its face appear to have a reasonable probability of functioning in a reasonable and timely manner in a crisis. In addition, it should contain a number of credibility-improving measures that can be implemented before a crisis. These measures will be discussed below in the context of the time period in which they are implemented.

Precrisis

Actions to be taken in the precrisis period are those that: (1) are feasible in the US political environment (low profile), (2) will facilitate the evacuation should it occur, and (3) enhance the credibility of the plan to the Soviets. These measures can include:

(1) Gradual surfacing (to the public) of the existence of evacuation plans.

(2) Education of governmental emergency organizations at all levels as to their role in the plans. Organizations that might be included are police (and firefighting), auxiliary police, National Guard, Dept. of Agriculture, various emergency committees within the Dept. of the Interior, Dept. of Commerce, Dept. of Transportation, and, of course, local Civil Defense.

(3) A campaign to encourage householders to accumulate and maintain at least two weeks' supply of non-perishable food. This is useful for natural disasters also.

(4) The development of industrial emergency plans including measures for the personnel to move to a common reception area and also to construct shelters at the plant.

(5) The development of special plans to protect the population residing close to critical military support facilities in such a way as not to require shutting down the critical facility while

the workers evacuate. These plans should be the responsibility of the military base commander in many cases.

(6) The development of crisis plans to redirect the food distribution system to supply the reception areas by food distributors and supermarket chains in conjunction with local civil defense officials. This step is absolutely indispensable to a credible program.

(7) If a sufficiently large budget were available, move the storage of some US food reserves into reception areas.

Crisis - Pre-Evacuation

In an escalating crisis there are a number of measures that can be taken by civilian authorities prior to the start of the Soviet evacuation to facilitate the US evacuation and, if desired, demonstrate the seriousness with which the US government regards the crisis. These can include:

(1) Distribution of the up-dated, pre-prepared evacuation and survival instructions to local newspapers and the public.

(2) Activation of the required emergency organizations and facilities.

(3) Strong encouragement for citizens to acquire at least a two-weeks' supply of food reserves, and preparation for reorientation of food distribution system to reception areas.

(4) Encouragement of the non-evacuating population to begin construction of expedient shelters.

(5) Encouragement of the potential evacuees to begin assembling the items to take with them (Appendix E).

Detection of Soviet Evacuation

The Soviet evacuation should be detected by correspondents of US news services either by direct observation or by their diplomatic contacts. In the tense emotional climate caused by the crisis, the news services, based on their past performance, are very likely to give the event sensational coverage regardless of the position of the US government.

Evacuation

Once the Soviet evacuation is apparent, the US population should be able to leave most population centers (with a few important exceptions) more quickly than the Soviet, due to the enormous transportation resource represented by the US automobile inventory. In addition to the 9[illegible] million automobiles, there are 1[illegible] million trucks and buses and a road net to match.[illegible] The US has approximately [illegible] million passenger spaces in road vehicles alone, compared to the Soviet inventory of less than 5[illegible] million spaces in all vehicles.[illegible] The Soviet literature estimates that three days will be required for the urban population to evacuate. With the exception of very large cities like New York and Los Angeles, it should be possible for most US cities to be evacuated in 1[illegible] hours or less. Counts of two sample cities (Knoxville, Tennessee and Richmond, Virginia) suggest they have about [illegible] lanes leaving the city per million population. At 1[illegible] cars per hour, and 2-1/2 passengers/car, it would take [illegible] hours to evacuate the city.

Automobile fuel tanks are usually sized to give at least a 200-mile range. If they average a little less than half-full, the gasoline inventory in the vehicle tanks theoretically would be sufficient for evacuating most cities, though maldistributed. The three-to-seven-day supply in the tanks of retail distributors is more than enough to supply individual fuel deficiencies if the filling stations continue to operate during the first few hours of the evacuation.

Traffic jams will develop due to wrecks or stalled vehicles. As part of the evacuation instructions, the public must be educated to push disabled vehicles out of the way, manually if necessary.

Expedient Shelter Construction

The very large size of the Soviet strategic forces, both in number and size of weapons, permits them to inflict very extensive blast damage even if the area coverage is reduced by ground-bursting weapons. The fallout produced by this targeting would aid their goal of

immobilizing the US economy and CONUS-based military forces in a war. It is logical to expect, therefore, that a large fraction of the Soviet warheads would be groundburst, producing a very severe fallout problem.

In view of the enormous increase in protection factor afforded by even the crudest covered-trench shelter as compared with houses and basements (PF 200 to 600 vs PF 6 to 20), it is essential that the population construct expedient shelters. Kearny has shown that untrained rural Americans, given written instructions and using hand tools, can construct quite sophisticated expedient shelters in less than [illegible] hours.[13] Spot checks indicate that the rural and suburban population has adequate tools for shelter construction.[24] It is likely that the supply of hand tools available to the population is greater in the US than in the Soviet Union. This is due to the very large fraction (about 70%) of the US population that lives in detached dwellings and owns their own home. Virtually every home with a yard has at least one shovel.

From the above, it appears likely that the US population can construct austere but high-protection fallout shelters at least as quickly as the Soviet population. With the US advantage in transportation, a careful and thorough planning should permit the US population to reduce its vulnerability to that of the evacuated Soviet population in three days, even allowing the Soviets a 24-hour head start.

CHAPTER V. POSTURE DURABILITY

It is essential that once the evacuation has been carried out, we be able to maintain a posture of low vulnerability.

Herman Kahn among others has pointed out the parallel between city evacuation and World War I general mobilization. (OTA) The postures are very expensive to maintain, but once assumed, give the mobilized nation an enormous advantage over an adversary in the peacetime configuration. Should one side gain this advantage, it has an increased incentive to attack. Once all parties have mobilized, it is very difficult for any party to demobilize. It was this dilemma that was the mechanism by which most of the European nations were drawn, in some cases against their will, into World War I.

Hence, despite its superior cost-effectiveness to any other program of civil defense, evacuation has to be approached with a good deal of caution. There is not only the problem of one side perceiving that it has such a large lead in the evacuation that, coupled with the belief that the war is unavoidable, it is tempted to pre-empt, but also the problem of one side being less able to maintain its low vulnerability posture, and the problem of standing down at the resolution of the crisis.

Economic Durability

If the US evacuation has not been designed to maintain the economy, after a week or two, the US President will be under pressure which increases daily to settle the crisis on less favorable terms.

The simultaneous requirement for operating industry and protecting the workers and their dependents by evacuation renders some commuting scheme necessary. In our society, any plan that does not provide for the safety of the worker's dependents, or that requires prolonged (more than a shift) separation of the worker from his dependents at a time of unprecedented crisis, will be resisted and/or evaded by the worker.

Posture durability is much less of a problem for the Soviet Union. Their evacuation is designed to maintain industrial production through

the efforts of a commuting work force. Their well-disciplined population and state control of all transportation will make a spontaneous "de-evacuation" unlikely.

One simple approach to a commuting system is to assign reception areas on the basis of place of employment rather than residence. Areas adjacent to but sufficiently distant from the high-risk areas would be reserved for workers and their families.

One disadvantage of such a plan is the potential congestion, on the initial evacuation, caused by people trying to get across town from their residence to the reception area for their employment. Usually only a small fraction of the population lives across town from their job, but only a few cars bucking the flow are enough to tie things up. This cross congestion can be avoided in many cases by initially directing all movement radially out of the city by the shortest route. Then adjustments in reception areas can be made for a day or two before beginning massive commuting.

An alternative approach is to have a day or two "free movement" before the main evacuation for people to join friends or relatives out of town. This time could also be used for relocation of key workers in key industries as well as people who have to commute across town.

Essential Industry

Designation of essential industry is a major problem requiring much more work than has been done. Which industries are essential will depend to some extent on assumptions about the military situation associated with the crisis, the strategic situation, the part of the country under consideration, and the time of the year.

It is clear that rail and truck transportation, petroleum production refining and distribution and electric power production are highly important. Food distribution in the host areas is critical.

It is probable that either a military emergency or highly increased force readiness level will be associated with the crisis. These conditions will make demands on transportation and military storage depots.

Due to their proximity to high-risk areas, expedient shelters of much higher grade should be constructed in areas from which workers commute to work than in more distant areas. These areas should also get priority for the available excavating equipment. Areas more remote from the targets would be available to the general public.

Commuting Requirements

The evacuated posture can put additional strain on the transportation resources around the larger cities. However, this can be kept well within acceptable limits by several measures. Non-essential economic activities within the evacuated area will be reduced to a minimum by transfer to the reception area where possible, and by transfer of the workers to essential activities. The load on the road net can be reduced by maximum use of car pooling, and by staggering shift change times in a given area. The road nets in the OBE areas are generally designed for movement of traffic between the population center and the surrounding low-density residential areas. For a given hosting ratio, the amount of shift staggering required to stay below acceptable traffic densities can be estimated from the duration of the commuting rush hours under normal conditions.

Protection of the Evacuated Areas

Some protection will be required for the evacuated areas to prevent looting and vandalism. If it is not clear that residential areas will be protected, the residents may be reluctant to leave. Regular police will have to be augmented with auxiliary police in many areas. In addition to the requirement for increased patrolling, some of the regular police may be required in reception areas.

Protection for the police can be expedient blast shelters constructed early in the crisis, which the patrols can reach on tactical warning. In some areas not near military targets, tactical warning may allow enough time, 20 or 30 minutes, for the residual security forces to leave

the target areas over nearly empty roads in the residential portions of the areas. This maneuver could be very effective if an impact prediction capability is developed as part of the warning system.

Improving the Standard of Living

In a prolonged crisis, posture durability will be greatly enhanced if there is a continuous improvement in the standard of living perceived by the evacuees. Resolution of the disorder and confusion of the first couple of days and billeting of mothers with small children in private housing will be the first steps in this process. The additional living space provided by the construction of shelters will help, as will improvement in shelter habitability, and construction of additional weather protection where possible. It may be desirable to encourage a member of each family to make a periodic return home for additional materials and possessions. If the crisis is prolonged more than a week or two, the follow-on program of permanent shelter construction can be started (see Chapter VI). As family blast shelters are installed in the lower risk areas, those residents can return home.

A parallel program of relocating some industry can be started at about the same time. The obvious first candidates are those of military importance that do not require heavy transportation support. Some types of instrument manufacture, clothing, and light machine work are examples.

Terminating the Evacuation

The evacuation must not be terminated until firm evidence is available that the Soviet population has returned to their cities. The US return can parallel the Soviet in stages but must not get far ahead. Under no circumstances should the US return in response only to a Soviet offer to make concessions to resolve the crisis. Past experience in Hungary (1956) and Czechoslovakia (1963) has shown that the apparent diplomatic resolution of the crisis with Soviet concessions may immediately be followed by a massive Soviet military strike.

CHAPTER VI. CRISIS RESOLUTION WITHOUT ATTACK - THE FALSE ALARM PROBLEM

Resolution of the crisis without an attack is the goal of the evacuation, it is the most probable result of the evacuation, yet it is the Achilles' heel of a US evacuation plan. The difficulty comes from trying to convince the US public that the evacuation had a decisive effect. If this is not done, it will not be possible to persuade them to evacuate a second or third time in a period of a few years. The second evacuation order may be effective. The third (or fourth) won't work. Thus, to neutralize a US evacuation plan, the Soviets need only cycle their plan two or three times. This should be possible under some circumstances for the authoritarian Soviet government and the disciplined Soviet population.

However, the first evacuation could profoundly alter the political and psychological climate in the United States. The people would be confronted with the twin realities that (1) nuclear war is possible and (2) measures to survive it are possible. The experience may even convince some articulate liberal opponents of civil defense of these realities. Congress would surely be convinced.

As a result, with some well-thought-out plans and advocacy it should be possible to get the physical and budgetary resources normally reserved for strategic offensive systems allocated for strategic defense. If the same enthusiasm that was generated for the space program can be developed for population defense, a funding level of $5 billion per year for five or more years is conceivable.

The details of the program that should be undertaken will require much more study. However, some capabilities of the system to be constructed can be outlined:

1. It must reduce US population vulnerability to approximately that of the evacuated Soviet population.
2. It must permit nearly normal functioning of the economy in the alert posture.
3. It must be indefinitely maintainable.
4. The alert posture must be sufficiently convenient that it can be assumed any number of times.

At the present time it appears that a system meeting these requirements is a combination of family and industrial blast shelters in areas of lower anticipated overpressure, evacuation tunnels (like the Chinese) or hardened underground mass transit systems in areas at risk of higher overpressures, and a good tactical warning system.

A desirable property of a shelter system that must respond to tactical warning is that it provide protected passages from inside the residences to the shelters. This is due to (1) the great range of thermal effects of megaton weapons and the terrible injuries they cause and (2) the great delay in taking shelter if one needs to change from sleepwear to street clothes after warning. Small children can really prolong this process.

Shelter hardness and population density at which transition is made from separate residential shelters to interconnected shelters will depend on budget and size of the expected attack.

Part of the program should be an incentive system to encourage relocation of critical industry into sparsely populated areas. Very large defense budgets could even include subsidies to accelerate this process.

At the present time it is the policy of the US government to encourage movement of industry and population from high-density to sparsely settled areas. One way this is done is by the construction of improved roads, including interstate-highways, in rural areas.

CHAPTER VII. LONG-TERM SURVIVAL AND PROTRACTED WAR

In order to contribute to a credible deterrent, US plans must provide not only for immediate survival of the population but also long-term survival and economic recovery at a rate at least comparable to that of the Soviet Union.

If the prospect for the long-term survival of the evacuees is questionable, the legitimate question can be raised by the US population "Why escape the direct effect of an attack only to die of starvation (or exposure, or leukemia, etc.)?" There must be assurance that, if there is a nuclear exchange, the plans and resources exist to (1) restore essential food production and distribution and (2) restore a meaningful economy and standard of living.

The United States has great advantages over the Soviet Union in food reserves and agricultural productivity that will survive any attack. These coupled with credible plans to keep our productive population healthy and overcome industrial bottlenecks will assure our own population of their survival, and the Soviet Union of our industrial recovery. The latter should be an additional disincentive for the Soviet Union to allow a crisis to escalate to an attack.

If in an evacuation scenario the Soviet decision makers perceive a significantly superior capacity of the Soviet Union to recover from an attack, it may harden their position in a confrontation as much as a comparable advantage in immediate vulnerability. For if hostilities are not terminated soon after the attack, the Soviet economic recovery could soon be translated into a modest reconstituted military capacity, which could be overwhelming military superiority over a still prostrated US.

This possibility makes the additional demands on the defense plans that the working force not only survive, but that it be healthy, well-nourished, mobile and not subject to foreign military harassment.

To be healthy, the working force and its dependents must have better fallout protection than that afforded by most unimproved basements. If a large fraction of the population were to get the 100 to 300 rem from fallout they would receive in ordinary basements, their effectiveness

would be greatly reduced, and their care would place an additional burden on the healthy survivors. The dose they could accept upon emerging from shelters to begin recovery operations would be correspondingly reduced.

One feasibile method of greatly reducing radiation dose would be the wide-spread use of covered-trench expedient shelters, discussed in Chapter II, which have protection factors at least ten times that of most residential basements. Use of these shelters would enable the work force to begin recovery operations with only a few rem per man, rather than tens of rem per man. Further reduction in exposure could be achieved by the work force sleeping in the better shelters.

The radiation dose avoided in this way could be considered to be a "reserve" exposure which could be used to begin critical recovery activities days earlier than if this dose had not been avoided. The much larger population with low exposure will permit spreading the unavoidable exposure from some critical activities over more people. Adequate food supplies for the work force and their dependents will maximize the strength and health of the work force and reduce their susceptibility to radiation-induced illnesses. Perhaps more important than both of these, the morale of the work force will be much higher if their dependents aren't starving.

In order to have an adequate food supply, plans must be made to move some food into the host areas before the attack and to restore food movement as soon as possible after the attack. Obviously, the food movement required before the attack depends on the anticipated time that people will be pinned down in their shelters by fallout. Since this depends on meteorology as well as Russian targeting, any prediction of its duration would be very uncertain. Two weeks' food accumulation before the attack would seem a prudent bare minimum over most of the country. Downwind of heavily industrialized areas of the Great Lakes and the Northeast Corridor, four weeks' supply would be desirable, but probably not achievable in a few days crisis, due to the very large population that must be supplied.

It will be necessary to restore enough transportation to the reception areas to handle food soon after the attack. It may be desirable

to evacuate badly damaged or very heavily contaminated areas as soon as the radiation level falls to the point where people can accept the exposure obtained in the move. Fuel reserves in retail tanks should be sufficient for these limited demands.

The much more widespread movement of people and materials required by economic recovery and reconstruction would soon require restoration of petroleum production and refining. A concerted attack on US refining facilities can be expected and must be assumed 90 to 95 percent successful. Some refined petroleum for the period when US facilities are being rebuilt will have to be imported, especially in the Northeast.

This fact will dominate US foreign policy and military strategy for the first four or five postattack years. If hostilities have not been terminated by diplomatic means, the central military problem will be protection of foreign petroleum suppliers and delivery means from attack. With the proper strategy, the US superiority in numbers of warheads could be very helpful in this effort. The conduct of military operations in these circumstances is outside the scope of this study.

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APPENDIX A

STRATEGIC OFFENSIVE FORCES OF THE US AND SU

TABLE A-1: Strategic Offensive Forces of the US and SU.

	1974 Force	Payload Megatons	15 psi Area per Booster mi²	Total W/H		Total Megatons		Total Area (sq mi)	
Minuteman II	450	1	12.6	450		450		5670	
Minuteman III	550	3 x .2	13.1	1650		330		7205	
Titan II	54	10	60.8	54		540		3280	
					2154		1320		16155
Polaris A-3	272	3 x .2	13.1	816		163		3563	
Poseidon	384	10 x .04	15.4	3840		154		5914	
					4656		317		9480
					6810		1637		25635
B-52	280	4 x 1 + 8 x .2	85.4	3369		1570		23900	
FB 111	70	6 x .2	26.3	420		840		1840	
					3780		2410		25740
					10590		4047		57375
SS-7 & 8	220	5	38.4	220		1100		8450	
SS-9	300	20	95.0	300		6000		28500	
SS-11	950	1	12.6	950		950		11970	
SS-13	60	1	12.6	60		60		750	
SSN-5	27	1*	12.6	27		27		340	
SSN-6	512	1	12.6	512		572		6457	
SSN-8	72	1	12.6	72		72		903	
					2140		8720		57370
Bear	100	4 x 1	50.4	400		400		5040	
Bison	40	2 x 1	25.2	80		80		1008	
					480		480		6048
					2520		9200		63418

*Not included in SALT I.

APPENDIX B

OBE AREAS - POPULATION AND AVERAGE DENSITY

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TABLE B-1: OBE AREAS POPULATION AND AVERAGE DENSITY

	OBE Name	Total 1960 Population (thousands)	OBE Area (mi^2)	Population Density (Persons/mi^2)	Radius of Circle of Equiv. Area	Alternate Evacuation Densities
1.	Bangor	406	18942	21.45	78	
2.	Portland	754	12367	60.9	63	
3.	Burlington	499	11906	42.0	63	
4.	Boston	6702	9938	675.0	56	
5.	Hartford	3537	7606	464.0	49	
6.	Albany, et al.	1332	12998	615.0*	64	102.7 (w/o N.Y.)
7.	Syracuse	1453	13740	105.9	66	
8.	Rochester	980	3647	268.5	34	
9.	Buffalo	2089	8240	254.0	51	
10.	Erie	534	3838	139.3	35	
11.	Williamsport	445	6715	66.4	46	
12.	Binghamton	740	9906	615.0*	56	74.9 (w/o N.Y.)
13.	Wilkes-Barre	626	3509	615.0*	33	178.7 (w/o N.Y.)
14.	New York	20253	10859	615.0	59	1869.0 (N.Y. only)
15.	Philadelphia	7970	10673	747.0	58	
16.	Harrisburg	1928	10045	193.0	56	
17.	Baltimore	2865	8651	331.0	52	
18.	Washington	3248	7782	418.0	50	
19.	Stanton	282	6041	46.7	44	
20.	Roanoke	1007	10471	96.3	58	
21.	Richmond	1170	11834	98.9	61	
22.	Norfolk	1026	5705	179.6	43	
23.	Raleigh	1690	17696	95.6	75	
24.	Wilmington	576	6897	83.7	47	
25.	Greensboro, et al.	1108	8013	138.2	50	
26.	Charlotte	1414	9810	144.2	56	

*Includes evacuees from New York OBE

Table B-1 (Continued)

	OBE Name	1960 Popl'tn (thousands)	OBE Area (sq mi)	Pop'ltn Density (persons/sq mi)	Radius of Circle of Equiv. Area	Alternate Evacuation Densities
27.	Asheville	346	5669	61.0	42	
28.	Greenville	781	6375	122.5	45	
29.	Columbia	628	6740	93.3	46	
30.	Florence	392	6420	61.0	45	
31.	Charleston	445	4808	92.4	39	
32.	Augusta	514	8298	62.0	51	
33.	Savannah	460	8515	54.0	51	
34.	Jacksonville	1305	15670	83.4	70	
35.	Orlando	1490	6601	226.5	46	
36.	Miami	3425	10682	321.0	58	
37.	Tampa	2581	12090	214.0	62	
38.	Tallahassee	4283	9392	456.0	57	
39.	Pensacola	554	4656	119.0	38	
40.	Montgomery	669	13919	48.0	67	
41.	Albany	582	11054	47.2	59	
42.	Macon	542	9750	55.7	56	
43.	Columbus	502	6851	73.3	47	
44.	Atlanta	2074	15249	136.0	71	
45.	Birmingham	1732	22414	77.3	84	
46.	Memphis	1710	21675	79.3	83	
47.	Huntsville	735	8962	82.0	53	
48.	Chattanooga	694	8016	86.5	51	
49.	Nashville	1308	20400	64.0	82	
50.	Knoxville	838	10739	78.1	58	
51.	Bristol	880	8868	99.1	53	
52.	Huntington	1213	18000	67.4	76	
53.	Lexington	686	11675	58.7	61	
54.	Louisville	1300	7979	163.0	50	
55.	Evansville	744	11750	64.1	61	
56.	Terre Haute	330	3867	85.3	35	
57.	Springfield	610	6850	89.3	47	
58.	Champaign	478	4795	100.1	39	
59.	Lafayette	333	3870	86.1	35	

Table B-1 (Continued)

	OBE Name	1960 Popl'tn (thousands)	OBE Area (sq mi)	Pop'ltn Density (persons/sq mi)	Radius of Circle of Equiv. Area	Alternate Evacuation Densities
60.	Indianapolis	1803	8580	210.0	52	
61.	Muncie	543	3087	176.0	31	
62.	Cincinnati	2123	8671	245.0	52	
63.	Dayton	1206	4015	301.0	36	
64.	Columbus	1897	11528	164.0	61	
65.	Clarksburg	269	4774	56.3	39	
66.	Pittsburgh	4016	13502	297.0	66	
67.	Youngstown	892	2078	430.0	26	
68.	Cleveland	4840	10660	454.0	58	
69.	Lima	282	2626	107.0	29	
70.	Toledo	1168	4845	242.0	39	
71.	Detroit	5576	6759	287.0	46	825.0 (Detroit only)
72.	Saginaw	903	15950	287.0*	71	[illegible] (w/o Detroit)
73.	Grand Rapids	1272	12337	103.0	63	
74.	Lansing	1166	5934	197.0	43	
75.	Fort Wayne	589	4869	121.0	39	
76.	South Bend	840	4243	198.0	37	
77.	Chicago	9557	12523	763.0	63	
78.	Peoria	749	6386	117.0	45	
79.	Davenport, et al.	683	5808	117.0	43	
80.	Cedar Rapids	346	4376	79.0	37	
81.	Dubuque	300	7306	41.0	48	
82.	Rockford	633	4162	152.0	36	
83.	Madison	439	6242	70.4	44	
84.	Milwaukee	2443	4306	461.0	41	
86.	Green Bay	992	19748	50.2	79	
87.	Wausau	339	10368	32.7	57	
88.	Eau Claire	185	6599	28.1	46	
89.	LaCrosse	260	6562	39.3	46	
90.	Rochester	249	4300	51.9	37	
91.	Minne.-St. Paul	3074	41321	74.4	114	

*Includes evacuees from Detroit OBE.

Table B-1 (Continued)

	OBE Name	19[illegible] Popl'tn (thousands)	OBE Area (sq mi)	Pop'ltn Density (persons/sq mi)	Radius of Circle of Equiv. Area	Alternate Evacuation Densities
92.	Grand Forks	[illegible]	[illegible]	[illegible]	[illegible]	
93.	Minot	[illegible]	[illegible]	[illegible]	[illegible]	
94.	Great Falls	[illegible]	[illegible]	[illegible]	[illegible]	
95.	Billings	[illegible]	[illegible]	[illegible]	[illegible]	
96.	Bismarck	[illegible]	[illegible]	[illegible]	88	
97.	Fargo-Moorhead	[illegible]	[illegible]	[illegible]	[illegible]	
98.	Aberdeen	118	[illegible]	[illegible]	[illegible]	
99.	Sioux Falls	[illegible]	[illegible]	[illegible]	[illegible]	
100.	Rapid City	[illegible]	[illegible]	[illegible]	[illegible]	
101.	Scotts Bluff	[illegible]	[illegible]	[illegible]	[illegible]	
102.	Grand Island	[illegible]	[illegible]	[illegible]	[illegible]	
103.	Sioux City	[illegible]	[illegible]	[illegible]	[illegible]	
104.	Fort Dodge	[illegible]	[illegible]	[illegible]	[illegible]	
105.	Waterloo	[illegible]	[illegible]	[illegible]	[illegible]	
106.	Des Moines	[illegible]	[illegible]	[illegible]	[illegible]	
107.	Omaha	[illegible]	[illegible]	[illegible]	[illegible]	
108.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
109.	Salina	[illegible]	[illegible]	[illegible]	[illegible]	
110.	Wichita	[illegible]	[illegible]	[illegible]	[illegible]	
111.	Kansas City	[illegible]	[illegible]	[illegible]	[illegible]	
112.	Columbia	381	[illegible]	[illegible]	[illegible]	
113.	Quincy	[illegible]	[illegible]	[illegible]	[illegible]	
114.	St. Louis	[illegible]	[illegible]	[illegible]	[illegible]	
115.	Paducah	618	[illegible]	[illegible]	[illegible]	
116.	Springfield	[illegible]	[illegible]	[illegible]	[illegible]	
117.	Little Rock	[illegible]	[illegible]	[illegible]	[illegible]	
118.	Fort Smith	[illegible]	[illegible]	[illegible]	[illegible]	
119.	Tulsa	[illegible]	[illegible]	[illegible]	[illegible]	
120.	Oklahoma City	[illegible]	[illegible]	[illegible]	[illegible]	
121.	Wichita Falls	[illegible]	18768	[illegible]	[illegible]	
122.	Amarillo	537	[illegible]	[illegible]	[illegible]	
123.	Lubbock	[illegible]	[illegible]	[illegible]	[illegible]	
124.	Odessa	[illegible]	[illegible]	[illegible]	[illegible]	
125.	Abilene	[illegible]	[illegible]	[illegible]	[illegible]	

Table B-1 (Continued)

	OBE Name	1960 Pop'ltn (thousands)	OBE Area (sq mi)	Pop'ltn Density (persons/sq mi)	Radius of Circle of Equiv. Area	Alternate Evacuation Densities
126.	San Angelo	117	15362	7.62	70	
127.	Dallas	2909	19688	147.8	79	
128.	Waco	436	9271	47.1	54	
129.	Austin	489	13099	37.3	64	
130.	Tyler	488	14589	33.5	68	
131.	Texarkana	280	11459	24.4	60	
132.	Shreveport	507	7592	66.8	49	
133.	Monroe	556	12408	44.8	62	
134.	Greenville	573	14462	39.6	68	
135.	Jackson	578	9138	63.3	43	
136.	Meridian	400	10989	36.4	59	
137.	Mobile	751	10881	69.1	59	
138.	New Orleans	2529	19983	126.7	80	
139.	Lake Charles	899	12220	73.5	62	
140.	Beaumont, et al.	471	5006	94.2	40	
141.	Houston	2532	15715	161.0	71	
142.	San Antonio	1352	28931	46.8	96	
143.	Corpus Cristi	591	19758	29.9	79	
144.	Brownsville, et al.	447	4241	105.2	37	
145.	El Paso	893	73606	12.1	153	
146.	Albuquerque	756	39906	18.9	113	
147.	Pueblo	542	35118	15.4	106	
148.	Denver	1631	34237	47.7	104	
149.	Grand Junction	377	52347	7.22	129	
150.	Cheyenne	290	51461	5.64	128	
151.	Salt Lake City	1191	77718	15.3	157	
152.	Idaho Falls	371	41050	9.03	114	
153.	Butte	239	33951	7.05	104	
154.	Spokane	872	50263	17.4	126	
155.	Seattle	2396	21051	114.0	82	
156.	Yakima	427	31851	13.4	101	
157.	Portland	1425	29292	48.6	96	
158.	Eugene	583	31494	18.5	100	

Table B-1 (Continued)

	OBE Name	1960 Pop'ltn (thousands)	OBE Area (sq mi)	Pop'ltn Density (persons/sq mi)	Radius of Circle of Equiv. Area	Alternate Evacuation Densities
159.	Boise	311	41713	7.46	[illegible]	
160.	Reno	206	69731	2.96	149	
161.	Las Vegas	280	57669	4.85	135	
162.	Phoenix	1914	90324	21.2	169	
163.	Tucson	698	23239	30.0	86	
164.	San Diego	159	4262	37.3	37	
165.	Los Angeles	12439	57329	217.0	135	
166.	Fresno	1621	22505	72.2	85	
167.	Stockton	831	10987	75.8	59	
168.	Sacramento	1316	11519	114.1	60	
169.	Redding	237	25226	9.38	90	
170.	Eureka	203	7785	26.1	50	
171.	San Francisco	6732	16928	397.0	73	

APPENDIX C

AVAILABILITY OF RURAL BASEMENTS

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TABLE C-1

AVAILABILITY OF RURAL BASEMENTS BY ORE AREA IN ORDER OF PERSONS PER RURAL BASEMENT

NO	OBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
98	ABERDEEN, SD	132	22861	5.8	0.1
104	FT DODGE, IA	266	46035	5.8	0.2
99	SIOUX FALLS, SD	351	55403	6.3	0.4
81	DUBUQUE, IA	301	46692	6.5	0.5
93	MINOT, ND	182	27435	6.6	0.6
103	SIOUX CITY, IA	452	67448	6.7	0.8
97	FARGO, ND	335	49671	6.8	1.0
86	WAUSAU, WI	350	49979	7.0	1.2
89	LA CROSSE, WI	269	38547	7.0	1.3
3	BURLINGTON, VT	502	70338	7.1	1.6
88	EAU CLAIRE, WI	219	31062	7.1	1.7
92	GRAND FORKS, ND	220	31000	7.1	1.8
96	BISMARCK, ND	144	20019	7.2	1.8
11	WILLIAMSPORT, PA	419	56835	7.4	2.1
105	WATERLOO, IA	426	56966	7.5	2.3
90	ROCHESTER, MN	245	30535	7.9	2.4
102	GRAND ISLAND, NE	323	40988	7.9	2.6
1	BANGOR, ME	321	39952	8.1	2.7
109	SALINA, KS	349	42871	8.1	2.9
12	BINGHAMPTON, NY	765	92050	8.3	3.3
19	STAUNTON, VA	355	44713	8.8	3.5
101	SCOTTSBLUFF, NE	105	11880	8.9	3.5
113	QUINCY, IL	299	33483	8.9	3.7
16	HARRISBURG, PA	1723	178054	9.7	4.5
27	ASHEVILLE, NC	391	39561	9.9	4.7
83	MADISON, WI	455	45175	10.1	4.9
2	PORTLAND, ME	740	72296	10.2	5.3
108	LINCOLN, NE	323	31810	10.2	5.5
76	SOUTH BEND, IN	747	72805	10.3	5.8
51	BRISTOL, VA	774	74442	10.4	6.2
65	CLARKSVILLE, WV	326	30827	10.6	6.4
100	RAPID CITY, SD	231	21881	10.6	6.5
80	CEDAR RAPIDS, IA	330	30941	10.7	6.7
10	ERIE, PA	459	42472	10.8	6.9
106	DES MOINES, IA	782	72760	10.8	7.3
85	GREEN BAY, WI	926	85345	10.9	7.7
6	ALBANY, NY	1332	117354	11.4	8.4
73	GRAND RAPIDS, MI	1124	98268	11.4	9.0
74	LANSING, MI	1034	90921	11.4	9.5
112	COLUMBIA, MO	397	34496	11.5	9.7
59	LAFAYETTE, IN	250	21583	11.6	9.8
87	DULUTH, MI	429	36945	11.6	10.0
72	SAGINAW, MI	798	68454	11.7	10.4

Table C-1 (Continued)

AVAILABILITY OF RURAL BASEMENTS BY CBE AREA
IN ORDER OF PERSONS PER RURAL BASEMENT

NO	CBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
7	SYRACUSE, NY	1445	119759	12.1	11.1
152	IDAHO FALLS, ID	300	24364	12.3	11.3
69	LIMA, OH	276	22090	12.5	11.4
78	PEORIA, IL	628	49802	12.6	11.7
57	SPRINGFIELD, IL	490	37498	13.1	12.0
56	TERRA HAUTE, IN	252	19033	13.3	12.1
94	GREAT FALLS, MT	222	16698	13.3	12.2
95	BILLINGS, MT	246	18435	13.4	12.3
66	PITTSBURG, PA	3716	273896	13.6	14.2
55	EVANSVILLE, IN	771	55098	14.0	14.5
91	MINNEAPOLIS, MN	2942	209336	14.1	16.0
13	WILKES BARRE, PA	692	48275	14.3	16.3
67	YOUNGSTOWN, OH	771	53444	14.4	16.7
82	ROCKFORD, IL	560	38661	14.5	17.0
79	DAVENPORT, IO	605	41306	14.7	17.3
75	FORT WAYNE, IN	597	39945	15.0	17.6
153	BUTTE, MT	234	15521	15.1	17.7
107	OMAHA, NE	794	50784	15.6	18.1
20	ROANOKE, VA	735	46872	15.7	18.5
8	ROCHESTER, NY	1016	64026	15.9	19.0
52	HUNTINGTON, WV	1309	79935	16.4	19.6
154	SPOKANE, WA	687	40652	16.9	20.0
64	COLUMBUS, OH	1763	102102	17.3	20.9
9	BUFFALO, NY	1789	98813	18.1	21.7
50	KNOXVILLE, TN	904	49785	18.2	22.2
17	BALTIMORE, MD	1764	96421	18.3	23.1
58	CHAMPAIGN, IL	390	21245	18.4	23.3
25	GREENSBORO, NC	1142	60248	19.0	23.8
149	GRAND JUNCTION	251	13250	19.0	24.0
70	TOLEDO, OH	1054	54213	19.4	24.5
61	MUNCIE, IN	551	26808	20.6	24.7
53	LEXINGTON, KY	753	36227	20.8	25.1
110	WICHITA, KA	728	34678	21.0	25.5
155	YAKIMA, WA	406	19248	21.1	25.7
159	BOISE CITY, ID	265	12484	21.3	25.8
5	HARTFORD, CN	2966	134857	22.0	27.3
63	DAYTON, OH	1162	52834	22.0	27.9
111	KANSAS CITY, MO	2249	94962	23.7	29.0
68	CLEVELAND, OH	4255	177036	24.0	31.1
116	SPRINGFIELD, MO	830	34584	24.0	31.5
150	CHEYENNE, WY	229	9415	24.4	31.6
62	CINCINNATI, OH	1889	72473	26.1	32.6
4	BOSTON, MA	6339	236983	26.8	35.7

Table C-1 (Continued)

AVAILABILITY OF RURAL BASEMENTS BY CBE AREA
IN ORDER OF PERSONS PER RURAL BASEMENT

NO	CBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
84	MILWAUKEE, WI	2066	76380	27.1	36.7
60	INDIANAPOLIS, IN	1613	59231	27.2	37.5
114	ST LOUIS, MO	3248	114202	28.4	39.1
26	CHARLOTTE, NC	1489	51789	28.8	39.9
115	PADUCAH, KY	558	19207	29.1	40.2
15	PHILADELPHIA, PA	7281	230230	31.6	43.8
54	LOUISVILLE, KY	1220	37872	32.2	44.4
147	PUEBLO, CO	509	15494	32.9	44.6
151	SALT LAKE CITY	1061	31731	33.5	45.2
49	NASHVILLE, TN	1426	39637	36.0	45.9
148	DENVER, CO	1523	39616	38.5	46.6
48	CHATTANOOGA, TN	718	17213	41.7	47.0
169	REDDING, PA	176	4199	42.1	47.1
21	RICHMOND, VA	1010	22663	44.6	47.6
157	PORTLAND, OR	1635	34786	47.0	48.4
44	ATLANTA, GA	2296	47197	48.7	49.5
28	GREENVILLE, SC	817	15631	52.3	49.9
160	RENO, NV	206	3905	52.9	50.0
122	AMARILLO, TX	437	8228	53.2	50.3
71	DETROIT, MI	5207	96242	54.1	52.8
155	SEATTLE, WA	2363	42795	55.2	54.0
167	STOCKTON, CA	643	9776	65.8	54.3
47	HUNTSVILLE, AL	671	9664	69.5	54.7
18	WASHINGTON, DC	3404	46905	72.6	56.4
45	BIRMINGHAM, AL	1743	23857	73.1	57.2
14	NEW YORK, NY	18272	233142	78.4	66.3
77	CHICAGO, IL	8193	103898	78.9	70.4
158	EUGENE, OR	543	6838	79.5	70.6
161	LAS VEGAS, NV	317	3542	89.6	70.8
168	SACRAMENTO, CA	1089	11768	92.6	71.3
120	OKLAHOMA CITY,OK	1158	12470	92.9	71.9
41	ALBANY, GA	461	4518	102.0	72.1
170	EUREKA, CA	121	1163	104.8	72.2
119	TULSA, OK	1012	9561	105.9	72.7
23	RALEIGH, NC	1621	15239	106.4	73.5
166	FRESNO, CA	1036	9597	108.0	74.0
121	WICHITA FALLS,TX	455	3765	121.1	74.2
118	FT SMITH, AR	289	2384	121.4	74.4
117	LITTLE ROCK, AR	864	6488	133.2	74.8
123	LUBBOCK, TX	328	2324	141.5	75.0
29	COLUMBIA, SC	592	3754	157.9	75.3
136	MERIDIAN, MS	393	2484	158.2	75.5
46	MEMPHIS, TN	1678	10573	158.7	76.3

Table C-1 (Continued)

AVAILABILITY OF RURAL BASEMENTS BY CBE AREA
IN ORDER OF PERSONS PER RURAL BASEMENT

NO	CBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
126	SAN ANGELO, TX	124	735	170.0	76.4
32	AUGUSTA, GA	451	2686	171.9	76.6
43	COLUMBUS, OH	488	2821	173.0	76.8
42	MACON, GA	496	2730	181.8	77.1
146	ALBUQUERQUE, NM	572	3083	185.8	77.4
40	MONTGOMERY, AL	687	3272	210.0	77.7
125	ABILENE, TX	264	1134	233.5	77.8
24	WILMINGTON, NJ	482	1948	247.5	78.1
30	FLORENCE, SC	400	1544	259.5	78.3
135	JACKSON, MS	510	1935	263.8	78.5
38	TALLAHASSA, FL	344	1171	294.2	78.7
134	GREENVILLE, MS	506	1658	305.5	78.9
130	TYLER, TX	553	1767	313.2	79.2
131	TEXARKANA, TX	329	1041	316.8	79.4
145	EL PASO, TX	681	2134	319.4	79.7
22	NORFOLK, VA	1232	3542	348.1	80.3
129	AUSTIN, TX	559	1531	365.5	80.6
162	PHOENIX, AR	1316	3595	366.2	81.3
33	SAVANNAH, GA	417	1060	394.2	81.5
171	SAN FRANCISCO,CA	5090	12733	399.8	84.0
137	MOBILE, AL	724	1797	403.0	84.4
133	MONROE, LA	532	1285	414.6	84.6
31	CHARLESTON, SC	430	1005	428.6	84.8
163	TUCSON, AR	454	1035	439.1	85.1
128	WACO, TX	403	833	484.9	85.3
35	ORLANDO, FL	941	1863	505.3	85.7
132	SHREVEPORT, LA	453	825	549.7	86.0
124	ODESSA, TX	319	568	562.0	86.1
39	PENSACOLA, FL	382	654	584.5	86.3
142	SAN ANTONIO, TX	1229	2072	593.3	86.9
138	NEW ORLEANS, LA	2175	3157	689.0	88.0
34	JACKSONVILLE, FL	1051	1501	700.5	88.5
139	LAKE CHARLES, LA	748	1001	747.7	88.9
37	TAMPA, FL	1798	2076	866.2	89.8
144	BROWNSVILLE, TX	355	365	973.1	90.0
140	BEAUMONT, TX	394	381	1036.0	90.1
127	DALLAS, TX	2736	2282	1199.2	91.5
165	LOS ANGELES, CA	10436	7810	1336.3	96.7
143	CORPUS CHRISTI	516	349	1479.3	96.9
164	SAN DIEGO, CA	1357	787	1725.4	97.6
141	HOUSTON, TX	2362	1077	2193.8	98.8
36	MIAMI, FL	2430	647	3757.1	100.0

TABLE C-2

AVAILABILITY OF RURAL BASEMENTS BY OBE AREA
IN DESCENDING ORDER OF POPULATION

NO	OBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
63	DAYTON, OH	1162	52834	22.0	67.1
120	OKLAHOMA CITY, OK	1158	12470	92.9	67.7
25	GREENSBORO, NC	1142	60248	19.0	68.2
73	GRAND RAPIDS, MI	1124	98268	11.4	68.8
168	SACRAMENTO, CA	1089	11768	92.6	69.3
151	SALT LAKE CITY	1061	31731	33.5	69.8
70	TOLEDO, OH	1054	54213	19.4	70.4
34	JACKSONVILLE, FL	1051	1501	700.5	70.9
166	FRESNO, CA	1036	9597	108.0	71.4
74	LANSING, MI	1034	90921	11.4	71.9
8	ROCHESTER, NY	1016	64026	15.9	72.4
119	TULSA, OK	1012	9561	105.9	72.9
21	RICHMOND, VA	1010	22663	44.6	73.4
35	ORLANDO, FL	941	1863	505.3	73.9
85	GREEN BAY, WI	926	85349	10.9	74.4
50	KNOXVILLE, TN	904	49785	18.2	74.8
117	LITTLE ROCK, AR	864	6488	133.2	75.2
116	SPRINGFIELD, MO	830	34584	24.0	75.6
28	GREENVILLE, SC	817	15631	52.3	76.0
72	SAGINAW, MI	798	68454	11.7	76.4
107	OMAHA, NE	794	50784	15.6	76.8
106	DES MOINES, IA	782	72760	10.8	77.2
51	BRISTOL, VA	774	74442	10.4	77.6
55	EVANSVILLE, IN	771	55098	14.0	78.0
67	YOUNGSTOWN, OH	771	53444	14.4	78.4
12	BINGHAMPTON, NY	765	92050	8.3	78.8
53	LEXINGTON, KY	753	36227	20.8	79.1
139	LAKE CHARLES, LA	748	1001	747.7	79.5
76	SOUTH BEND, IN	747	72805	10.3	79.9
2	PORTLAND, ME	740	72296	10.2	80.2
20	ROANOKE, VA	735	46872	15.7	80.6
110	WICHITA, KA	728	34678	21.0	81.0
137	MOBILE, AL	724	1797	403.0	81.3
48	CHATTANOOGA, TN	718	17213	41.7	81.7
13	WILKES BARRE, PA	692	48275	14.3	82.0
154	SPOKANE, WA	687	40652	16.9	82.4
40	MONTGOMERY, AL	687	3272	210.0	82.7
145	EL PASO, TX	681	2134	319.4	83.0
47	HUNTSVILLE, AL	671	9664	69.5	83.4
167	STOCKTON, CA	643	9776	65.8	83.7
78	PEORIA, IL	628	49802	12.6	84.0
79	DAVENPORT, IO	605	41306	14.7	84.3
75	FORT WAYNE, IN	597	39945	15.0	84.6

Table C-2 (Continued)

AVAILABILITY OF RURAL BASEMENTS BY OBE AREA
IN DESCENDING ORDER OF POPULATION

NO	OBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
14	NEW YORK, NY	18272	233142	78.4	9.1
165	LOS ANGELES, CA	10436	7810	1336.3	14.3
77	CHICAGO, IL	8193	103898	78.9	18.3
15	PHILADELPHIA, PA	7281	230230	31.6	21.9
4	BOSTON, MA	6339	236983	26.8	25.1
71	DETROIT, MI	5207	96242	54.1	27.7
171	SAN FRANCISCO,CA	5090	12733	399.8	30.2
68	CLEVELAND, OH	4255	177036	24.0	32.3
66	PITTSBURG, PA	3716	273886	13.6	34.2
18	WASHINGTON, DC	3404	46909	72.6	35.8
114	ST LOUIS, MO	3248	114202	28.4	37.5
5	HARTFORD, CN	2966	134857	22.0	38.9
91	MINNEAPOLIS, MN	2962	209336	14.1	40.4
127	DALLAS, TX	2736	2282	1199.2	41.8
36	MIAMI, FL	2430	647	3757.1	43.0
155	SEATTLE, WA	2363	42799	55.2	44.1
141	HOUSTON, TX	2362	1077	2193.8	45.3
44	ATLANTA, GA	2296	47187	48.7	46.4
111	KANSAS CITY, MO	2249	94962	23.7	47.6
138	NEW ORLEANS, LA	2175	3157	689.0	48.6
84	MILWAUKEE, WI	2066	76380	27.1	49.7
62	CINCINNATI, OH	1889	72473	26.1	50.6
37	TAMPA, FL	1798	2076	866.2	51.5
9	BUFFALO, NY	1789	98813	18.1	52.4
17	BALTIMORE, MD	1764	96421	18.3	53.3
64	COLUMBUS, OH	1763	102102	17.3	54.1
45	BIRMINGHAM, AL	1743	23857	73.1	55.0
16	HARRISBURG, PA	1723	178054	9.7	55.9
46	MEMPHIS, TN	1678	10573	158.7	56.7
157	PORTLAND, OR	1635	34786	47.0	57.5
23	RALEIGH, NC	1621	15239	106.4	58.3
60	INDIANAPOLIS, IN	1613	59231	27.2	59.1
148	DENVER, CO	1523	39616	38.5	59.9
26	CHARLOTTE, NC	1489	51789	28.8	60.6
7	SYRACUSE, NY	1445	119759	12.1	61.3
49	NASHVILLE, TN	1426	39637	36.0	62.0
164	SAN DIEGO, CA	1357	787	1725.4	62.7
6	ALBANY, NY	1332	117354	11.4	63.4
162	PHOENIX, AR	1316	3595	366.2	64.0
52	HUNTINGTON, WV	1309	79935	16.4	64.7
22	NORFOLK, VA	1232	3542	348.1	65.3
142	SAN ANTONIO, TX	1229	2072	593.3	65.9
54	LOUISVILLE, KY	1220	37872	32.2	66.5

Table C-2 (Continued)

AVAILABILITY OF RURAL BASEMENTS BY OBE AREA
IN DESCENDING ORDER OF POPULATION

NO	OBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
29	COLUMBIA, SC	592	3754	157.9	84.9
146	ALBUQUERQUE, NM	572	3083	185.8	85.2
82	ROCKFORD, IL	560	38661	14.5	85.5
129	AUSTIN, TX	559	1531	365.5	85.7
115	PADUCAH, KY	558	19207	29.1	86.0
130	TYLER, TX	553	1767	313.2	86.3
61	MUNCIE, IN	551	26808	20.6	86.6
158	EUGENE, OR	543	6838	79.5	86.8
133	MONROE, LA	532	1285	414.6	87.1
143	CORPUS CHRISTI	516	349	1479.3	87.4
135	JACKSON, MS	510	1935	263.8	87.6
147	PUEBLO, CO	509	15494	32.9	87.9
134	GREENVILLE, MS	506	1658	305.5	88.1
3	BURLINGTON, VT	502	70338	7.1	88.4
42	MACON, GA	496	2730	181.8	88.6
57	SPRINGFIELD, IL	490	37498	13.1	88.9
43	COLUMBUS, OH	488	2821	173.0	89.1
24	WILMINGTON, NJ	482	1948	247.5	89.3
41	ALBANY, GA	461	4518	102.0	89.6
32	AUGUSTA, GA	461	2686	171.9	89.8
10	ERIE, PA	459	42472	10.8	90.0
83	MADISON, WI	455	45175	10.1	90.2
121	WICHITA FALLS,TX	455	3765	121.1	90.5
163	TUCSON, AR	454	1035	439.1	90.7
132	SHREVEPORT, LA	453	825	549.7	90.9
103	SIOUX CITY, IA	452	67448	6.7	91.1
122	AMARILLO, TX	437	8228	53.2	91.4
31	CHARLESTON, SC	430	1005	428.6	91.6
87	DULUTH, MI	429	36945	11.6	91.8
105	WATERLOO, IA	426	56966	7.5	92.0
11	WILLIAMSPORT, PA	419	56835	7.4	92.2
33	SAVANNAH, GA	417	1060	394.2	92.4
156	YAKIMA, WA	406	19248	21.1	92.6
128	WACO, TX	403	833	484.9	92.8
30	FLORENCE, SC	400	1544	259.5	93.0
112	COLUMBIA, MO	397	34496	11.5	93.2
19	STAUNTON, VA	395	44713	8.8	93.4
140	BEAUMONT, TX	394	381	1036.0	93.6
136	MERIDIAN, MS	393	2484	158.2	93.8
27	ASHEVILLE, NC	391	39561	9.9	94.0
58	CHAMPAIGN, IL	390	21245	18.4	94.2
39	PENSACOLA, FL	382	654	584.5	94.4
144	BROWNSVILLE, TX	355	365	973.1	94.6

Table C-2 (Continued)

AVAILABILITY OF RURAL BASEMENTS BY OBE AREA
IN DESCENDING ORDER OF POPULATION

NO	OBE NAME	POPULATION (THOUSANDS)	RURAL BASE-MENTS	PERSONS PER RURAL BASEMENT	CUMULATIVE POPULATION (PERCENT)
99	SIOUX FALLS, SD	351	55403	6.3	94.7
86	WAUSAU, WI	350	49979	7.0	94.9
109	SALINA, KS	349	42871	8.1	95.1
38	TALLAHASSA, FL	344	1171	294.2	95.2
97	FARGO, ND	335	49671	6.8	95.4
80	CEDAR RAPIDS, IA	330	30941	10.7	95.6
131	TEXARKANA, TX	329	1041	316.8	95.7
123	LUBBOCK, TX	328	2324	141.5	95.9
65	CLARKSVILLE, WV	326	30827	10.6	96.1
102	GRAND ISLAND, NE	323	40988	7.9	96.2
108	LINCOLN, NE	323	31810	10.2	96.4
1	BANGOR, ME	321	39952	8.1	96.5
124	ODESSA, TX	319	568	562.0	96.7
161	LAS VEGAS, NV	317	3542	89.6	96.9
81	DUBUQUE, IA	301	46692	6.5	97.0
152	IDAHO FALLS, ID	300	24364	12.3	97.2
113	QUINCY, IL	299	33483	8.9	97.3
118	FT SMITH, AR	289	2384	121.4	97.5
69	LIMA, OH	276	22090	12.5	97.6
89	LA CROSSE, WI	269	38547	7.0	97.7
104	FT DODGE, IA	266	46039	5.8	97.9
159	BOISE CITY, ID	265	12484	21.2	98.0
125	ABILENE, TX	264	1134	233.5	98.1
56	TERRA HAUTE, IN	252	19033	13.3	98.2
149	GRAND JUNCTION	251	13250	19.0	98.4
59	LAFAYETTE, IN	250	21583	11.6	98.5
95	BILLINGS, MT	246	18435	13.4	98.6
90	ROCHESTER, MN	245	30935	7.9	98.7
153	BUTTE, MT	234	15521	15.1	98.9
100	RAPID CITY, SD	231	21881	10.6	99.0
150	CHEYENNE, WY	229	9415	24.4	99.1
94	GREAT FALLS, MT	222	16698	13.3	99.2
92	GRAND FORKS, ND	220	31000	7.1	99.3
88	EAU CLAIRE, WI	219	31062	7.1	99.4
160	RENO, NV	206	3905	52.9	99.5
93	MINOT, ND	182	27435	6.6	99.6
169	REDDING, PA	176	4199	42.1	99.7
96	BISMARCK, ND	144	20019	7.2	99.8
98	ABERDEEN, SD	132	22861	5.8	99.8
126	SAN ANGELO, TX	124	735	170.0	99.9
170	EUREKA, CA	121	1163	104.8	99.9
101	SCOTTSBLUFF, NE	105	11880	8.9	100.0

APPENDIX D

TIMBER RESOURCES FOR EXPEDIENT SHELTER

TABLE D-1

TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY OBE AREA
IN ORDER OF PERCENT TIMBER NEEDED

OBE NO	OBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
169	REDDING, PA	176	7.0	0.01	0.1
157	PORTLAND, OR	1635	55.9	0.02	0.9
146	ALBUQUERQUE, NM	572	14.4	0.02	1.2
158	EUGENE, OR	543	17.3	0.02	1.5
170	EUREKA, CA	121	15.7	0.02	1.5
156	YAKIMA, WA	406	12.8	0.03	1.7
153	BUTTE, MT	234	6.9	0.03	1.8
155	SEATTLE, WA	2363	112.4	0.04	3.0
154	SPOKANE, WA	687	13.7	0.04	3.3
1	BANGOR, ME	321	17.0	0.04	3.5
152	IDAHO FALLS, ID	300	7.3	0.04	3.7
159	BOISE CITY, ID	265	6.4	0.05	3.8
149	GRAND JUNCTION	251	4.8	0.06	3.9
87	DULUTH, MI	429	18.6	0.09	4.1
150	CHEYENNE, WY	229	4.5	0.13	4.2
136	MERIDIAN, MS	393	35.8	0.15	4.4
131	TEXARKANA, TX	329	29.3	0.15	4.6
2	PORTLAND, ME	740	59.9	0.16	5.0
11	WILLIAMSPORT, PA	419	62.5	0.16	5.2
116	SPRINGFIELD, MO	830	31.9	0.17	5.6
134	GREENVILLE, MS	506	35.0	0.17	5.8
3	BURLINGTON, VT	502	42.2	0.17	6.1
133	MONROE, LA	532	43.0	0.18	6.3
42	MACON, GA	496	50.9	0.20	6.6
19	STAUNTON, VA	395	48.1	0.20	6.8
118	FT SMITH, AR	289	25.4	0.20	6.9
117	LITTLE ROCK, AR	864	41.9	0.21	7.4
167	STOCKTON, CA	643	58.9	0.21	7.7
130	TYLER, TX	553	38.8	0.21	8.0
33	SAVANNAH, GA	417	49.1	0.22	8.2
147	PUEBLO, CO	509	14.5	0.23	8.4
32	AUGUSTA, GA	461	55.6	0.24	8.6
27	ASHEVILLE, NC	391	69.3	0.24	8.8
85	GREEN BAY, WI	926	46.6	0.25	9.3
41	ALBANY, GA	461	42.4	0.25	9.5
140	BEAUMONT, TX	394	79.2	0.26	9.7
135	JACKSON, MS	510	56.2	0.27	10.0
132	SHREVEPORT, LA	453	61.1	0.27	10.2
95	BILLINGS, MT	246	3.7	0.27	10.3
52	HUNTINGTON, WV	1309	72.8	0.28	11.0
72	SAGINAW, MI	798	50.0	0.28	11.4
30	FLORENCE, SC	400	62.5	0.28	11.6
168	SACRAMENTO, CA	1089	94.9	0.29	12.1

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Table D-1 (Continued)

TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY OBE AREA
IN ORDER OF PERCENT TIMBER NEEDED

OBE NO	OBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
21	RICHMOND, VA	1010	85.5	0.30	12.6
137	MOBILE, AL	724	66.6	0.30	13.0
86	WAUSAU, WI	350	33.7	0.30	13.1
65	CLARKSVILLE, WV	326	68.5	0.30	13.3
20	ROANOKE, VA	735	70.7	0.32	13.7
24	WILMINGTON, NJ	482	70.1	0.32	13.9
50	KNOXVILLE, TN	904	84.3	0.36	14.4
31	CHARLESTON, SC	430	89.6	0.36	14.6
43	COLUMBUS, OH	488	72.1	0.37	14.8
23	RALEIGH, NC	1621	102.8	0.38	15.6
34	JACKSONVILLE, FL	1051	67.1	0.38	16.1
170	RAPID CITY, SD	231	4.4	0.38	16.3
12	BINGHAMPTON, NY	765	77.5	0.39	16.6
88	EAU CLAIRE, WI	219	33.3	0.39	16.7
10	ERIE, PA	459	120.2	0.41	17.0
40	MONTGOMERY, AL	687	49.4	0.42	17.3
51	BRISTOL, VA	774	90.9	0.45	17.7
89	LA CROSSE, WI	269	41.0	0.46	17.8
166	FRESNO, CA	1036	46.1	0.48	18.3
138	NEW ORLEANS, LA	2175	109.2	0.51	19.4
49	NASHVILLE, TN	1426	70.4	0.52	20.1
53	LEXINGTON, KY	753	64.7	0.55	20.5
139	LAKE CHARLES, LA	748	61.3	0.55	20.9
29	COLUMBIA, SC	592	88.0	0.57	21.2
22	NORFOLK, VA	1232	217.5	0.59	21.8
48	CHATTANOOGA, TN	718	87.8	0.60	22.1
6	ALBANY, NY	1332	102.6	0.61	22.8
73	GRAND RAPIDS, MI	1124	91.1	0.62	23.4
151	SALT LAKE CITY	1061	13.7	0.63	23.9
25	GREENSBORO, NC	1142	133.4	0.64	24.5
45	BIRMINGHAM, AL	1743	76.1	0.65	25.3
47	HUNTSVILLE, AL	671	75.0	0.65	25.7
44	ATLANTA, GA	2296	151.0	0.66	26.8
7	SYRACUSE, NY	1445	104.9	0.70	27.5
16	HARRISBURG, PA	1723	171.6	0.82	28.4
28	GREENVILLE, SC	817	129.2	0.83	28.8
13	WILKES BARRE, PA	692	197.4	0.84	29.1
148	DENVER, CO	1523	44.3	0.86	29.9
92	GRAND FORKS, ND	220	11.8	0.89	30.0
26	CHARLOTTE, NC	1489	152.7	0.92	30.7
55	EVANSVILLE, IN	771	68.7	0.96	31.1
9	BUFFALO, NY	1789	217.7	1.00	32.0
145	EL PASO, TX	681	9.3	1.07	32.3

Table D-1 (Continued)

TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY OBE AREA
IN ORDER OF PERCENT TIMBER NEEDED

OBE NO	OBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
38	TALLAHASSA, FL	344	36.7	1.08	32.5
171	SAN FRANCISCO,CA	5090	300.8	1.14	35.0
115	PADUCAH, KY	558	43.5	1.21	35.3
56	TERRA HAUTE, IN	252	73.4	1.21	35.4
97	FARGO, ND	335	14.6	1.28	35.6
35	ORLANDO, FL	941	142.5	1.35	36.1
83	MADISON, WI	455	73.0	1.35	36.3
91	MINNEAPOLIS, MN	2942	69.8	1.40	37.8
46	MEMPHIS, TN	1678	79.8	1.42	38.6
66	PITTSBURG, PA	3716	275.6	1.47	40.4
141	HOUSTON, TX	2362	150.5	1.49	41.6
54	LOUISVILLE, KY	1220	145.1	1.54	42.2
64	COLUMBUS, OH	1763	153.3	1.55	43.1
17	BALTIMORE, MD	1764	205.7	1.62	44.0
81	DUBUQUE, IA	301	41.0	1.78	44.1
39	PENSACOLA, FL	382	82.1	1.84	44.3
119	TULSA, OK	1012	64.7	2.13	44.8
113	QUINCY, IL	299	43.3	2.56	45.0
60	INDIANAPOLIS, IN	1613	188.9	2.67	45.8
18	WASHINGTON, DC	3404	610.8	2.81	47.4
90	ROCHESTER, MN	245	57.0	3.35	47.6
37	TAMPA, FL	1798	149.3	3.37	48.5
74	LANSING, MI	1034	174.4	3.48	49.0
8	ROCHESTER, NY	1016	279.3	3.78	49.5
62	CINCINNATI, OH	1889	217.9	3.79	50.4
59	LAFAYETTE, IN	250	72.5	3.97	50.5
67	YOUNGSTOWN, OH	771	374.6	4.33	50.9
75	FORT WAYNE, IN	597	123.8	4.46	51.2
76	SOUTH BEND, IN	747	176.1	4.08	51.6
112	COLUMBIA, MO	397	29.8	5.33	51.8
129	AUSTIN, TX	559	42.9	5.42	52.1
114	ST LOUIS, MO	3248	117.9	5.47	53.7
78	PEORIA, IL	628	98.4	5.67	54.0
4	BOSTON, MA	6339	638.8	5.71	57.1
5	HARTFORD, CN	2966	390.8	6.69	58.6
69	LIMA, OH	276	105.7	6.83	58.7
68	CLEVELAND, OH	4255	399.3	7.57	60.9
165	LOS ANGELES, CA	10436	182.1	7.93	66.0
15	PHILADELPHIA, PA	7281	682.4	8.73	69.7
51	MUNCIE, IN	551	178.8	9.64	69.9
70	TOLEDO, OH	1054	217.5	10.98	70.5
162	PHOENIX, AR	1316	14.6	13.24	71.1
82	ROCKFORD, IL	560	134.7	13.46	71.4

Table D-1 (Continued)

TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY OBE AREA
IN ORDER OF PERCENT TIMBER NEEDED

OBE NO	OBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
128	WACO, TX	403	43.8	13.84	71.6
79	DAVENPORT, IO	605	104.2	14.11	71.9
98	ABERDEEN, SD	132	10.3	16.16	71.9
63	DAYTON, OH	1162	289.4	16.29	72.5
163	TUCSON, AR	454	19.6	17.57	72.8
164	SAN DIEGO, CA	1357	318.7	17.90	73.4
71	DETROIT, MI	5207	769.2	18.22	76.0
111	KANSAS CITY, MO	2249	74.2	18.59	77.1
99	SIOUX FALLS, SD	351	21.3	18.77	77.3
14	NEW YORK, NY	18272	1830.9	19.35	86.4
120	OKLAHOMA CITY,OK	1158	38.4	20.17	86.9
36	MIAMI, FL	2430	227.6	20.35	88.2
94	GREAT FALLS, MT	222	4.3	32.68	88.3
84	MILWAUKEE, WI	2066	389.5	37.90	89.3
142	SAN ANTONIO, TX	1229	42.5	48.05	89.9
127	DALLAS, TX	2736	140.0	53.68	91.3
161	LAS VEGAS, NV	317	5.5	69.28	91.4
103	SIOUX CITY, IA	452	20.5	74.70	91.6
77	CHICAGO, IL	8193	654.3	94.12	95.7
107	OMAHA, NE	794	75.7	OVER 100	96.1
106	DES MOINES, IA	782	56.0	OVER 100	96.5
110	WICHITA, KA	728	24.4	OVER 100	96.9
143	CORPUS CHRISTI	516	26.2	OVER 100	97.1
57	SPRINGFIELD, IL	490	77.9	OVER 100	97.4
121	WICHITA FALLS,TX	455	24.3	OVER 100	97.6
122	AMARILLO, TX	437	9.0	OVER 100	97.8
105	WATERLOO, IA	426	47.7	OVER 100	98.0
58	CHAMPAIGN, IL	390	82.6	OVER 100	98.2
144	BROWNSVILLE, TX	355	83.7	OVER 100	98.4
109	SALINA, KS	349	10.8	OVER 100	98.6
80	CEDAR RAPIDS, IA	330	75.4	OVER 100	98.7
123	LUBBOCK, TX	328	24.0	OVER 100	98.9
102	GRAND ISLAND, NE	323	9.4	OVER 100	99.0
108	LINCOLN, NE	323	37.9	OVER 100	99.2
124	ODESSA, TX	319	9.5	OVER 100	99.4
104	FT DODGE, IA	266	32.2	OVER 100	99.5
125	ABILENE, TX	264	16.7	OVER 100	99.6
160	RENO, NV	206	3.0	OVER 100	99.7
93	MINOT, ND	182	6.7	OVER 100	99.8
96	BISMARCK, ND	144	6.0	OVER 100	99.9
126	SAN ANGELO, TX	124	8.2	OVER 100	99.9
101	SCOTTSBLUFF, NE	105	6.5	OVER 100	100.0

TABLE D-2

TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY CBE AREA
IN DESCENDING ORDER OF POPULATION

CBE NO	CBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
14	NEW YORK, NY	18272	1830.9	19.35	9.1
165	LOS ANGELES, CA	10436	182.1	7.93	14.3
77	CHICAGO, IL	8193	554.3	94.12	18.3
15	PHILADELPHIA, PA	7281	682.4	8.73	21.9
4	BOSTON, MA	6339	638.8	5.71	25.1
71	DETROIT, MI	5207	769.2	18.22	27.7
171	SAN FRANCISCO,CA	5090	300.8	1.14	30.2
68	CLEVELAND, OH	4255	399.3	7.57	32.3
66	PITTSBURG, PA	3716	275.6	1.47	34.2
18	WASHINGTON, DC	3404	610.8	2.81	35.8
114	ST LOUIS, MO	3248	117.9	5.47	37.5
5	HARTFORD, CN	2966	390.8	6.69	38.9
91	MINNEAPOLIS, MN	2942	69.8	1.40	40.4
127	DALLAS, TX	2736	140.0	53.68	41.8
36	MIAMI, FL	2430	227.6	20.35	43.0
155	SEATTLE, WA	2363	112.4	0.04	44.1
141	HOUSTON, TX	2362	150.5	1.49	45.3
44	ATLANTA, GA	2296	151.0	0.66	46.4
111	KANSAS CITY, MO	2249	74.2	18.59	47.6
138	NEW ORLEANS, LA	2175	109.2	0.51	48.6
84	MILWAUKEE, WI	2066	389.5	37.90	49.7
62	CINCINNATI, OH	1889	217.9	3.79	50.6
37	TAMPA, FL	1798	149.3	3.37	51.5
9	BUFFALO, NY	1789	217.7	1.00	52.4
17	BALTIMORE, MD	1764	205.7	1.62	53.3
64	COLUMBUS, OH	1763	153.3	1.55	54.1
45	BIRMINGHAM, AL	1743	76.1	0.65	55.0
16	HARRISBURG, PA	1723	171.6	0.82	55.9
46	MEMPHIS, TN	1678	79.8	1.42	56.7
157	PORTLAND, OR	1635	55.9	0.02	57.5
23	RALEIGH, NC	1621	102.8	0.38	58.3
60	INDIANAPOLIS, IN	1613	188.9	2.67	59.1
148	DENVER, CO	1523	44.3	0.86	59.9
26	CHARLOTTE, NC	1489	152.7	0.92	60.6
7	SYRACUSE, NY	1445	104.9	0.70	61.3
49	NASHVILLE, TN	1426	70.4	0.52	62.0
164	SAN DIEGO, CA	1357	318.7	17.90	62.7
6	ALBANY, NY	1332	102.6	0.61	63.4
162	PHOENIX, AR	1316	14.6	13.24	64.0
52	HUNTINGTON, WV	1309	72.8	0.28	64.7
22	NORFOLK, VA	1232	217.5	0.59	65.3
142	SAN ANTONIO, TX	1229	42.5	48.05	65.9
54	LOUISVILLE, KY	1220	145.1	1.54	66.5

Table D-2 (Continued)

TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY CBE AREA
IN DESCENDING ORDER OF POPULATION

CBE NO	CBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
63	DAYTON, OH	1162	289.4	16.29	67.1
120	OKLAHOMA CITY,OK	1158	38.4	20.17	67.7
25	GREENSBORO, NC	1142	133.4	0.64	68.2
73	GRAND RAPIDS, MI	1124	91.1	0.62	68.8
168	SACRAMENTO, CA	1089	94.9	0.29	69.3
151	SALT LAKE CITY	1061	13.7	0.63	69.8
70	TOLEDO, OH	1054	217.5	10.98	70.4
34	JACKSONVILLE, FL	1051	67.1	0.38	70.9
166	FRESNO, CA	1036	46.1	0.48	71.4
74	LANSING, MI	1034	174.4	3.48	71.9
8	ROCHESTER, NY	1016	279.3	3.78	72.4
119	TULSA, OK	1012	64.7	2.13	72.9
21	RICHMOND, VA	1010	85.5	0.30	73.4
35	ORLANDO, FL	941	142.5	1.35	73.9
85	GREEN BAY, WI	926	46.6	0.25	74.4
50	KNOXVILLE, TN	904	84.3	[illegible]36	74.8
117	LITTLE ROCK, AR	864	41.9	0.21	75.2
116	SPRINGFIELD, MO	830	31.9	0.17	75.6
28	GREENVILLE, SC	817	129.2	0.83	76.0
72	SAGINAW, MI	798	50.0	0.28	76.4
107	OMAHA, NE	794	75.7	OVER 100	76.8
106	DES MOINES, IA	782	56.0	OVER 100	77.2
51	BRISTOL, VA	774	90.9	0.45	77.6
55	EVANSVILLE, IN	771	68.7	0.96	78.0
67	YOUNGSTOWN, OH	771	374.6	4.33	78.4
12	BINGHAMPTON, NY	765	77.5	0.39	78.8
53	LEXINGTON, KY	753	64.7	0.55	79.1
139	LAKE CHARLES, LA	748	61.3	0.55	79.5
76	SOUTH BEND, IN	747	176.1	4.98	79.9
2	PORTLAND, ME	740	59.9	0.16	80.2
20	ROANOKE, VA	735	70.7	0.32	80.6
110	WICHITA, KA	728	24.4	OVER 100	81.0
137	MOBILE, AL	724	66.6	0.30	81.3
48	CHATTANOOGA, TN	718	87.8	0.60	81.7
13	WILKES BARRE, PA	692	197.4	0.84	82.0
154	SPOKANE, WA	687	13.7	0.04	82.4
40	MONTGOMERY, AL	687	49.4	0.42	82.7
145	EL PASO, TX	681	9.3	1.07	83.0
47	HUNTSVILLE, AL	671	75.0	0.65	83.4
167	STOCKTON, CA	643	58.9	0.21	83.7
78	PEORIA, IL	628	98.4	5.67	84.0
79	DAVENPORT, IO	605	104.2	14.11	84.3
75	FORT WAYNE, IN	597	123.8	4.46	84.6

Table D-2 (Continued)

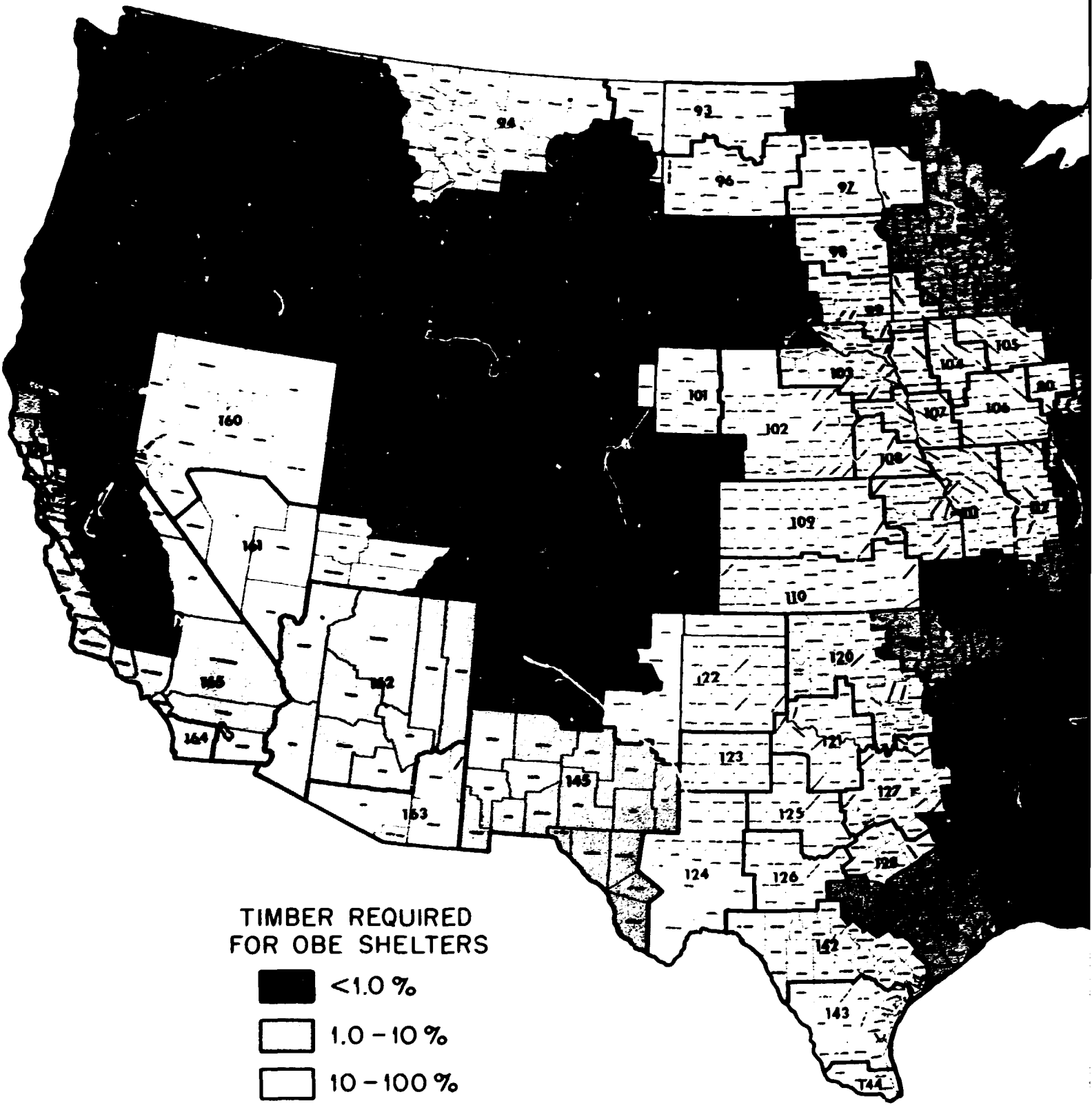
TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY OBE AREA
IN DESCENDING ORDER OF POPULATION

OBE NO	OBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
29	COLUMBIA, SC	592	88.0	0.57	84.9
146	ALBUQUERQUE, NM	572	14.4	0.02	85.2
82	ROCKFORD, IL	560	134.7	13.46	85.5
129	AUSTIN, TX	559	42.9	5.42	85.7
115	PADUCAH, KY	558	43.5	1.21	86.0
130	TYLER, TX	553	38.8	0.21	86.3
61	MUNCIE, IN	551	178.8	9.64	86.6
158	EUGENE, OR	543	17.3	0.02	86.8
133	MONROE, LA	532	43.0	0.18	87.1
143	CORPUS CHRISTI	516	26.2	OVER 100	87.4
135	JACKSON, MS	510	56.2	0.27	87.6
147	PUEBLO, CO	509	14.5	0.23	87.9
134	GREENVILLE, MS	506	35.0	0.17	88.1
3	BURLINGTON, VT	502	42.2	0.17	88.4
42	MACON, GA	496	50.9	0.20	88.6
57	SPRINGFIELD, IL	490	77.9	OVER 100	88.9
43	COLUMBUS, OH	488	72.1	0.37	89.1
24	WILMINGTON, NJ	482	70.1	0.32	89.3
41	ALBANY, GA	461	42.4	0.25	89.6
32	AUGUSTA, GA	461	55.6	0.24	89.8
10	ERIE, PA	459	120.2	0.41	90.0
83	MADISON, WI	455	73.0	1.35	90.2
121	WICHITA FALLS, TX	455	24.3	OVER 100	90.5
163	TUCSON, AR	454	19.6	17.57	90.7
132	SHREVEPORT, LA	453	61.1	0.27	90.9
103	SIOUX CITY, IA	452	20.5	74.70	91.1
122	AMARILLO, TX	437	9.0	OVER 100	91.4
31	CHARLESTON, SC	430	89.6	0.36	91.6
87	DULUTH, MI	429	18.6	0.09	91.8
105	WATERLOO, IA	426	47.7	OVER 100	92.0
11	WILLIAMSPORT, PA	419	62.5	0.16	92.2
33	SAVANNAH, GA	417	49.1	0.22	92.4
156	YAKIMA, WA	406	12.8	0.03	92.6
128	WACO, TX	403	43.8	13.84	92.8
30	FLORENCE, SC	400	62.5	0.28	93.0
112	COLUMBIA, MO	397	29.8	5.33	93.2
19	STAUNTON, VA	395	48.1	0.20	93.4
140	BEAUMONT, TX	394	79.2	0.26	93.6
136	MERIDIAN, MS	393	35.8	0.15	93.8
27	ASHEVILLE, NC	391	69.3	0.24	94.0
58	CHAMPAIGN, IL	390	82.6	OVER 100	94.2
39	PENSACOLA, FL	382	82.1	1.84	94.4
144	BROWNSVILLE, TX	355	83.7	OVER 100	94.6

Table D-2 (Continued)

TIMBER RESOURCES FOR EXPEDIENT SHELTERS BY OBE AREA
IN DESCENDING ORDER OF POPULATION

OBE NO	OBE NAME	POPULATION (THOUSANDS)	POPULATION DENSITY (PERSONS PER SQ MI)	PERCENT OF TIMBER NEEDED	CUMULATIVE POPULATION (PERCENT)
99	SIOUX FALLS, SD	351	21.3	18.77	94.7
86	WAUSAU, WI	350	33.7	0.30	94.9
109	SALINA, KS	349	10.8	OVER 100	95.1
38	TALLAHASSA, FL	344	36.7	1.08	95.2
97	FARGO, ND	335	14.6	1.28	95.4
80	CEDAR RAPIDS, IA	330	75.4	OVER 100	95.6
131	TEXARKANA, TX	329	29.3	0.15	95.7
123	LUBBOCK, TX	328	24.0	OVER 100	95.9
65	CLARKSVILLE, WV	326	68.5	0.30	96.1
102	GRAND ISLAND, NE	323	9.4	OVER 100	96.2
108	LINCOLN, NE	323	37.9	OVER 100	96.4
1	BANGOR, ME	321	17.0	0.04	96.5
124	ODESSA, TX	319	9.5	OVER 100	96.7
161	LAS VEGAS, NV	317	5.5	69.28	96.9
81	DUBUQUE, IA	301	41.0	1.78	97.0
152	IDAHO FALLS, ID	300	7.3	0.04	97.2
113	QUINCY, IL	299	43.3	2.56	97.3
118	FT SMITH, AR	289	25.4	0.20	97.5
69	LIMA, OH	276	105.7	6.83	97.6
89	LA CROSSE, WI	269	41.0	0.46	97.7
104	FT DODGE, IA	266	32.2	OVER 100	97.9
159	BOISE CITY, ID	265	6.4	0.05	98.0
125	ABILENE, TX	264	16.7	OVER 100	98.1
56	TERRA HAUTE, IN	252	73.4	1.21	98.2
149	GRAND JUNCTION	251	4.8	0.06	98.4
59	LAFAYETTE, IN	250	72.5	3.97	98.5
95	BILLINGS, MT	246	3.7	0.27	98.6
90	ROCHESTER, MN	245	57.0	3.35	98.7
153	BUTTE, MT	234	6.9	0.03	98.9
100	RAPID CITY, SD	231	4.4	0.38	99.0
150	CHEYENNE, WY	229	4.5	0.13	99.1
94	GREAT FALLS, MT	222	4.3	32.68	99.2
92	GRAND FORKS, ND	220	11.8	0.89	99.3
88	EAU CLAIRE, WI	219	33.3	0.39	99.4
160	RENO, NV	206	3.0	OVER 100	99.5
93	MINOT, ND	182	6.7	OVER 100	99.6
169	REDDING, PA	176	7.0	0.01	99.7
96	BISMARCK, ND	144	6.0	OVER 100	99.8
98	ABERDEEN, SD	132	10.3	16.16	99.8
126	SAN ANGELO, TX	124	8.2	OVER 100	99.9
170	EUREKA, CA	121	15.7	0.02	99.9
101	SCOTTSBLUFF, NE	105	6.5	OVER 100	100.0



Adequacy of Timber for Expedient

Fig. D-1.

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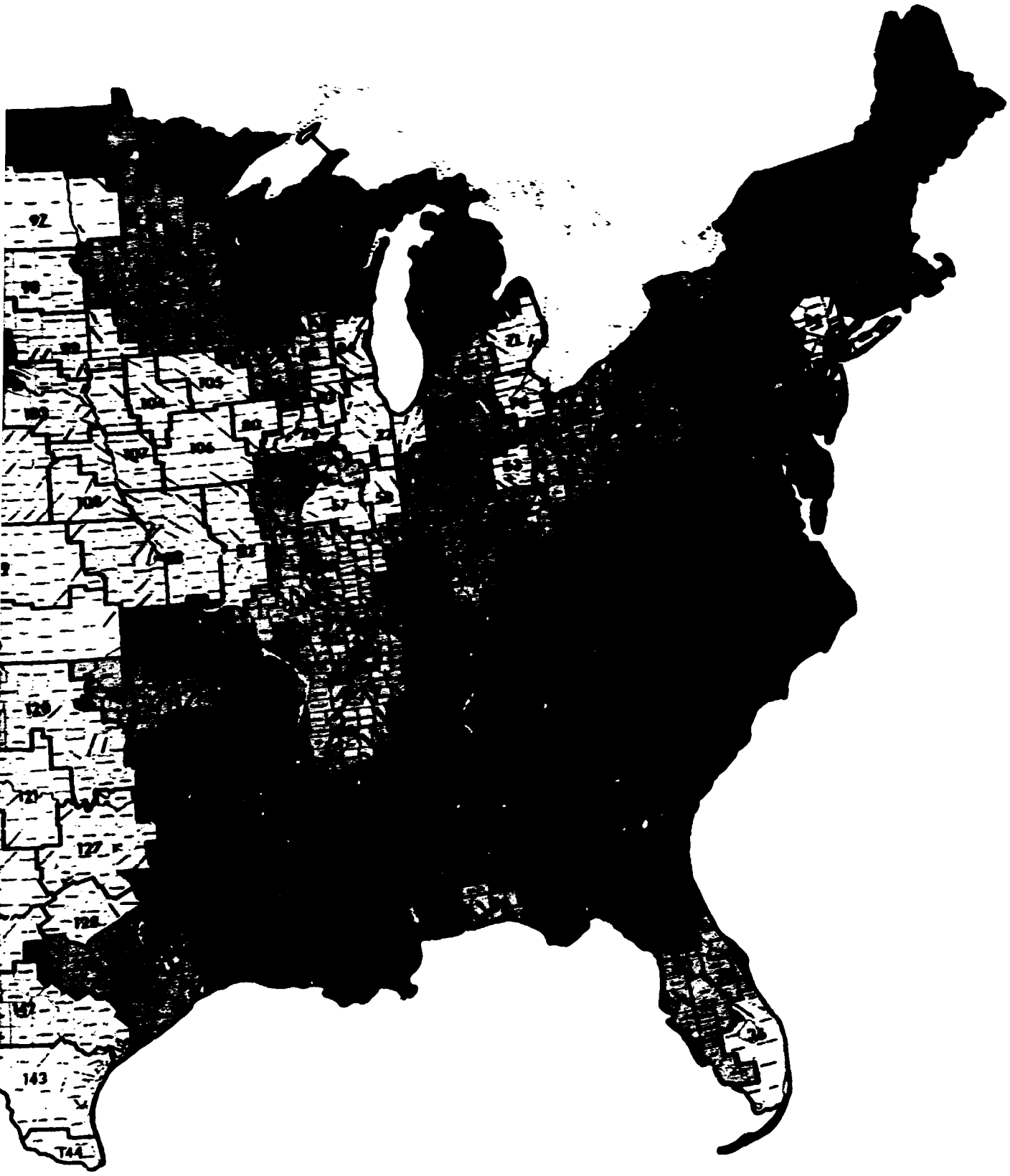

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nber for Expedient Shelters

Fig. D-1.

APPENDIX E

RECOMMENDED ITEMS FOR URBAN EVACUEES

RECOMMENDED ITEMS FOR URBAN EVACUEES TO TAKE WITH THEM IN THEIR CARS IF THEY PLAN TO BUILD OR IMPROVE EXPEDIENT SHELTERS DURING A WORSENING CRISIS:

LOADING PROCEDURES: Except for categories 1 and 2, first make separate piles of items, one pile for each category. Then load the car (leaving enough room for each crowded passenger), by taking items from each of categories 3 through 12.

A. THE MOST NEEDED ITEMS:

Category 1. Valuables: Money; credit cards; negotiable securities; valuable jewelry; checkbooks; and the most important documents at home.

Category 2. Survival Information: Shelter-building and other nuclear survival instructions; maps; battery-powered radio.

Category 3. Tools: Pick; shovel; file; knife and any other tools specified in the building instructions for the type shelter you plan to make. Also take work gloves.

Category 4. Shelter-Building Materials: Rainproofing materials (plastic, shower curtains, etc.); cloth; etc.--as specified in the shelter-building instructions for the type shelter you plan to make.

Category 5. Water: Smaller water containers (filled), plus an empty cleaned and sterilized garbage can with plastic (bags or film) to use as liners before filling the larger container (or a water pit) in the shelter-building area; water-purifying material (like Clorox) and a teaspoon for measuring--one teaspoonful per 5 gallons.

Category 6. Light: Flashlights; candles; materials to make expedient lamps (jars, cooking oil or fat, and wick materials--see instructions); matches and moisture-proof jar for matches.

Category 7. Clothing: Especially cold-weather boots, overshoes and warm outdoor clothing (to be used in hot weather for padding and for sleeping); raincoats and ponchos, work clothes and work shoes.

Category 8. Sleeping Gear: Compact sleeping bags, or two blankets per person.

Category 9. Food: Compact foods that require no cooking preferred. Include a pound of salt. Food for babies has highest priority. If other foods are available, take as much as the car or cars will hold in addition to passengers and the items listed above. Can and bottle opener; one spoon and one bowl per person; 2 cooking pots with lids (4-quart size preferred).

Category 10. Sanitation Items: Plastic or plastic bags in which to collect and contain excrement; bucket for urine, toilet paper; tampax; diapers for babies; soap.

Category 11. Medical Items: Aspirin; first-aid kit and supplies; special prescription medicines (if essential to a member of the family); spare glasses and contact lenses.

Category 12. Miscellaneous: Two square yards of mosquito netting or screen wire, to screen the shelter openings if insects are a problem, and insect repellent; Bible and/or a very few books; a few small toys, for small children.

B. SOME USEFUL ITEMS -- To take if car space is available:

1. Additional Tools: Saw (bow-saw best); ax; hammer; pliers.

2. Tent and some additional kitchen utensils.

APPENDIX F

CITIES WITH AVERAGE ANNUAL PRECIPITATION LESS THAN 16 INCHES PER YEAR

Table F-1. Cities with Average Annual Precipitation Less than 16 Inches per Year

City	Average Annual Precipitation (inches)
Phoenix, Arizona	7.20
Los Angeles, California	12.63
Denver, Colorado	14.31
Boise, Idaho	11.43
Great Falls, Montana	14.07
Reno, Nevada	7.15
Albuquerque, New Mexico	8.13
Bismarck, North Dakota	15.15
El Paso, Texas	7.89
Cheyenne, Wyoming	15.06

APPENDIX G

USDA HOME AND GARDEN BULLETIN NO. 77

Home and Garden Bulletin No. 77

U.S. DEPARTMENT OF AGRICULTURE

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Home and Garden Bulletin No. 77

This publication was prepared by the U.S. Department of Agriculture with cooperation by the Office of Civil Defense, U.S. Department of Defense.

The Office of Civil Defense recommends two methods of home food storage for emergencies:

1. Increase your regular food supply so there will always be a 2-week supply of food for your family in your home. Replace food as it is used.

2. Store and maintain in your fallout shelter or home a special 2-week stockpile of survival foods. Choose foods that will keep for months without refrigeration, require little or no cooking, and yet will provide a reasonably well-balanced family diet.

Decide which type of food reserve best meets your own situation. In some cases, a combination of these two methods may be desirable. The important thing is that you have enough food in your home or shelter to last until it is safe and possible to get more food.

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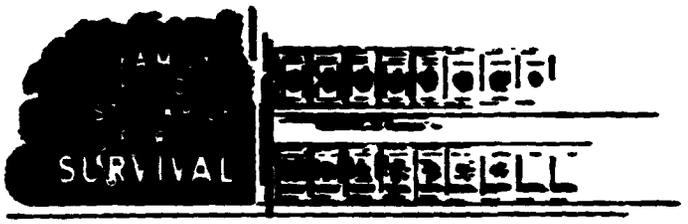
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402—Price 10 cents



An attack on the United States with nuclear weapons would make it necessary for many survivors to rely on their own food and water reserves—for up to 2 weeks following attack.

A nuclear explosion can blanket an area many miles from the target area with dangerous radioactive fallout. If you and your family survive the explosion, you may have difficulty obtaining food and water from regular sources without overexposure to fallout radiation. Essential services, such as gas, electricity, and water, may be disrupted.

Safeguard your family's survival by planning your food-and-water stockpile now. Start building it up in your home or fallout shelter. Maintain it.

Individuals and families are responsible for maintaining personal stocks of food and water in their homes or shelters sufficient to meet their needs until other supplies are available. The stocks should be sufficient for at least 2 weeks following attack.

As soon as possible after attack—if there is one—local authorities will inform you of safe sources of food and water.

Stored food and water can also be useful in many peacetime emergencies.

FOOD

Every family should either build up and keep a 2-week supply of regular food in the home at all times or assemble and maintain a special 2-week stockpile of survival foods in the fallout shelter or home.

Survival foods may vary from a single cracker-type food, such as rye or wheat wafers or specially prepared biscuits, to a fairly complete assortment of familiar foods.

Stockpile foods should be in cans, jars, or sealed paper or plastic containers. Select foods that will last for months without refrigeration and can be eaten with little or no cooking.

Take into consideration the needs and preferences of family members, storage space, and ability to rotate the stored foods in family meals. Familiar foods are likely to be more acceptable in times of stress.

Kinds of food familiar to the family and suitable to store for emergency use are shown in table 1. Amounts suggested will supply the calories needed by one adult for 2 weeks. If your family consists of four adults, store four times the amount suggested in table 1. Teen-

TABLE 1.—*Guide for Reserve Food Supply*

Kind of food	Amount per person for—		Remarks
	1 day	2 weeks	
1. Milk	Equivalent of 2 glasses (fluid).	Equivalent of 7 quarts (fluid).	Each of the following is the equivalent of 1 quart of fluid milk: Evaporated milk: three 6-ounce cans; one 14½-ounce can. Nonfat dry milk or whole dry milk: 3 to 3½ ounces.
2. Canned meat, poultry, fish, cooked dry beans, and peas.	2 servings	28 servings (8 to 9 pounds).	Amounts suggested for one serving of each food are as follows: Canned meat, poultry: 2 to 3 ounces. Canned fish: 2 to 3 ounces. Canned mixtures of meat, poultry, or fish with vegetables, rice, macaroni, spaghetti, noodles, or cooked dry beans: 8 ounces. Condensed soups containing meat, poultry, fish, or dry beans or dry peas: one-half of a 10½-ounce can.
3. Fruits and vegetables	3 to 4 servings	42 to 56 servings (about 21 pounds, canned).	Amounts suggested for one serving of each food are as follows: Canned juices: 4 to 6 ounces, single strength. Canned fruit and vegetables: 4 ounces. Dried fruit: 1½ ounces.

4. Cereals and baked goods.	3 to 4 servings...	42 to 56 servings (5 to 7 pounds).	Amounts suggested for one serving of each food are as follows (selection depends on extent of cooking possible): Cereal: Ready-to-eat puffed: ½ ounce. Ready-to-eat flaked: ¾ ounce. Other ready-to-eat cereal: 1 ounce. Uncooked (quick-cooking): 1 ounce. Crackers: 1 ounce. Cookies: 1 ounce. Canned bread, steamed puddings, and cake: 1 to 2 ounces. Flour mixes: 1 ounce. Flour: 1 ounce. Macaroni, spaghetti, noodles: Dry: ¾ ounce. Cooked, canned: 6 ounces.
5. Spreads for bread and crackers.	According to family practices.....		Examples: Cheese spreads. Peanut and other nut butters. Jam, jelly, marmalade, preserves. Sirup, honey. Apple and other fruit butters. Relish, catsup, mustard.
6. Fats and vegetable oil.	.....	Up to 1 pound or 1 pint.	Amount depends on extent of cooking possible. Kinds that do not require refrigeration.
7. Sugars, sweets, and nuts.	.....	1 to 2 pounds...	Sugar, hard candy, gum, nuts, instant puddings.
8. Miscellaneous.....	According to family practices and extent of cooking possible.		Examples: Coffee, tea, cocoa (instant). Dry cream product (instant). Bouillon products. Flavored beverage powders. Salt and pepper. Flavoring extracts, vinegar. Soda, baking powder.

agers are likely to need more than the amount in the table; younger children need less.

By including, each day, foods from the eight groups listed, members of your family can have a reasonably nutritious diet.

If necessary, include special kinds of milk and strained, chopped, or other specially prepared foods required for infants, toddlers, elderly persons, and others on limited diets.

Whenever possible, choose cans and jars in sizes that will fill your family's needs for only one meal. This is especially desirable for meat, poultry, fish, vegetables, evaporated milk, and other foods that deteriorate rapidly after a container is opened.

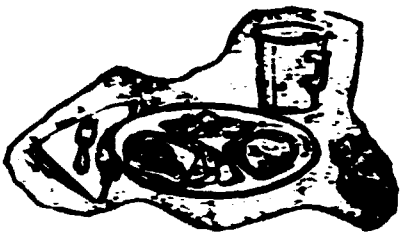
If your home food freezer is located in your basement or where you would have safe access to it after attack, you might count foods in it as some of your reserve supply.

Food spoilage in a well-filled, well-insulated home freezer does not begin until several days after power goes off. Food in large freezers will keep longer than food in small freezers. Once the freezer has been opened foods should be used as promptly as possible.

Sample Meal Plans

Sample meal plans are presented on pages 8 and 9. These plans suggest the kinds of meals you could serve from the foods shown in the table on pages 4 and 5.

Half of the meals fit a situation where there are no cooking facilities. The other meals require facilities for heating water or food but not for any extended cooking.



If you have provided a sufficient variety of canned foods in your reserve supply, it is possible to have reasonably well-balanced meals. However, because of limited space and in order to use fewer dishes, it may be more practical to serve fewer foods at a meal and make the servings more generous.

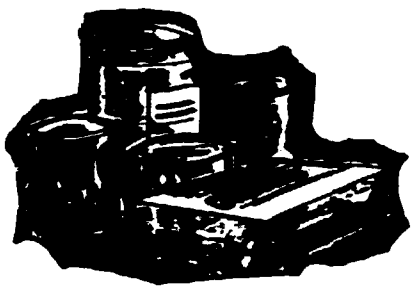
Storing and Replacing Foods

If you have prepared a fallout shelter, keep your reserve food supply there. If you have no shelter, keep it in that part of your basement where you will be safest in case of attack.

In homes without basements and in apartments, your food stockpile would probably be stored in the kitchen or in a storage closet.

To maintain the eating quality of your reserve food supply, keep foods in cans or jars in a dry place, where the temperature is fairly cool—preferably not above 70° F. and not below freezing.

Protect food in paper boxes from rodents and insects by storing boxes in tightly closed cans or other metal containers; leave the foods in their original boxes. Keeping these foods in metal containers also extends the length of time they can be stored.



Eating quality was the first consideration in setting the maximum replacement periods given on this page. Many food items will be acceptable for a much longer period if storage temperatures do not usually exceed 70° F. Most of the foods suggested in table 1 would be safe to use after longer storage periods.

It is a good idea to draw regularly on the food stockpile so that foods are used while they are still of good eating quality. As food items are used, replace them in the stockpile with fresh supplies. When you put in fresh supplies, put them at the back of the stockpile; keep older supplies in front.

Here are suggested replacement periods for the kinds of food listed in table 1:

Use within 6 months:
- Evaporated milk
- Dried fruit, in metal container
- Dry crisp crackers, in metal container
- Gum

Use within 1 year:
- Nonfat dry or whole dry milk, in metal container
- Canned meat, poultry, fish
- Mixtures of meat, vegetables, and cereal products, in sealed cans or jars
- Canned condensed meat-and-vegetable soups
- Dehydrated soups, in metal container
- Canned fruits, fruit juices, and vegetables
- Cereal:
  - Ready-to-eat cereals, in metal container
  - Uncooked cereal (quick-cooking or instant), in metal container
- Hydrogenated fats, vegetable oils
- Sweets and nuts:
  - Hard candy
  - Nuts, canned
  - Instant puddings
- Miscellaneous:
  - Coffee, tea, cocoa (instant)
  - Dry cream products (instant)
  - Bouillon products
  - Flavored beverage products
  - Flavoring extracts
  - Soda, baking powder

May be stored indefinitely:
- Sugar
- Salt

You may want to label cans and containers with the date of purchase and the approximate date when the particular item should be replaced by a new supply. Suggested charts for keeping a record of your family food reserves are given on pages 13, 14, and 15 of this bulletin.

Canned foods are generally safe to eat as long as the seal of the can is not broken. Food spoilage may have occurred if a can has bulging ends, is leaking, or if, when the can is opened, there is spurting liquid, off-odor, or mold on the food.

When food in glass containers becomes spoiled, the cover may bulge, or the container may show leakage of the food through the broken seal. Gas bubbles, cloudiness, and films of growth that can be seen through the glass may indicate bacterial growth.

SAMPLE MEAL PLANS: *No Cooking Facilities*

First day	Second day	Third day
MORNING		
Citrus fruit juice.[1] Ready-to-eat cereal. Milk, cold coffee,[2] or tea.[2] Crackers. Peanut butter or other spread.	Fruit juice.[1] Corned beef hash.[1] Crackers. Spread. Milk, cold coffee,[2] or tea.[2]	Grapefruit segments.[1] Ready-to-eat cereal. Vienna sausage.[1] Milk, cold coffee,[2] or tea.[2]
NOON		
Spaghetti with meat sauce.[1] Green beans.[1] Crackers. Spread. Milk, cold coffee,[2] or tea.[2]	Baked beans.[1] Brown bread.[1] Tomatoes.[1] Fruit.[1] Milk, cold coffee,[2] or tea.[2]	Chile con carne with beans.[1] Crackers. Fruit.[1] Cookies. Milk, cold coffee,[2] or tea.[2]
BETWEEN MEALS		
Fruit-flavored drink or fruit drink.	Milk.	Tomato juice.
NIGHT		
Lunch meat.[1] Sweetpotatoes.[1] Applesauce.[1] Milk, cold coffee,[2] or tea.[2] Candy.	Pork and gravy.[1] Corn.[1] Potatoes.[1] Instant pudding. Fruit juice.[1]	Sliced beef.[1] Macaroni and cheese.[1] Peas and carrots.[1] Crackers. Milk, cold coffee,[2] or tea.[2]

[1] Canned. [2] Instant.

SAMPLE MEAL PLANS: *Limited Cooking Facilities*

First day	Second day	Third day
MORNING		
Citrus fruit juice.[1] Ready-to-eat cereal. Milk. Hot coffee,[2] tea,[2] or cocoa.[2]	Citrus fruit juice.[1] Hot cereal (quick-cooking). Milk. Hot coffee,[2] tea,[2] or cocoa.[2]	Prunes.[1] Ready-to-eat cereal. Milk. Crackers. Cheese. Hot coffee,[2] tea,[2] or cocoa.[2]
NOON		
Vegetable soup.[1] Potato salad.[1] Crackers. Ham spread.[1] Milk. Candy bar.	Beef-and-vegetable stew.[1] Green beans.[1] Crackers. Peanut butter. Milk.	Chile con carne with beans.[1] Tomatoes.[1] Crackers. Hot coffee,[2] tea,[2] or cocoa.[2]
BETWEEN MEALS		
Fruit-flavored drink or fruit drink.	Tomato juice.[1]	Fruit-flavored drink or fruit drink.
NIGHT		
Beef and gravy.[1] Noodles.[1] Peas and carrots.[1] Instant pudding. Hot coffee,[2] tea,[2] or cocoa.[2]	Tuna fish,[1] cream of celery soup,[1] mixed sweet pickles[1]—combined in one dish. Fruit.[1] Cookies. Hot coffee,[2] tea,[2] or cocoa.[2]	Lunch meat.[1] Hominy.[1] Applesauce.[1] Cookies. Peanuts. Hot coffee,[2] tea,[2] or cocoa.[2]

[1] Canned. [2] Instant.

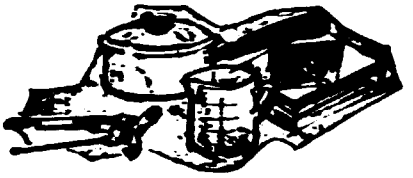
If the seal has broken on jars of baby food, the "safety button" in the center of the lid will be pushed upward instead of drawn downward.

Food from containers showing any signs of food spoilage should be discarded immediately *without tasting.*

Equipment for Cooking and Serving

You need to have ready certain equipment for emergency cooking and serving.

A suggested list includes: a small, compact cooking unit, such as the ones used by campers; one or two cooking pans; disposable knives, forks, and spoons; paper plates, towels, cups, and napkins; can and bottle openers; nursing bottles and nipples if there is a baby in the family; measuring cup; medicine



dropper for measuring water purifier; matches; and a pocket knife.

If you already have plastic dishes, cups, forks, knives, and spoons, you may want to use them instead of disposable tableware. They would probably take less space to store, but water for washing them might not be available after an attack.

If disposable serving dishes and eating utensils are used, each family will need to estimate the number required for a 2 weeks' period.

Store your emergency cooking and serving equipment with your reserve food supply or near it.

WATER

You and your family can get along for quite a while without food, but only for a short time without water. Store a 2 weeks' supply of water for each member of your family NOW.

Allow at least one-half gallon of water per person each day, or 7 gallons for a 2 weeks' period, for drinking purposes in moderate weather. Extra water should be stored where temperatures are above the *comfort zone.*

If a family member needs more than the minimum amount of water specified because of chronic illness or other condition, be sure to consider his needs in planning your supply of water.

Some of the need for liquids can be met by storing large quantities of fruit juice and soft drinks.

If you want to have water available for bathing, brushing teeth, and dishwashing, it should be of the same quality as water stored for drinking, and must be stored in addition to the amount mentioned above. Another 7 gallons of water is recommended for such purposes.

Some of your water requirements could be met by making use of the

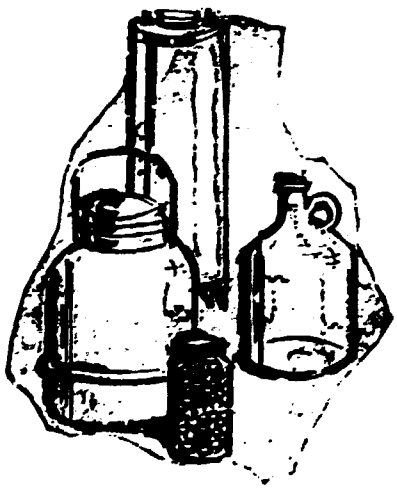
water in home hot-water tanks and toilet tanks.

At the time of attack, water in these tanks would be safe to use. Know the location of your main incoming water valve so you can shut it off if directed by local health authorities, to prevent the entrance of contaminated water. As a safety measure the valve on the gasline to your hot-water heater should be turned off also.

Water from a hot-water tank can be obtained by opening the drain cock at the bottom of the tank. To get a free flow of water with the watere inlet valve turned off, you may need to vent the tank by turning on a faucet somewhere on the waterline. Some hot-water tanks are automatically vented.

Safe Sources of Water for Storage

It is of the utmost importance that water stored for emergency use be clean. Any water that has been tested and approved by health authorities would be safe to store.



If there is any question about the safety or cleanliness of the water you intend to store or if it has not been tested and approved by health authorities, it must be purified before it is stored.

How to Purify Water

Boiling.—The safest method of purifying water is to boil it vigorously for 1 to 3 minutes to destroy bacteria that might be present. Boiling, however, does *not* destroy radioactivity. To improve the taste of the water after it has been boiled, pour the boiled water from one clean container to another several times.

Easy bleach method.—Any household bleach solution that contains hypochlorite, a chlorine compound, as its only active ingredient will purify water easily and inexpensively.

Bleach solutions with 5.25 percent of sodium hypochlorite are most common. They are available in grocery stores. Add the bleach solution to the water in any clean container in which it can be thoroughly mixed by stirring or shaking. The following table shows the proper amount of a 5.25-percent solution to add to water.

Amount of water	Amount of solution to add to—	
	Clear water	Cloudy water
1 quart (¼ gallon)	2 drops	4 drops
1 gallon	8 drops	16 drops
5 gallons	⅔ teaspoon	1 teaspoon

Add the chlorine solution to the water and stir, then let the mixture stand for 30 minutes. After this length of time the water should still have a distinct taste or smell of chlorine. If this taste or smell is not present, add another dose of the solution to the water and let the water stand another 15 minutes. The taste or smell of chlorine in water thus treated is a sign of safety. If you cannot detect chlorine in the water you are trying to purify by this method, do not store it. The chlorine solution may have weakened through age or for some other reason.

Iodine or tablet purification.— If you have ordinary household 2-percent tincture of iodine in your home medicine chest, you can use it to purify small quantities of water. Add 3 drops of tincture of iodine to each quart of clear water, 6 drops to each quart of cloudy water. For a gallon, add 12 drops for clear water, 24 drops for cloudy water. Stir thoroughly.

Water-purification tablets that release chlorine or iodine can be used safely to purify water. They are inexpensive and can be bought at most sporting goods stores and some drugstores.

If you use water-purification tablets, follow the directions on the package. Usually 1 tablet is sufficient for 1 quart of water; double the dosage if the water is cloudy.

Storing Water Reserves

Store your water reserves in thoroughly washed, clean containers, preferably of heavy plastic with tight-fitting caps, or in glass jugs or bottles with screw tops. Metal containers tend to give water an unpleasant taste.

You may want to buy 5-gallon containers of rigid plastic or glass for water storage. The plastic containers have the advantage of being shatterproof and lighter in weight than glass jugs.

Pack glass containers tightly against damage or shock. Put newspapers, excelsior, or other packing material between the containers to keep them from coming in contact with one another.

Clean water stored in this way should remain palatable for an indefinite period. It is advisable to check the containers every few months for leaks. At the same time check the water for cloudiness or other undesirable appearance or undesirable taste. If undesirable appearances or tastes have developed, the water should be changed.

WARNING

Water that has been contaminated by radioactive material should not be used unless no alternate supply is available. The danger from water contaminated in this way is greatest immediately after fallout deposition. Infants and children are more at risk from such water than are adults.

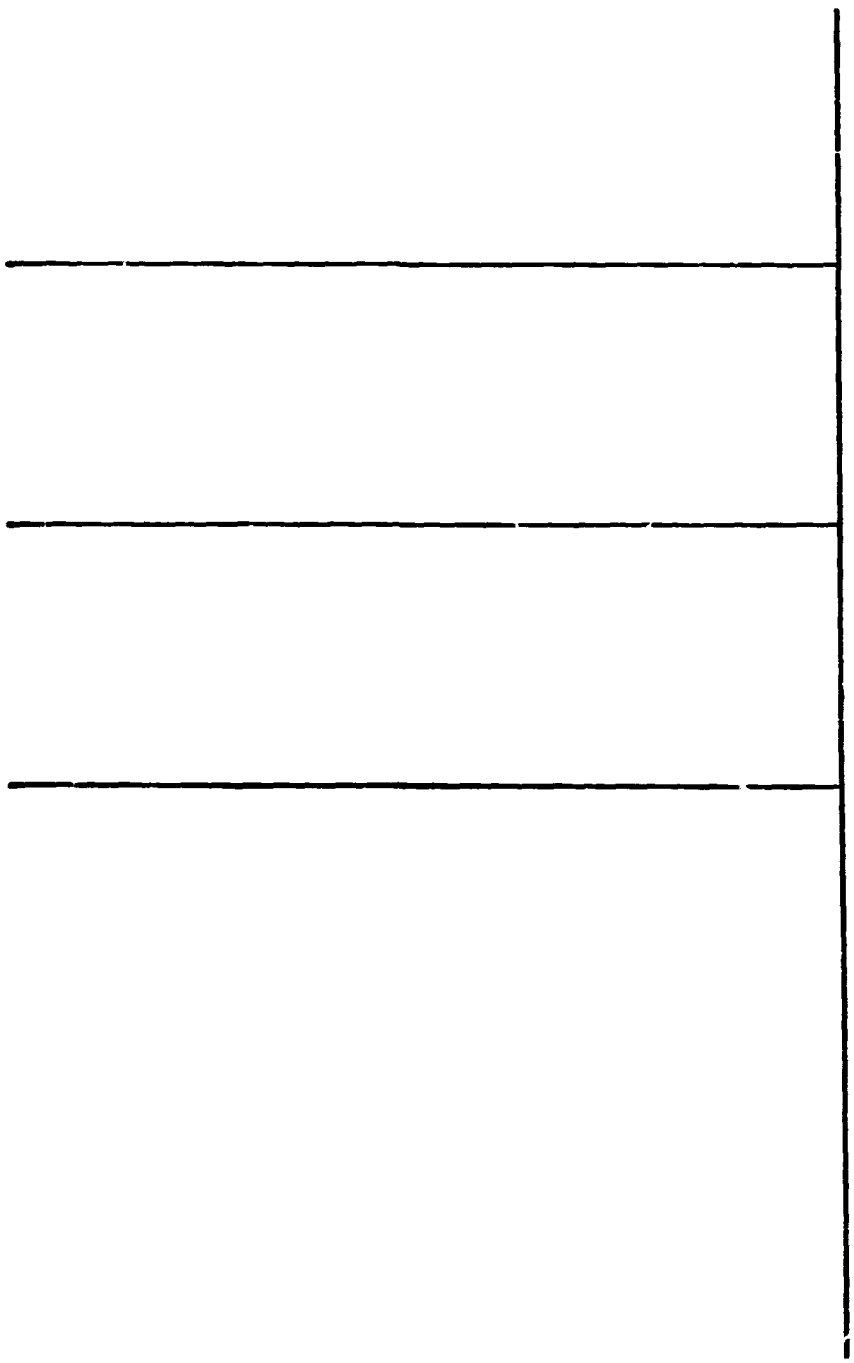
Water from springs and covered wells could be used.

OUR FAMILY FOOD RESERVE

Kind of food	Amount stored	Date purchased	Suggested replacement date

OUR FAMILY FOOD RESERVE

Kind of food	Amount stored	Date purchased	Suggested replacement date



In Time of Emergency: A Citizen's Handbook on . . . Nuclear Attack . . . Natural Disasters." H-14, March 1968. This handbook, prepared by the Office of Civil Defense, U.S. Department of Defense, contains comprehensive information on the effects of nuclear weapons and natural disasters, and how people can protect themselves. Descriptions of home fallout shelters and methods of improvising shelter are included. You can obtain copies from your State or local civil defense office.

Civil Defense. MP-54, May 1970. This publication, prepared by the Office of Civil Defense, U.S. Department of Defense, briefly describes the nationwide civil defense program, and also presents personal-preparedness information. You can obtain copies from your State or local civil defense office.

Defense Against Radioactive Fallout on the Farm. Farmers' Bulletin 2107. Presents easily understood information on the effects of radioactive fallout on the farm. Includes recommendations for the protection of the farm family, for livestock, and for land and crops. Further information on radioactive fallout may be obtained from your county agricultural agent or from U.S. Department of Agriculture, Washington, D.C. 20250).

The following motion pictures on defense and radioactive fallout are available:

Fallout and Agriculture. (USDA, 16 mm., sound, color, 23 minutes.)

The Safest Place. (USDA, 16 mm., sound, color, 13½ minutes.)

These films may be borrowed from the film library of your State land-grant college. For the address of the land-grant college in your State, write to Motion Picture Service, Office of Information, U.S. Department of Agriculture, Washington, D.C. 20250.

About Fallout. (OCD, 16 mm., sound, color, 24 minutes.)

This may be borrowed from your Army Audio-Visual Communication Center (formerly Army Film and Equipment Exchange).

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