SYSTEM PLANNING CORPORATION

CIVIL-DEFENSE NEEDS OF HIGH-RISK AREAS OF THE UNITED STATES

FINAL REPORT

SPC 409

March 1979

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Defense Civil Preparedness Agency
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Contracting Officer's Technical Representative

ABSTRACT

This report documents the results of a study of special civil-defense measures that might be used in areas of the United States that contain significant elements of the U.S. strategic nuclear retaliatory forces or significant defense-related research laboratories or facilities. The study includes (1) an identification of these areas of the U.S., (2) a determination of existing and planned civil defense evacuation and shelter plans and warning systems for these areas, (3) an evaluation of the effectiveness of the existing plans and systems, (4) a determination of the feasibility of establishing more effective evacuation and shelter plans and warning systems for these areas, and of potential costs, (5) an analysis of the effects of a nuclear attack, and (6) a determination of the need for public information, training, and education on CD matters in these areas.

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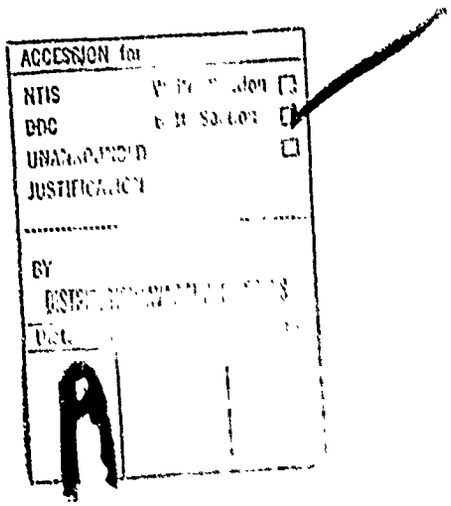


CONTENTS

I. SUMMARY

A. PURPOSE

If a serious international crisis were to lead to a strategic nuclear attack against the United States, such an attack might be initially limited to areas of the U.S. containing strategic nuclear retaliatory forces and to other significant defense-related facilities. Thus, the populations of areas containing such installations may be considered to be at a higher level of risk than the U.S. population as a whole.

With this consideration in mind, the Congress in October 1978 directed the Defense Civil Preparedness Agency (DCPA) to perform a study of the civil defense (CD) needs of such areas. DCPA selected System Planning Corporation (SPC) to provide contractor support for this effort. SPC asked Human Sciences Research, Inc. (HSR) to provide assistance. This is the final report of the study, and documents the contributions of DCPA, SPC, and HSR.

B. SCOPE

The Congress specified that DCPA would conduct:

> A study of the special [civil] defense needs of areas of the United States which contain significant elements of the United States strategic nuclear retaliatory forces or significant defense-related research laboratories or facilities.
>
> The study ... shall include the following:
>
> (1) An identification of areas of the United States which, because they contain significant elements of the United States strategic nuclear retaliatory forces or significant defense-related research laboratories or facilities, are prime targets in case of a nuclear attack.

(2) A determination of what civil defense evacuation and shelter plans and warning systems are now available or are proposed to be made available to such areas.

(3) An evaluation of the effectiveness of such existing evacuation and shelter plans and warning systems.

(4) A determination of the feasibility of establishing more effective evacuation and shelter plans and warning systems for such areas and a determination of the potential costs and methods of financing such plans and systems.

(5) A detailed analysis of the specific effects of a nuclear attack on each such area.

(6) A determination of the need for educating, and the most effective methods of educating, the public in such areas on civil defense matters.

For the purposes of this study, DCPA made the following decisions. The strategic military (counterforce) targets in the Continental U.S. (CONUS) were identified as the six MINUTEMAN missile fields, the three TITAN missile fields, the 36 Strategic Air Command bases, and the two strategic submarine bases. A specific set of significant defense-related research laboratories and other research facilities within CONUS was also identified. Two potential limited nuclear attacks were chosen for analysis: one versus the counterforce targets only, and one versus the counterforce targets plus the research facilities. (Although the latter type of attack per se is deemed relatively unlikely, it appears to be representative of an intermediate-level attack, somewhat greater than a purely counterforce attack but considerably less than a "large-scale" attack.)

C. BACKGROUND

1. Nuclear Weapons Effects

The effects of nuclear weapons include direct effects (blast and heat), which would be experienced out to a distance of about 7 miles from a 1-megaton (equivalent to 1 million tons of TNT) surface burst, and fallout radiation. Figure 1 shows the direct effects of a 1-megaton detonation.

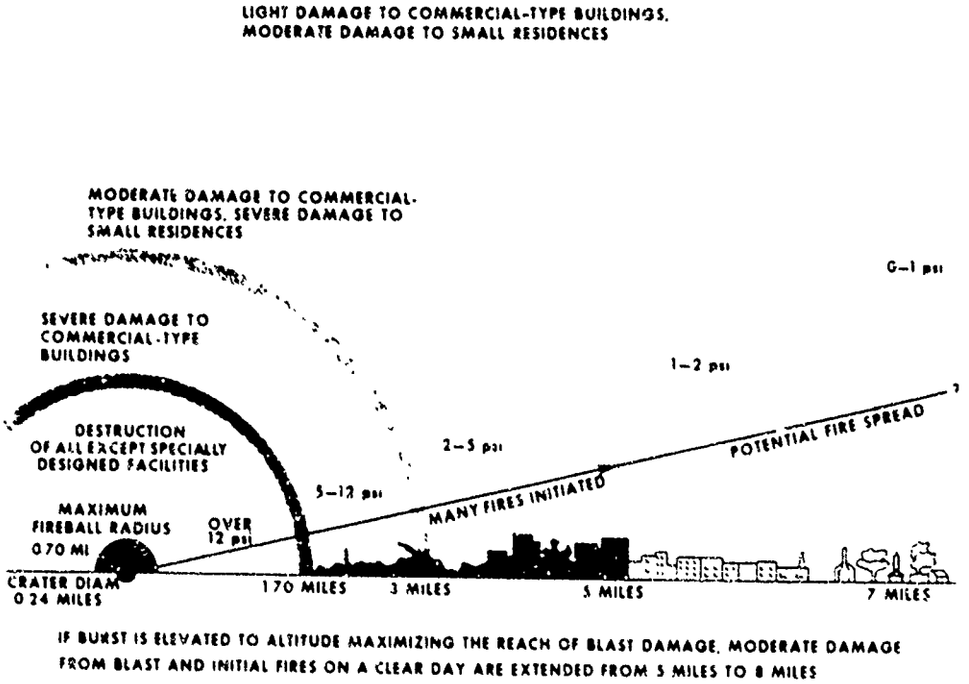


FIGURE 1. DIRECT EFFECTS OF 1 MT BLAST (Surface Burst)

Fallout is produced when a nuclear weapon explodes near the ground, sucking up great quantities of pulverized earth and other debris into the nuclear cloud. There the radioactive gases produced by the explosion condense on and into this debris, producing radioactive fallout particles. Within a short time these particles fall back to earth--the larger ones first, the smaller ones later. On the way down, and after they reach the ground, the radioactive particles give off invisible gamma rays, too much of which can kill or injure people. These particles give off most of their radiation quickly; therefore, the first few hours or days after an attack would be the most dangerous period.

In dangerously affected areas the particles themselves would look like grains of salt or sand; but the rays they would give off could not be seen, tasted, smelled, or felt. Special instruments would be required to detect the rays and measure their intensity.

The distribution of fallout particles after a nuclear attack would depend on wind currents, weather conditions, and other factors. There is no way of predicting definitely in advance what areas of the country would be affected by fallout, or how soon the particles would fall back to earth at a particular location.

Some communities might get a heavy accumulation of fallout, while others--even in the same general area--might get little or none. No area in the U.S. could be sure of not getting fallout, and it is probable that some fallout particles would be deposited on most of the country.

Areas close to a nuclear explosion might receive fallout within 15 to 30 minutes. It might take 5 to 10 hours or more for the particles to drift down on a community 100 or 200 miles away.

Generally, the first 24 hours after fallout began to settle would be the most dangerous period to a community's residents. The heavier particles falling during that time would still be highly radioactive and give off strong radiation. The lighter particles falling later would have lost much of their radiation high in the atmosphere.

2. Protection from Nuclear Attack Effects

There are two basic methods for protecting people from the direct (blast and heat) effects of nuclear weapons. One is to relocate (evacuate) people from likely target or high-risk areas before any weapons explode, and this could be done if a period of intense crisis should precede a nuclear attack. The other method is to shelter the people in-place, at or near their homes, schools, or places of work. (Since fallout could be deposited anywhere, people evacuated from risk areas, to avoid blast and heat, would, of course, need fallout protection in the "host" areas.)

The quality of shelter against attack effects can cover a broad range. Existing buildings provide varying degrees of fallout protection, from fair to fairly good in homes with basements, up to very good in the basements of larger buildings. Basements of homes and many larger buildings also provide a modest degree of blast protection; people would obviously be much less vulnerable in basements than in upstairs areas, where they would be more endangered by flying glass and debris.

Better protection than that in existing structures could be developed during a crisis, as by people constructing "expedient shelters." There are many types of expedient shelter, many of which provide significant blast as well as fallout protection. One type, a shored-trench shelter, is shown in Figure 2. DCPA field tests involving four dozen American families have shown conclusively that any family can construct an expedient shelter during one or two days.

Fallout protection could also be developed during a crisis, and, as noted above, everyone would need such shelter, as harmful or lethal levels of fallout could be deposited anywhere in the U.S. Where people did not have adequate protection available in the home or a larger building, it would be essential to improve fallout protection during the crisis, and this would apply particularly to evacuees.

One approach is to develop fallout protection for groups of people (for example, evacuees), by adding earth beside and on top of existing structures. The earth provides added shielding against the gamma

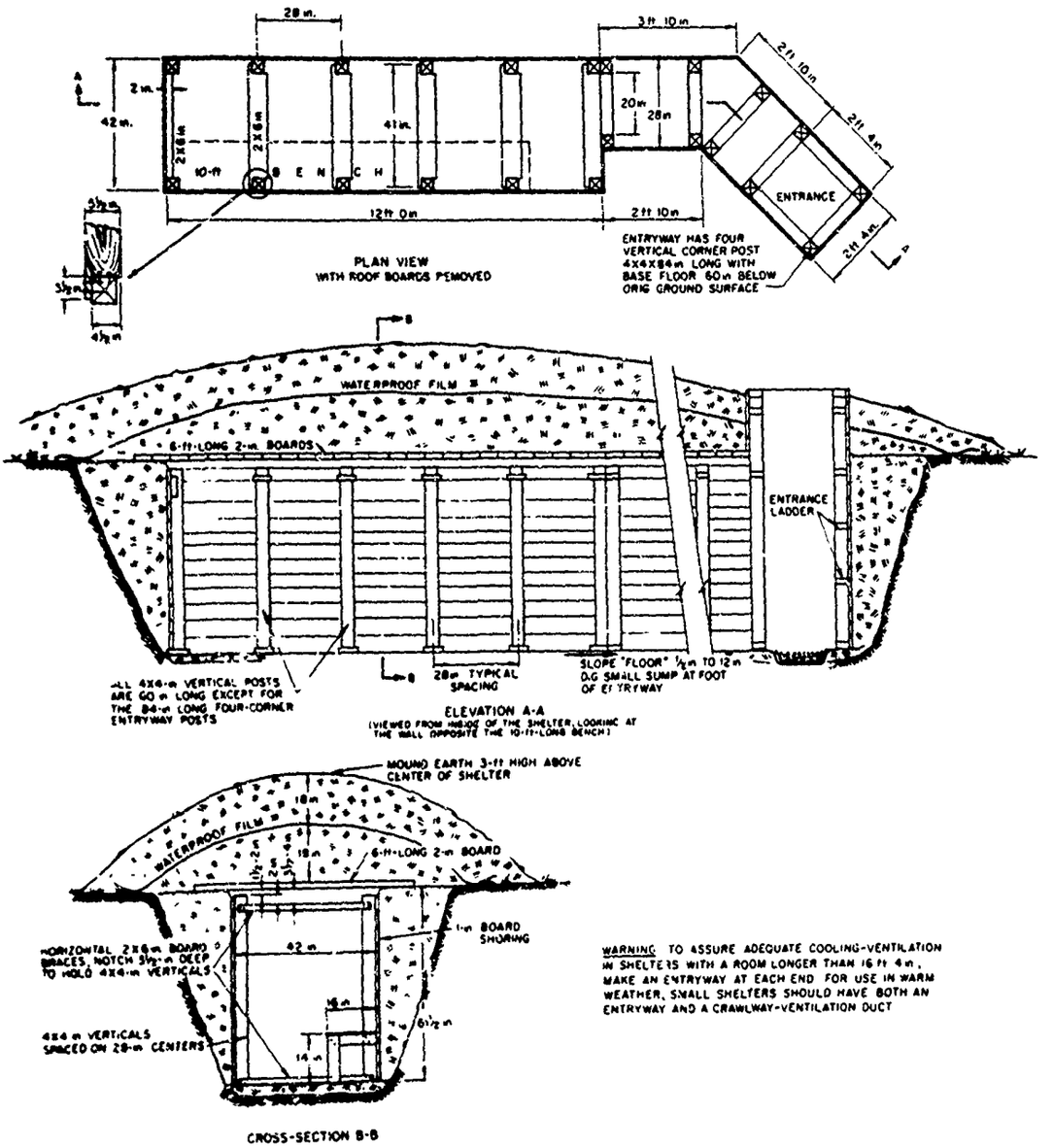


FIGURE 2. EXPEDIENT SHELTER

rays given off by fallout particles, and providing good fallout protection would involve moving about a cubic yard or earth for each person to be sheltered--which amounts to something like 70 to 100 buckets of earth. Additional fallout protection can also be improvised by families in the home, for example, by piling boxes of earth around and on top of a work bench in a basement corner.

The basic problem or uncertainty connected with constructing or improving shelter during a crisis is time. Would people have the day or two needed to develop added protection? (Also, they would have to know what to do.) If they did have time, would those in risk areas be more apt to leave the area than to construct an expedient shelter? (Upon arrival in a lower risk area, of course, they would need to cooperate in developing fallout protection there.) Frozen ground would be a problem during several months of the year, at least in the northern part of the country, and improving the fallout protection of larger buildings would require mobilizing earth-moving equipment, and in the case of expedient shelters, procuring lumber, basically to hold up the protective layer of earth.

One way to provide higher confidence that enough expedient shelters could in fact be constructed during a crisis would be for the government to provide the materials in peacetime, so that expedient shelters could be constructed without delay. Such an option is analyzed in this report.

The highest-confidence approach to providing shelter is to construct it in peacetime, as is done in Finland, Sweden, Switzerland, and elsewhere, but this is also the most expensive. To provide blast shelters for people in risk areas would cost on the order of $300 for each person sheltered.

The advantage of providing shelters in peacetime is, of course, that they are accessible in a matter of minutes. Little time is needed to protect the people, as contrasted with the several days to a week needed to evacuate people from risk areas and develop fallout protection elsewhere.

In principle, then, protection can be provided by moving people away from risk areas and protecting them elsewhere, if time permits during a crisis, or by protecting them in-place. The approaches adopted depend largely upon funding made available. The confidence one may have in performance depends upon the funding level, and one's estimate as to the time that may be available. Crisis relocation (or evacuation) can be very effective--but only if the several days to a week needed for evacuation are available, and if one is confident that the plans would be executed quite effectively, though not necessarily perfectly. Shelters constructed in peacetime, by contrast, provide very high confidence of high effectiveness--but at high cost.

3. Civil Defense Systems

While protecting people is simple in principle, there are more requirements for protection than merely providing for sheltering people in-place or evacuating them from risk areas during a crisis. DCPA analyses suggest, for example, that "paper plans" only for relocation procedures would result in only about half the lifesaving that would result from the balanced civil defense system needed to realize the full lifesaving potential of crisis relocation.

Some of the more important systems needed for a balanced CD system include:

- Direction and Control--Protected facilities, with necessary communications, from which key local and state officials could direct coordinated operations during an emergency (both a crisis and through the in-shelter period, if an attack occurred). Direction and Control facilities and, most of all, exercises for the key officials, are needed to familiarize the officials with their duties in crisis relocation and during any attack period.
- Warning--Systems, procedures, and hardware, to inform the people that an attack has been launched and that they must take protective actions immediately.
- Radiological Defense (RADEF)--Instruments, plans, and trained personnel to detect the degree of fallout radiation hazard, analyze the results, and advise emergency forces and the public on what to do. (For example, to advise

people in the southern part of X county that they must remain in sheltered areas for three more days, after which they should move to Y county to the north--or to advise people in Z county that they may leave shelters tomorrow after which they may remain in the county, taking certain countermeasures for protection against the remaining low levels of radiation.)

- Emergency Public Information (EPI)--Plans, equipment, and trained personnel to provide prompt, authoritative advice and instructions to the population on what to do to maximize their chances of survival. An EPI capability would make use of all news media during a crisis, but during the in-shelter period would rely primarily on radio broadcast stations to get information to the sheltered population. This in turn requires that radio stations be provided emergency power, fallout protection, and other capabilities to assure their being able to remain on the air during an emergency.

There are other elements needed for even an austere civil defense system, such as programs to educate the public on attack hazards and means of protection. CD programs must also provide for research, and for support of competent civil defense staffs at local, state, and federal levels.

The current U.S. civil defense program is extremely austere and would not be able to function well under crisis or attack conditions, due to inadequacies in Direction and Control, Radiological Defense, and other systems. However, it does provide some basis for protecting people in-place, and a modest start has been made on planning to add an option for crisis relocation.

The program recommended by the Secretary of Defense for fiscal years 1980-1984 would stress crisis relocation, while maintaining a hedge for in-place protection, in case time or circumstances did not permit crisis relocation. It would provide for development or rebuilding of all of the supporting systems required to realize the full lifesaving potential of crisis relocation, some 80 percent survival under a heavy, mid-1980s attack.

A recent Presidential Decision (PD-41) supported the Secretary's program recommendation. The FY 1980 budget request now being considered by the Congress represents an initial step towards implementing the President's policy and the Secretary's program decisions. The funding

requested (6 percent real growth over FY 1979) would lay the foundation for developing crisis relocation capabilities at an accelerated pace in FY 1981 and future years, but the actual pace at which the program was implemented would depend, of course, upon future budget decisions.

The program recommended by the Secretary of Defense can be characterized as austere but serious. Thus, it would provide for substantially improving Direction and Control, Radiological Defense, and other systems, but there would still be substantial reliance upon crisis actions to train additional personnel and bring systems to full effectiveness. All means for population protection would be based on use of existing resources plus crisis actions. Thus, basic reliance for lifesaving is placed on crisis relocation plus development of fallout protection in host areas by adding earth to existing structures, both of which would require time for implementation. (Figure 3, showing how the fallout protection at a school building could be improved by crisis actions, is illustrative of the approach to developing protection contemplated in this CD program--which includes funds for detailed planning for crisis development of shelters in host areas.) If time and circumstances did not permit crisis relocation, in-place protection would be employed, making use of best-available protection in existing structures (which can provide significant fallout protection but only modest blast protection for people in risk areas). The recommended program would not provide for any shelter construction in peacetime, or for procuring any material for crisis construction of expedient shelters.

D. FINDINGS

1. High-Risk Areas

The number of people "at risk" from direct effects (blast and heat) in the postulated counterforce attack was found to be about 7 million. The attack versus the counterforce targets plus research facilities would put at risk about 75 million people, since many of the research facilities are in large metropolitan areas.

An existing school building can serve as a congregate care facility for risk area evacuees. The best fallout protection can be found in interior corridors and rooms on the lowest floor, especially if the school has two or more stories and the exterior walls are of concrete or masonry construction. Fallout protection can be improved by first expediently constructing a wood support wall at the mid-span point and then providing additional vertical and horizontal barriers of earth as shown in sketches. Windows in exterior walls that are to be covered with earth should be protected with lumber or plywood sheets so that they will not break under the earth fill.

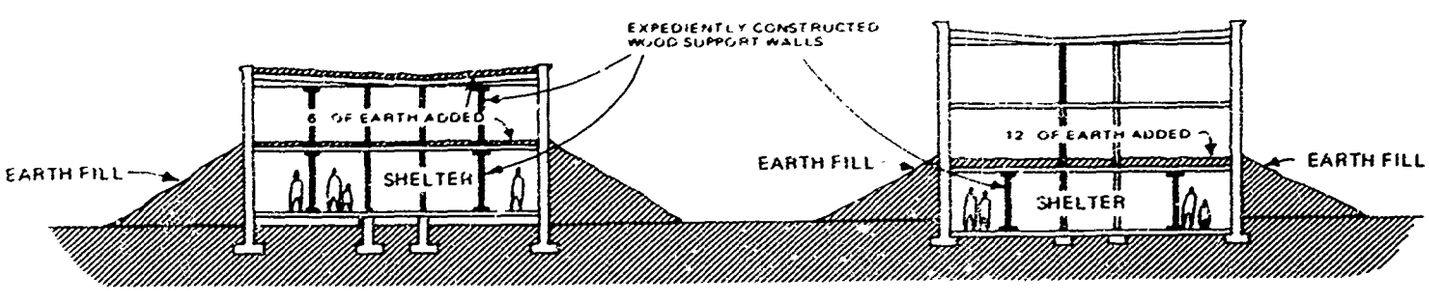


FIGURE 3. FALLOUT PROTECTION IN SCHOOL BUILDINGS

For the analyses made in this study, any political subdivision containing territory receiving significant blast was identified as a "high-risk area." Fallout was not considered as a criterion in defining "high risk" areas, since it is not possible to predict with certainty the direction in which the fallout would be blown by the winds prevailing at the time of attack.

2. Existing Civil Defense Plans and Warning Systems; Estimated Effectiveness

DCPA-funded planners have been working since 1966 with states and local communities to develop Community Shelter Plans (CSPs) for each area in the U.S. These plans result in emergency information materials (to be disseminated during a crisis) advising the people on "where to go and what to do" to seek nearby in-place protection in case attack warning is received.

DCPA has also made a start on developing Crisis Relocation Plans (CRPs) for areas designated as "risk areas" and for their corresponding host areas. To date, about 10 percent of the U.S. population is covered by initial CRPs. In a given area, the CSP is updated as the CRP is prepared. Priority for crisis relocation planning is being given to areas containing counterforce targets. The CRP for one of the nine areas in CONUS containing missile complexes (Tucson, Arizona) is complete; CRPs for another three are about 50 percent complete; CRPs for the other five have just begun. CRPs for most large cities have not yet commenced, although a few cities have essentially complete relocation plans (e.g., San Antonio, Fort Worth, and Oklahoma City). With the present limited funding, CRPs for all CONUS risk areas are not expected to be complete until the early 1990s.

Warning would currently be transmitted over the National Warning System to over 1,200 U.S. warning points staffed around the clock, and to communications networks of other government agencies and of the press. Warning to the people would be by means of sirens, which are marginally effective by day and almost completely ineffective during sleeping hours.

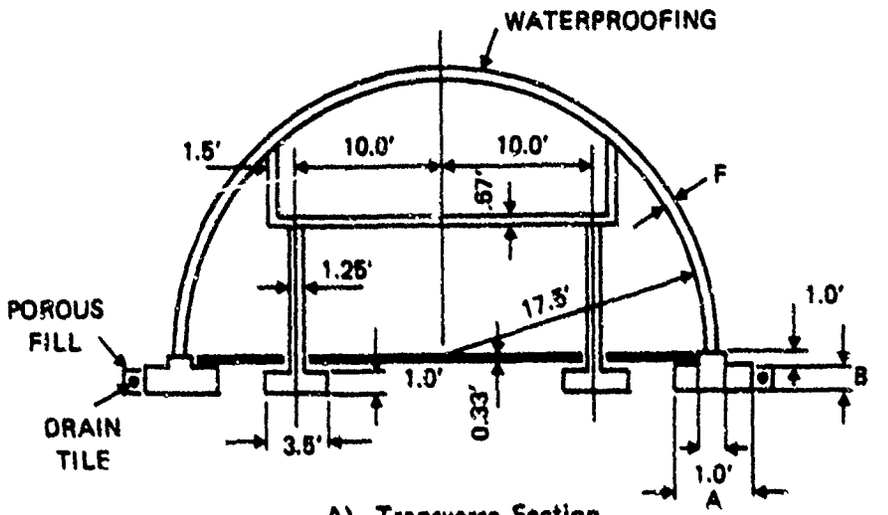
Supporting systems provided under the current program are inadequate, as noted previously. Due to lack of exercising for key local and state officials, and to deficiencies in Direction and Control, Emergency Public Information, and other systems, crisis relocation plans--even if completed under the current program--would not be highly effective. Total survival would, under any type of attack, be much less than that which could result from a full relocation program such as the one recommended by the Secretary of Defense, given time for reasonably effective crisis relocation and related actions.

3. Feasibility of More Effective Civil Defense

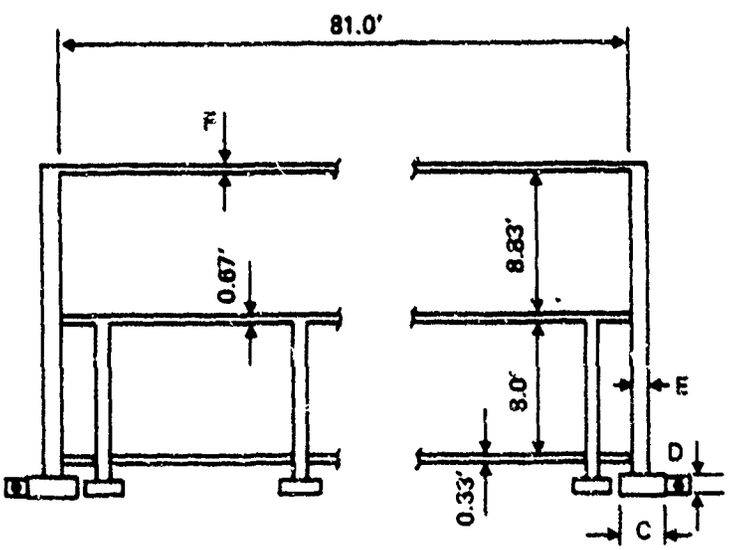
Given increased funding, it would be possible to establish much better plans, preparations, and systems (materials, organizations, and facilities), including warning systems, which would save many more lives if an attack occurred, assuming that the public cooperated.

Four CD programs were analyzed for this study.

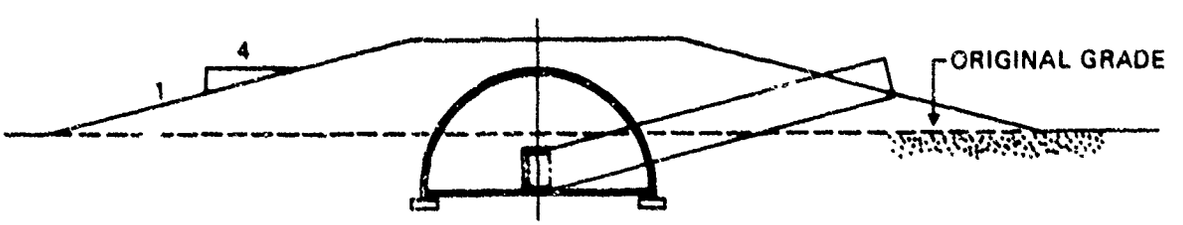
- Current Civil Defense
- Crisis Relocation: This program, recommended by the Secretary of Defense, includes development of crisis relocation plans by the mid-1980s, as well as essential supporting systems and capabilities. (About 10 percent of total funding would be devoted to planning per se, and the remaining 90 percent to development of Direction and Control, Radiological Defense, Communications Systems, Training, and other supporting systems.) Expedient fallout protection would be necessary in host areas (see Figure 3).
- Expedient Shelters (see Figure 2): The word "expedient" indicates that the shelters would be built by the public during a crisis. The shelters would be family-sized, and would provide modest protection against blast and very good protection against fallout. Construction "kits," containing all necessary materials, would be stockpiled by the government in high-risk areas during peacetime.
- Dedicated Blast Shelters (see Figure 4): The word "dedicated" indicates that the shelters would be built by professional construction personnel during peacetime. The shelters would be built in high-risk areas, and would provide excellent protection against both blast and fallout.



A) Transverse Section



B) Longitudinal Section



C) Completed Shelter in Place

FIGURE 4. DEDICATED BLAST SHELTER

In the latter two cases, the shelters would be constructed far enough away from any counterforce target to withstand the effects of a nuclear weapon exploding at the target. In the latter three cases, warning systems would be significantly improved.

Clearly, other improved CD programs could be considered, based on a mix of these features, and tailoring specific approaches to the various local areas.

Three "warning" times were considered: a 1- to 2-week crisis buildup period, a 24-hour crisis buildup period, and 15 to 30 minutes of warning prior to attack. For the first two of these, it was assumed that the government orders execution of the CD preparations once the crisis buildup has clearly begun.

4. Estimated Effectiveness and Costs of Potential Improved Civil Defense Programs

DCPA made analytical estimates of fatalities under the two attack scenarios previously discussed. Improved CD in counterforce areas only was evaluated relative to the counterforce (CF) attack. Improved CD in counterforce areas plus areas containing defense-related research facilities was evaluated relative to the counterforce-plus-research-facilities (CF-plus) attack. Fatalities were estimated for each of the two assumed attacks, for the present CD program and the three improved programs, and for the three assumed "crisis-buildup" times. Estimates were also made of annual program costs, over the five-year period required to establish the program (maintenance costs thereafter would, in 1979 dollars, generally be somewhat lower). For example, whereas the U.S. currently spends about $0.45 per person per year on civil defense, improved CD in counterforce areas would require an annual expenditure of about $0.65 to $2.70 per U.S. citizen. A summary of the estimated effectiveness and costs is given in Figures 5 and 6.

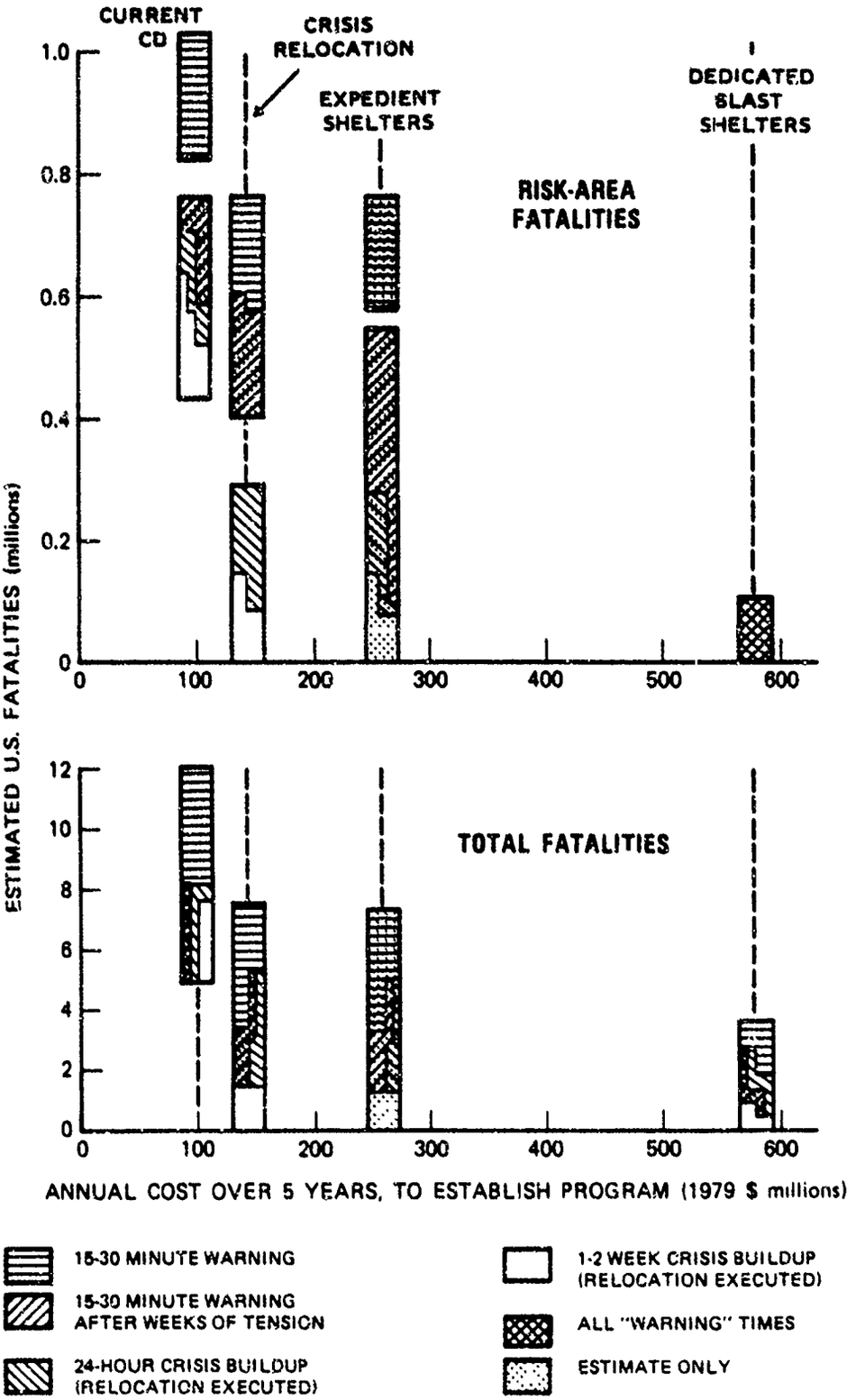


FIGURE 5. ESTIMATED EFFECTIVENESS AND COSTS OF CD PROGRAMS: PROGRAM ESTABLISHED FOR COUNTERFORCE AREAS (WITH 7 MILLION PEOPLE), AND EVALUATED FOR COUNTERFORCE ATTACK

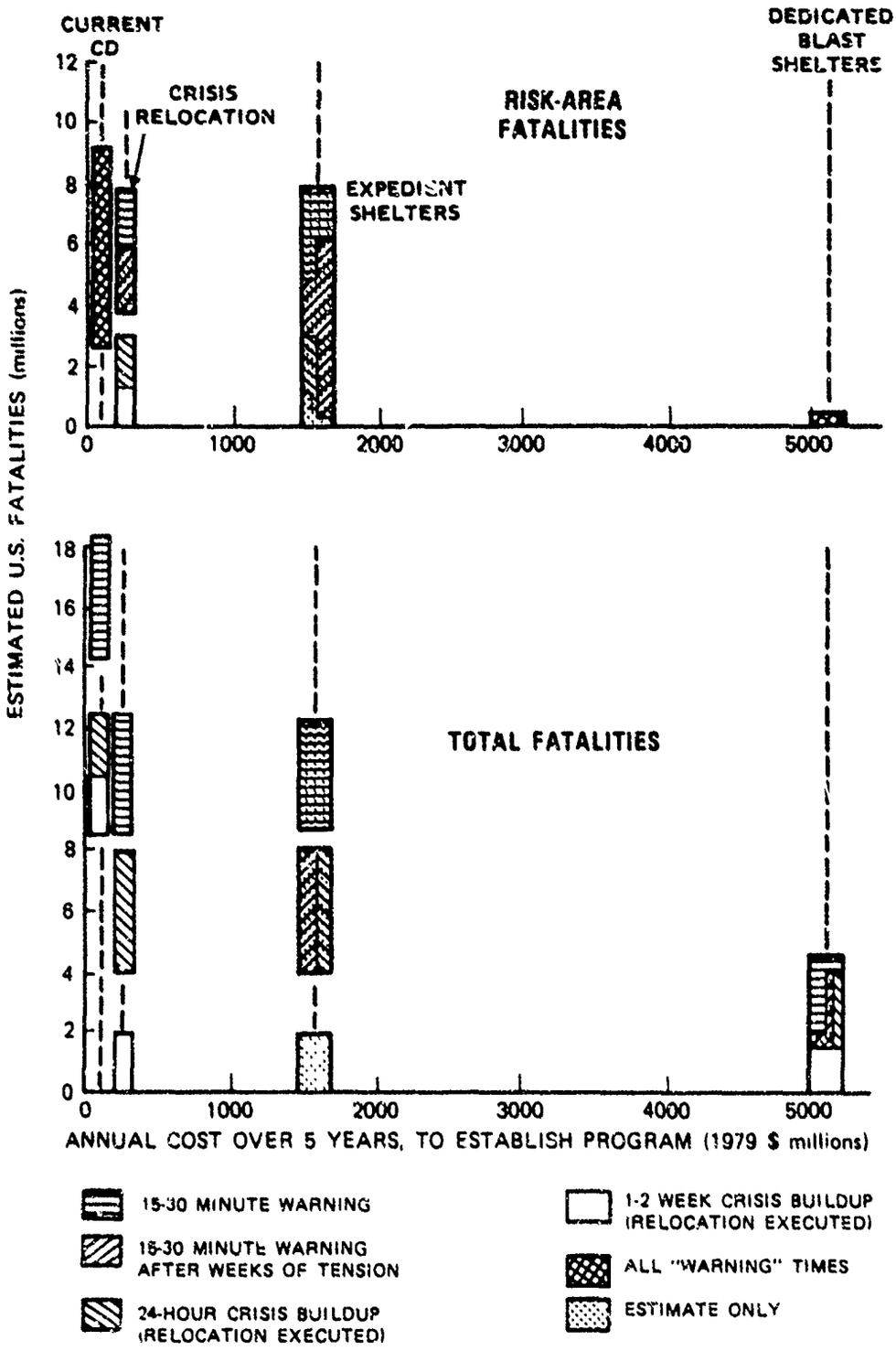


FIGURE 6. ESTIMATED EFFECTIVENESS AND COSTS OF CD PROGRAMS: PROGRAM ESTABLISHED FOR AREAS WITH 75 MILLION PEOPLE, EVALUATED FOR ATTACK VS COUNTERFORCE TARGETS PLUS RESEARCH FACILITIES

a. Risk-Area Fatalities (Both "CF" and "CF-Plus" Attacks)

For a 15- to 30-minute warning time, only Dedicated Blast Shelters would be effective in reducing fatalities. For a 1- to 2-week crisis buildup, assuming that the relocation order is given, Crisis Relocation would be essentially as effective as any program. Expedient Shelters could be effective under a scenario characterized by several weeks of severe tension, perhaps involving some spontaneous evacuation and then return, during which the government directs people to build Expedient Shelters--followed by a sudden attack. (This scenario is not dissimilar to the events in London during 1939-1940.) Current CD would be relatively ineffective under any assumed warning scenario.

b. Total Fatalities

Under the improved CD programs, the public across the nation would be generally more aware of proper actions to take in the event of an attack (including construction of expedient fallout protection) than they would under the other programs. Especially under the Dedicated Blast Shelter Program (highest public information budget, highest public awareness), fallout fatalities nationwide were estimated to be considerably less than under the other programs, even given only a 15- to 30-minute warning (it would still take many hours for fallout to blow several hundred miles).

For a 15- to 30-minute warning time, compared with the relatively ineffective Current CD, total fatalities (mostly from fallout) were estimated to be greatly reduced for the Dedicated Blast Shelter Program, and considerably reduced for the Crisis Relocation and Expedient Shelter Programs. For a 1- to 2-week crisis buildup, crisis relocation would be virtually as effective as the in-place shelter programs. Under the Expedient Shelter Program analyzed and costed, which is essentially the Crisis Relocation Program plus the stockpiled shelter-construction "kits" in risk areas, total fatalities would be only slightly less (in percent) than total fatalities under the Crisis Relocation Program, for each assumed "warning" time, because most fatalities occur in non-risk areas, from fallout.

c. A Value-Judgment

Prior to establishing any improved U.S. CD program for protecting against a counterforce attack, officials must make the following value-judgment: Given a limited budget, should one prepare for minimizing fatalities in the high-risk areas, or minimizing fatalities nationwide?

Minimizing fatalities in the designated high-risk areas, given only short warning, would call for quite expensive blast shelters for the people in these areas. Minimizing fatalities nationwide, for a short-warning scenario, could call for developing fallout protection in peacetime, throughout most of the U.S. (a program not analyzed in this study).

It is possible that the issue would be seen as one of weighing the merits of providing expensive, high-quality protection for the people in the counterforce areas, versus providing a somewhat improved level of protection for the entire population. This would assume that providing good protection for counterforce areas would imply doing nothing substantial to improve in-place protection for the rest of the country. An alternative formulation would see the improved protection in counterforce areas as being an initial step, which might well be followed by improving in-place protection elsewhere--though not necessarily involving peacetime construction of blast shelters in all U.S. cities. In either case, a basic rationale would be that people in counterforce areas were considered to be at substantially higher risk of short-warning attack than the rest of the people, by virtue of their proximity to missile complexes and other strategic nuclear offensive forces.

5. Public Response and Civil Defense Effectiveness: The Criticality of Training, Education, and Public Information

Different CD approaches to sheltering or evacuation demonstrate varying estimates of lives saved, but public behavior just before an attack would determine how closely those estimated survival rates were approached following an actual attack. For example, a CD program can construct numerous, well-positioned blast or fallout shelters, but the public's

actual use of those shelters would depend on such factors as a timely warning message, knowledge of how to respond, and an orderly movement of people which distributed the population among those shelters by the time of attack.

The factors which would influence an appropriate public response include:

- The nature, complexity, and difficulty of the required public action. Thus, use of blast shelters, constructed near homes and places of work, requires relatively little public knowledge or skill, and a simple and straightforward "take shelter" message. For the public to construct expedient blast shelters requires greater skill, time, and effort, and the capability to perform this action is differentially distributed through various population groups. Crisis relocation requires the most complex public action, access to private transportation or knowledge of alternative (public) sources, and time to execute the move.
- The need for planning and staffing a CD management effort to implement the program. The extent of management activity required to implement a program must be assessed against the needs for CD to augment its management capability from the modest pre-crisis level to the (potentially) much larger organization needed to implement a program just before an attack. These personnel must come from other organizations or citizen volunteers, and must be trained in the diverse skills required to implement--for example--an elaborate crisis relocation operation.
- The amount of public knowledge required to take appropriate, orderly action. The blast shelter program requires relatively little public knowledge and allows a simple warning message, whereas the expedient shelter and relocation programs require extensive knowledge and more elaborate instructions.

Public awareness of the programs, willingness to receive instructions, and willingness to participate in CD management at the grass-roots level (for example, a Shelter Manager position) will also vary during a crisis-expectancy period--a time of heightened international tension likely to precede any ultimate crisis and attack. CD approaches requiring extensive population management and complex public activity must be geared to using such a period both to increase public knowledge and recruit personnel who would carry out CD operations.

Existing public attitudes exhibit strong approval of CD efforts but little understanding or knowledge of what would be required to implement them. A crisis-expectancy period would see a dramatic increase in public concern and a heavy demand for information about what to do. Information and training efforts would have to be geared to taking advantage of that public interest in order to achieve maximum public responsiveness to any program--and particularly, to the programs requiring greater public knowledge and more complex activity.

CD training, education, and public information programs would seek to prepare the public for a government message to take action. These CD elements would respond to gradually increasing--then dramatically increasing--public concern, by phasing communications to the public. As would be expected, these elements increase in cost and complexity as CD programs require public activities which are more elaborate, complex, and dependent on an emerging CD population-management capability.

A high level of public response--hence, a high level of CD effectiveness--would revolve around the following general factors:

	Current Program	Crisis Relocation	Expedient Shelters	Dedicated Blast Shelters
Difficulty/ complexity of public action	complex	complex	intermediate	simple
Reliance on CD operational management	probably unwork-able	highest	intermediate	lowest
Probable extent of appropriate public response	least	intermediate	intermediate	greatest

E. CONCLUSIONS

Existing Civil Defense in the Designated High-Risk Areas. Crisis Relocation Plans are being established for the U.S., beginning with counties in missile-complex areas. So far, relocation planning for roughly one-fourth of these counties has been completed. Relocation plans should be complete for essentially the entire U.S. by the early 1990s. However, necessary supporting systems are inadequate, and no definite decision has been made to improve them.

Feasibility of More Effective Civil Defense. Given increased funding, it would be possible to establish much better civil defense systems in the designated high-risk areas, which could save many lives if an attack occurred. In particular, at least three types of improved civil defense are possible, based on the concepts of crisis relocation, expedient shelters (the government would stockpile materials), and dedicated blast shelters.

Effects of a Nuclear Attack:

- Current Civil Defense would be relatively ineffective under any type of nuclear attack, and for any amount of warning, from 15 to 30 minutes of warning up to a 1- to 2-week crisis.
- Crisis Relocation preparations (such as the program recommended by the Secretary of Defense) would be highly effective for the designated high-risk areas and corresponding host areas, but only if several days of crisis-buildup time were available and if the government ordered relocation early enough during this period, prior to an attack, so that risk-area populations could in fact be moved to host areas and fallout protection developed there.
- Expedient Shelters, with modest blast resistance, would be very effective for the designated high-risk areas, but only if the public constructed these shelters during an extended period of tension prior to an attack.
- Dedicated Blast Shelters would be the most expensive means of protection, but would also be highly effective for the designated high-risk areas under almost any foreseeable warning time. Under a limited attack, high effectiveness nationwide would require that fallout protection be established throughout most of the U.S., either in peacetime or during a crisis.

Public Response; Training, Education, and Public Information. Existing public attitudes exhibit strong approval of civil defense efforts, but little understanding of what would be required to implement them. A crisis period would cause a dramatic increase in public concern. Training, education, and public information are essential for effective civil defense, and should be geared to take advantage of increasing public interest during a crisis.

II. IDENTIFICATION OF AREAS STUDIED

DCPA, after consulting with personnel in the Office of the Joint Chiefs of Staff, generated a set of strategic military installations within the contiguous 48 states (CONUS, consisting of the nine strategic missile fields, the 36 Strategic Air Command bases, and the two strategic submarine bases) and a set of about 80 significant defense-related research facilities. Two attacks were postulated: a counterforce attack (against the first set) and a counterforce-plus-research-facilities attack (against the first and second sets). The counterforce attack consisted of the same attack against U.S. land-based strategic missiles, strategic submarine bases, and bomber bases as that used for SPC Report 342, Candidate U.S. Civil Defense Programs [Ref. 1]. All of these weapons were surface burst. Furthermore, for each additional defense-related research facility, a 1-megaton air burst was assumed, with a height-of-burst optimized for coverage of 10 pounds per square inch (psi) peak overpressure, as per Reference 2. Neither of these attacks is as extensive as the large-scale attack used by DCPA as its planning base, usually called the "TR-82 attack" [Ref. 3].

Demographic data bases for CONUS, used for this study, were originally obtained from the Bureau of the Census, U.S. Department of Commerce, and included data based on:

- Minor Civil Divisions (MCDs). An MCD is a fraction of a county. Typically a county consists of about 2 to 20 MCDs.
- "Places." A "place" is a significant-sized city or town.
- Urbanized Areas (UAs). These correspond to the major metropolitan areas of CONUS.

A set of areas was generated within CONUS, in which people would be considered to be at risk from each of the two attacks. The algorithm for specifying these risk areas was the following. For each location receiving

more than 2-psi overpressure from this attack, the entire MCD and (where applicable) the entire "place" or UA that included the location was considered to be at risk. The reasons for this were (1) it was considered unreasonable to try to evacuate part of a "place" or UA without evacuating it in its entirety, and (2) no one knows how an attack would really be configured, and if weapons were considered relatively likely to land in one part of a "place" or UA, they might well land in other parts as well, possibly unintentionally.

Figures 7 and 8 show maps of the risk areas which were specified for CONUS for the two attacks. Because of the method used, the boundaries of the risk areas correspond to boundaries of political subdivisions such as MCDs. The fallout patterns are also shown, assuming representative March winds. (The fallout is the same for the two attacks, because the 1-megaton air bursts produce negligible fallout.) The number of people at risk were 7 million and 75 million, respectively, the latter figure occurring because several of the research facilities are in large cities.

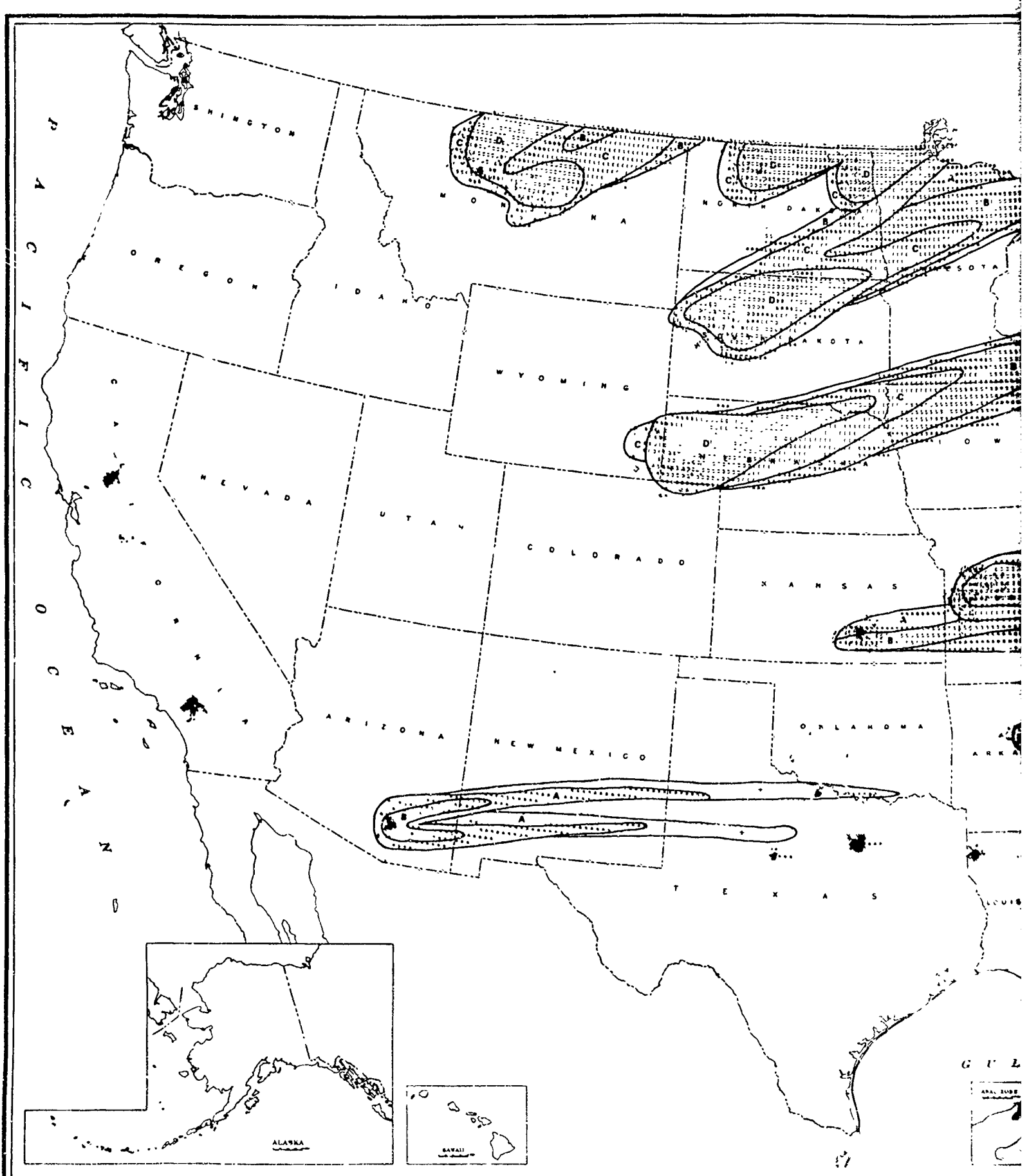
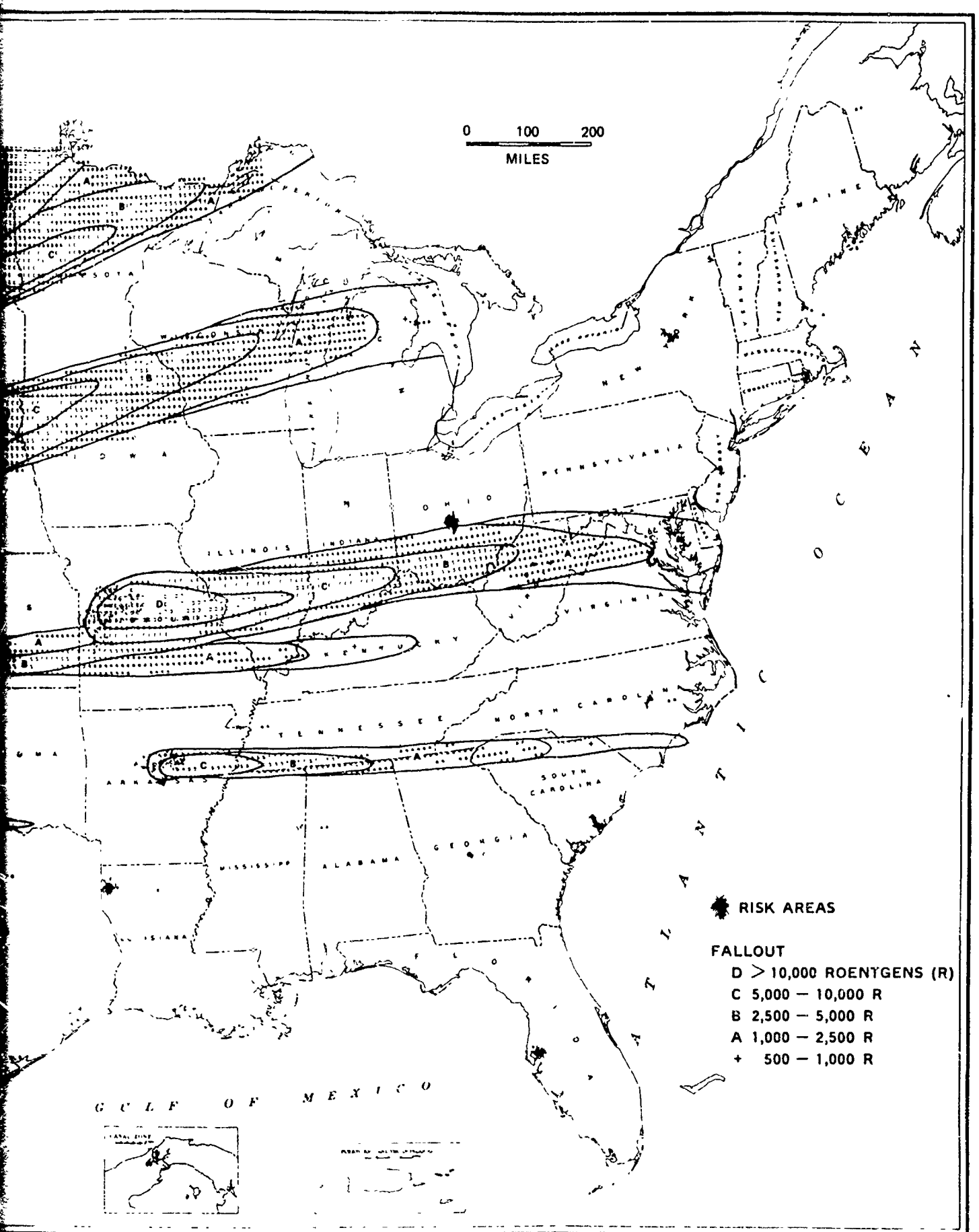


FIGURE 7. RISK AREAS AND FALLOUT PATTERNS FOR ATTACI
(Representative March Winds)



NS FOR ATTACK VS COUNTERFORCE TARGETS

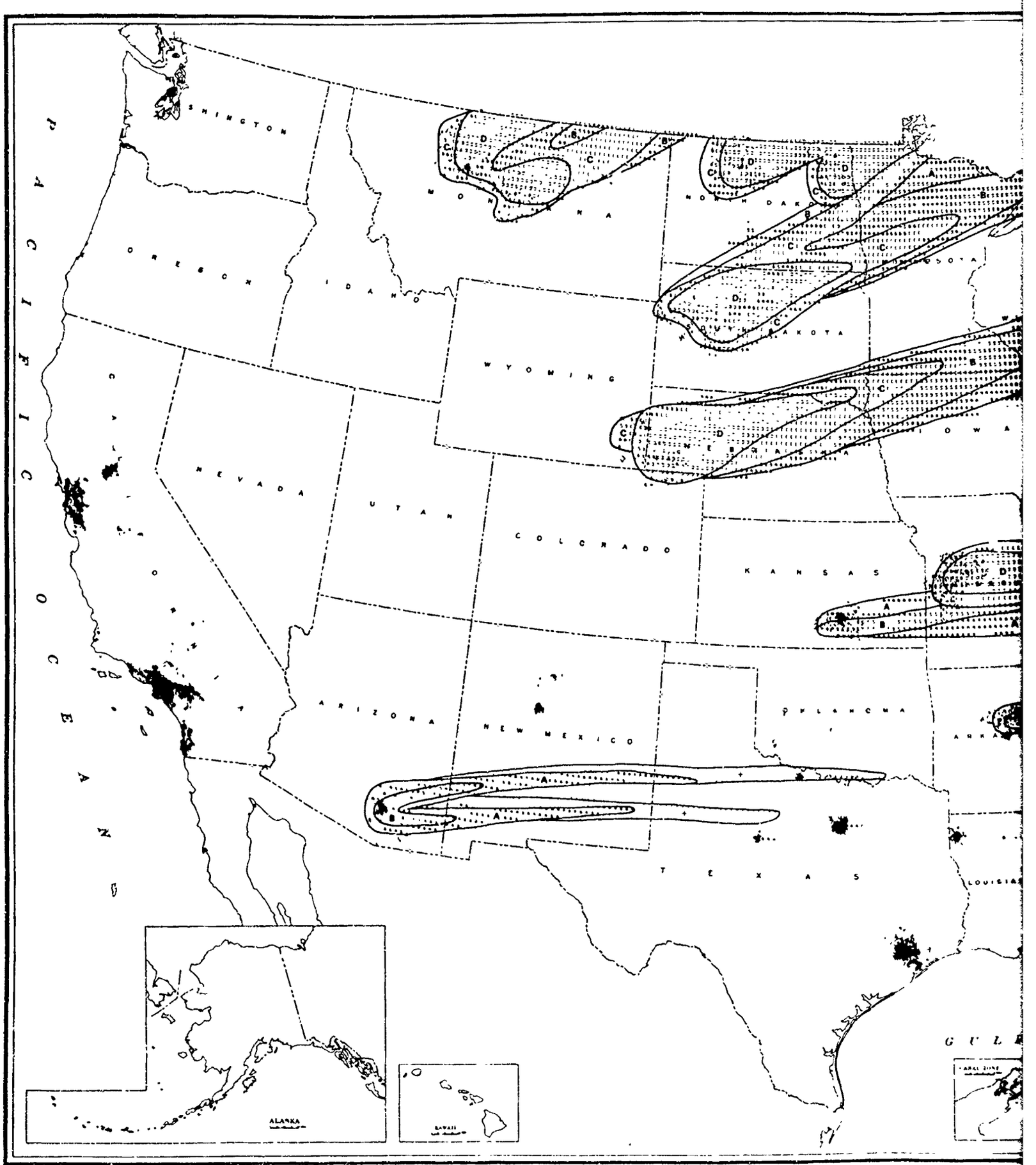
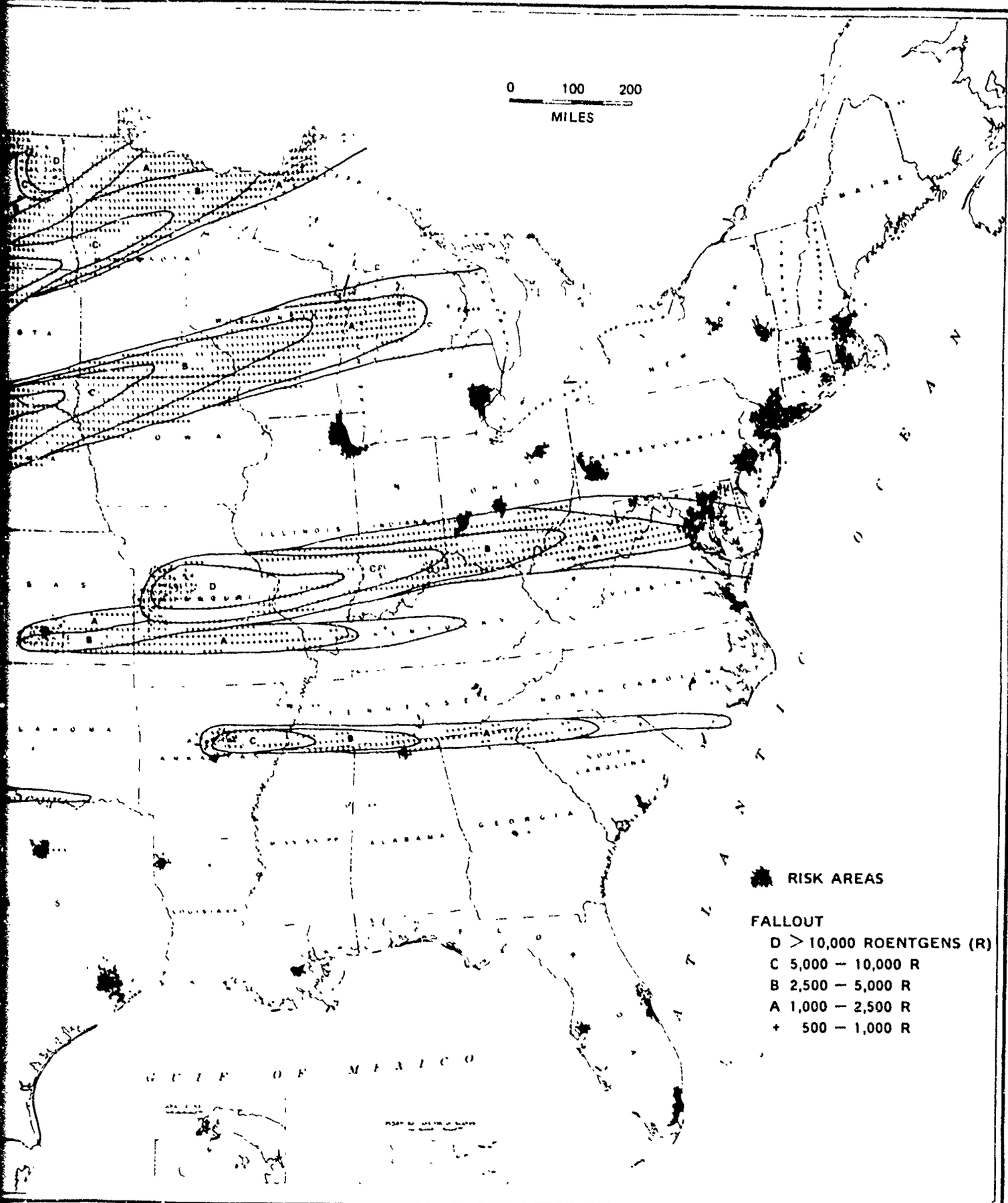


FIGURE 8. RISK AREAS AND FALLOUT PATTERNS FOR ATTACK VS COUNTERFO
(Representative March Winds)



TTACK VS COUNTERFORCE TARGETS PLUS RESEARCH FACILITIES

III. EXISTING CIVIL DEFENSE PLANS AND WARNING SYSTEMS; ESTIMATED EFFECTIVENESS

Throughout this report, each point is discussed as it applies to CONUS as a whole. Furthermore, two states are analyzed in particular detail because they illustrate different important aspects of the overall situation. Missouri was chosen for detailed analysis because it represents a state with a large number of deployed U.S. strategic nuclear retaliatory forces, specifically a MINUTEMAN Missile Wing, and Whiteman Air Force Base, which comes under the Strategic Air Command. Missouri has a relatively high population and would be subject to a relatively large portion of the attacking force. New Mexico was also selected for detailed analysis because it represents a state with some of the defense-related laboratories considered in the study. It has a relatively low population and would be subject to a relatively small portion of the attacking force.

A. STATUS FOR UNITED STATES

DCPA is conducting a program of Nuclear Civil Protection (NCP) planning, aimed at producing both a detailed Community Shelter Plan (CSP) for each county in the U.S. (for protecting people in-place, at or near residences), and a Crisis Relocation Plan (CRP) for those counties considered to be at risk and for their corresponding host counties. These plans are based on the "TR-82" DCPA Planning Base [Ref. 3], which includes all of the counterforce areas but excludes many of the defense-related research facilities considered in this study. The plans consist of book-length summaries of details of CD activities to be performed in the county, should an emergency occur. The plans are developed in coordination with local officials. Currently, priority is being given to counterforce areas. A summary of the current status for the counties containing the nine missile fields is given

in Table 1, and a detailed breakdown is given in Appendix A. At the present rate, full nationwide planning should be completed in the early 1990s. The time to complete the CRP plans is, within reason, inversely proportional to the funding allotted for planning. For example, if such funding were doubled, the planning time could essentially be cut in half.

Attack warning is provided from the National Warning Center at Colorado Springs, Colorado, through the National Warning System (NAWAS). Warning is transmitted over NAWAS to:

- Over 1,200 warning points manned around the clock, which fan out the warning to local governments according to local procedures
- Over 300 Weather Service Field Offices manned around the clock rebroadcast the warning over the local Weather Service transmitter (people who have purchased automatic weather radios (special signal turns on the radio) receive warning immediately)
- The Federal Aviation Administration, which retransmits the warning over their networks to aircraft
- The Coast Guard, which retransmits the warning to ships at sea
- The news networks (wire, radio, and TV) which retransmit the warning as a news bulletin over their news networks
- Emergency Broadcast System (EBS) stations, which can activate the local EBS networks and broadcast the warning to the listening public (special receivers equipped with the EBS-2 tone detection circuiting will be turned on automatically if tuned to the proper station).

Transmittal of warning from the local NAWAS points to the public is currently done by sirens, which during daytime could be heard by roughly 50 percent of persons in risk areas, and during sleeping hours would be essentially useless. DCPA has long recognized the limited effectiveness of sirens and has developed concepts for several improved warning systems, the most effective being the Decision Information Distribution System (DIDS), involving an indoor radio-activated alarm for all homes. Deployment of such an improved system would require substantially increased funding for warning.

In addition to plans and warning systems, DCPA performs the following functions:

TABLE 1

CURRENT STATUS OF CRISIS RELOCATION PLANNING
IN RISK AND HOST COUNTIES OF CONUS MISSILE FIELDS

Missile Field	No. Counties With Completed Book-Length CRP/Total No. Counties	Estimated Completion Date for CRPs
Davis-Monthan, AZ	6/6	Complete
Ellsworth, SD	0/15	1982
Grand Forks, ND	1/15	1984
Little Rock, AR	14/24	1982
Malmstrom, MT	2/14	1982
McConnell, KS	12/22	1980
Minot, ND	0/14	1984
Warren; CO, NE, WY	0/21	1982
Whiteman, MO	10/19	1981

Direction and Control

- Federal--Wire Communications (with radio backup) connect DCPA Headquarters, Regions, and States. Six of the eight DCPA Regions have underground Federal Regional Centers.
- State--Over 40 states have state-level Emergency Operating Centers (EOCs).
- Local--Some local EOCs (in localities containing about half the population) have adequate fallout protection but minimal blast protection. Others have sub-standard fallout protection.

Radiological Defense (RADEF)

- Radiation [illegible]strument sets are deployed.
- Radiological [illegible]icers are trained.
- Radiological Monitors are trained.

Emergency Public Information (EPI)

- Fallout protection and emergency generators are provided for about 600 AM radio stations of the EBS.
- Areas containing over half the U.S. population have some EPI plans.

Training and Education

- Training, in CD skills, of local CD officials, business leaders, and RADEF personnel
- Education, in CD information, of county leaders, mayors, and city administrators
- Education of school pupils and interested adults in CD information.

Federal Supporting Activities

- DCPA performs program management and implementation, plus research and development.

Although the current preparations are of value, they fall far short of a CD program which under any attack could save a majority of residents in the areas attacked.

B. STATUS FOR MISSOURI

Although a tentative crisis relocation plan has been worked out for the state as a whole, detailed county-by-county planning has so far been performed only in the counties containing the Whiteman missile complex. Detailed planning for the large St. Louis metropolitan area (risk and host areas) has not yet begun. Table 2 summarizes the current status of planning for Whiteman.

Planning for the Whiteman Air Force Base (AFB) missile complex is more advanced than for most of the other missile complexes. The present organization is not extensive enough to be fully effective. The local organization for each of the counties in the Whiteman risk/host conglomerate consists of one person, with the exception of one county that has three people. Only 3 of the 19 counties have personnel who have completed detailed civil defense training. Local government support varies from none to very good, and reaction to the NCP planning effort runs parallel to this attitude. Plans which have been completed and presented to local officials have been well received. Only 2 of the 19 counties are receiving significant financial assistance from OCPA. In the other counties, there are no extensive civil defense organizations and no significant training, equipment, or Emergency Operating Centers.

During a tactical warning period, no time would be available to move to best available shelter. Movement would be to home basements, and some of those who received warning but had no basement in their home could reach public shelter. The remainder could only seek shelter in their homes. Much more planning is needed for the possibility of a protracted (1- to 2-week) relocation with no war (e.g., as things stand now, the number of key workers would decline as the crisis period were extended, since some of the key workers are in industries which will run out of resources, such as gasoline, food, and drugs). Key workers would be sheltered in the best protection available in the risk area, and in all cases these are surveyed spaces below grade. Home basements for key workers are not being considered.

TABLE 2

STATUS OF NCP[a] PLANNING FOR WHITEMAN MISSILE FIELD

Risk and Host Counties (as of April 1978)

	CRP[b]	CSP[c]	Warning	D & C[d]	EPI[e]	RADEF[f]	Nuclear EOP[g]	Public Education	Emergency Services
Risk Counties									
Benton									
Cedar									
Cooper									
Henry									
Johnson									
Lafayette	C[h]								
Moniteau			C	C		C	C		C
Morgan		C							
Pettis	C								
Saline	C		C	C		C	C		C
St. Clair	C		C	C		C	C		C
			C	C		C	C		C
Host Counties									
Howard	C								
LaClede	C		C	C		C	C		C
Maries	C	C	C	C		C	C		C
Osage			C	C		C	C		C
Pulaski	C	C			C				
Randolph	C		C	C		C	C		C
Texas	C		C	C		C	C		C
			C	C		C	C		C

[a] Nuclear Civil Protection

[b] Crisis Relocation Planning (applies to risk or host county)

[c] Community Shelter Planning (in-place option)

[d] Direction and Control

[e] Emergency Public Information

[f] Radiological Defense

[g] Emergency Operations Planning

[h] Complete

To summarize, the plans for crisis relocation in the Whiteman AFB missile complex area should be completed and approved by local officials about 1981. The plans identify the evacuation routes for people to take to host areas, and shelter space to be used there (including space in buildings where fallout protection could be expediently upgraded during the crisis by the occupants). Food and other human needs are also addressed. The plans (as such) are generally well done. However, a problem lies in the inability of the communities to support the plans with resources now available (e.g., Emergency Operating Centers are virtually nonexistent).

C. STATUS FOR NEW MEXICO

New Mexico was chosen for detailed discussion because it contains several defense-related research laboratories or research facilities. In this study, an attack was assumed to occur against Los Alamos Laboratory, Albuquerque (including research facilities at Kirtland Air Force Base), and White Sands Missile Range Center.[1]

CD preparations at these areas are quite extensive. A detailed description has been prepared and is included as Appendix B.

[1]These targets do not correspond exactly with the standard DCPA risk area designation [Ref. 3], thus emphasizing the fact that, although relative degrees of risk can be specified for various areas, no one can know in advance exactly how a nuclear attack might actually be configured.

IV. FEASIBILITY OF ESTABLISHING MORE EFFECTIVE CIVIL DEFENSE; POTENTIAL COSTS AND METHODS OF FINANCING

A. MORE EFFECTIVE CIVIL DEFENSE PLANS AND CAPABILITIES

As previously discussed, many studies [e.g., Ref. 1] have established the technical feasibility of more effective CD plans and capabilities. Increased funding for planning would be particularly effective at the present time, since it would directly reduce the expected decade or more until detailed county-by-county crisis relocation plans are made for all of CONUS. Good lifesaving performance, should the crisis culminate in a nuclear attack, would require a number of supporting systems, such as Direction and Control, Communications, Radiological Defense, and others, as well as Training. Given detailed planning and other necessary preparations, crisis relocation could definitely be carried out for the U.S. counterforce areas, which have relatively low population density. Large cities, and the Northeast Corridor generally, would present more problems, but relocation would still be technically feasible [Refs. 4-6], i.e., virtually all the uncertainty concerns human behavior. The degree of public cooperation in a serious crisis would probably be high [Ref. 1; see also Chapter VI].

B. MORE EFFECTIVE WARNING SYSTEMS

The essential element for high performance warning (as opposed to the present low-performance sirens) is the deployment of indoor warning receivers. Fifteen-minute warning would clearly require that these receivers be in place. DCPA has investigated alternative system configurations to provide high-performance home warning. These configurations are types of the Decision Information Distribution System (DIDS). They include use of: the electric power distribution system, the telephone system, the commercial broadcast industry, NOAA (National Oceanic and

Atmospheric Administration) Weather Radio, and low frequency radio. A radio-based warning system was judged to be the most cost-effective because of coverage and the insensitivity of system performance to the number of receivers deployed.

Indoor-warning radio receivers must have continuous operation, emergency battery power, and automatic turn-on by transmitter signals. Studies have shown that receivers built with these characteristics in quantities of 1 million or more will cost $25 to $30 each. Options for distribution of receivers in risk areas are:

- Government procurement and distribution of receivers
- Government procurement, with receiver purchased (at subsidized cost?) by the individual, from a government outlet such as a Post Office
- Procurement from commercial retail store
- Requirement that all new radio and TV sets contain a special warning device.

Studies predict that fewer than 10 percent of the population would voluntarily purchase receivers.

Several options exist for the radio network which would transmit the warning signals.

- The Emergency Broadcast System (EBS) is a voluntary association of commercial broadcast stations operating under FCC (Federal Communications Commission) regulations. Each state is divided into several operational areas, usually along county lines. Each operational area has a lead station called a common program control station (CPCS-1). Other stations in the operational area are equipped with a special EBS receiver, which is tuned to the CPCS-1 station. In the event of an emergency, the lead station activates the EBS by broadcasting the EBS two-tone signal. Listening stations are alerted and repeat the procedure. Warning messages and information are then broadcast to the listening public. The EBS signal can be used to turn on certain specially designated home receivers.
- NOAA Weather Radio (NWR). Radio broadcasts of weather forecasts, alerts, and warnings are transmitted by NWR. VHF-FM transmitters are controlled and programmed by the National Weather Service Field Office (WSFO) responsible for transmitters' coverage area, approximately 5,000 square miles. Most WSFOs are connected to the National Warning System (NAWAS) and have agreed to broadcast

the attack warning. NWR transmits a special tone preceding the warning message. This NWR tone can be used to turn on certain home warning receivers. When completed, NWR will cover about 50 percent of the land area of the United States, containing approximately 90 percent of the population.

- Low Frequency Radio. High power, low frequency (LF) transmitters designed and located to provide reliable ground wave coverage to the contiguous United States would be used to broadcast the attack warning. LF ground wave coverage is the service least affected by nuclear detonation. (Although it is clearly essential to transmit warning before nuclear detonations occur, a multistage attack scenario is entirely possible and would require warning systems capable of surviving certain nuclear effects, particularly Electromagnetic Pulse (EMP).) Specially designed receivers would be turned on in less than 30 seconds by coded tone signals. The alert signal and warning message would then be broadcast. The system would be designed to meet all operational requirements for warning, including standby electric power generators, EMP protection, and "anti-spoof" features.

An "intermediate" warning system, less effective than DIDS but still more effective than the present system, would be an improved NAWAS. The service could be extended to all CPCS-1 stations, designated EBS stations, and to National Weather Service Offices which control NOAA Weather Radio transmitters. Protection against fallout and EMP, emergency power, and an emergency radio link to a local government Emergency Operating Center (EOC) could be provided to CPCS-1 stations and to approximately 2,000 radio stations serving host areas. Another intermediate system, which could greatly improve sleeping-time responses, would be the low cost CHAT (Crisis Home Alerting Technique) procedure, provided a few hours of strategic warning are available. People would keep TV sets on all night during a crisis, tuned to a special channel. No sound would be broadcast unless warning was transmitted, in which case a loud message would awaken people.

In the U.S. missile complexes, present ability to warn people at risk is as follows, based on allowing 30 minutes from incoming weapon detection to desired defensive reaction (sheltering) of people at home or work.

TABLE 3

WARNING SYSTEMS IN MISSILE-COMPLEX AREAS

Objective	Rating of Current Systems in Meeting Objective		
Deliver immediate "take shelter" warning to people within +2 psi range of MT-range surface bursts at:	Day or night, if people are listening to radio or TV	Via sirens only, day or night, if awake	During sleeping hours, via any means
Three TITAN complexes (Tucson, Wichita, Little Rock)	Good	Fair	Poor
Six MINUTEMAN complexes	Fair	Poor	Very Poor

C. ENHANCEMENT OF CURRENT CIVIL DEFENSE FOR MISSOURI AREAS STUDIED

The simplest way to enhance current CD in Missouri would be to complete present CRP/CSP planning for all counties, including the St. Louis area, to develop the necessary supporting systems, and to conduct the exercises (for key officials) and the training essential for effective performance.

Another resource which could be tapped in Missouri is the existence of a large number of mines and caves which could be used for shelter, many of which are not presently included in DCPA's National Shelter Survey. The finding of a 1960-1962 survey was that more than 3.1 million spaces (at 30 square feet per person) existed for the population (now nearly 5 million). Little of this space was used in the Community Shelter Plans of 1965-1975 because of the severely limited population-movement times allowed by the planners (generally one hour or less). Also, many mines require improvements (lighting, ventilation, sanitary facilities, etc.) in order to exploit their enormous capacities, often 10,000 to 100,000 persons. The advent of Crisis Relocation Planning in 1975 caused renewed interest in this high-grade protection resource, although the improvement problem is an

impediment. For example, enough good mine space (when improved) exists to shelter essentially "in place" the entire risk area populations of Kansas City and Springfield, and, with some movement, the entire populations of St. Louis and St. Joseph. Mine shelter resources (when improved) reasonably near the Whiteman AFB MINUTEMAN complex also offer an excellent opportunity for high-grade sheltering of most of the "at-risk" population in lieu of moving them to upgradable buildings in currently-designated "host" counties, where potential heavy fallout may vitiate the expedient fallout protection. Further, mines offer high-grade shelter for "key workers," who must remain in the high risk areas to carry out essential services. For example, a mine with 20,000 shelter spaces in Henry County offers potential for blast and fallout sheltering of nearly all the key workers for several adjacent high risk counties of the Whiteman AFB complex. Federal and State planners are considering use of such mines in the current planning effort. (DCPA recently sponsored a study to upgrade a limestone mine. The study showed that the mine could be lighted and ventilated very quickly using expedient techniques.)

D. ENHANCEMENT OF CURRENT CIVIL DEFENSE FOR NEW MEXICO AREAS STUDIED

As in Missouri, there could be good confidence of effective lifesaving only if essential supporting systems and capabilities were developed, such as Direction and Control, Communications, Radiological Defense, and Emergency Public Information, including necessary exercising and training.

1. Los Alamos

a. Shelter Survey

Since many of the designated public shelters are in basement areas, an "all-effects" survey could be made of existing NSS shelters to determine the relative blast resistance thereof. Based on such a survey, plans could be developed for upgrading those buildings where the inherent blast resistance can be enhanced through expedient measures.

b. Crisis Relocation Plans

A plan for relocating the population of Los Alamos to lower risk areas could be developed. Although the opinion has been expressed by officials at Los Alamos that not more than 50 percent of the population would relocate if given that option, it seems prudent that such an option should be provided for those not electing to stay.

c. Warning

In order to increase outdoor warning coverage to 90 percent or more, 6 additional sirens would be required; 1 in the Pajarito area; 3 in the town of White Rock; and 2 in the Los Alamos residential area. An indoor warning system would also be effective in improving nighttime coverage.

2. Albuquerque

a. The "all-effects" survey of all National Shelter Survey (NSS) buildings in the Albuquerque Risk Area could be completed, and the CSP updated to current criteria.

b. Installation of additional outdoor warning sirens could be accelerated to obtain 90 percent coverage.

c. Completion of planning in host counties could be accelerated.

3. White Sands

a. An "all-effects" survey of existing shelter spaces could be made to determine the feasibility of utilizing best available inherent blast protection for personnel who might be required to stay at White Sands if the decision is made to relocate the general population.

b. Contingency plans could be developed for crisis relocation of the population.

E. DESCRIPTION OF POTENTIAL IMPROVED CIVIL DEFENSE PROGRAMS; POTENTIAL COSTS

Four types of CD programs, including three potential improved CD programs, were analyzed in this study:

- Current CD
- A Crisis Relocation Program
- An Expedient Shelter Program
- A Dedicated Blast Shelter Program.

The following paragraphs describe the programs and their estimated costs. Table 4 summarizes the cost estimates.

As envisioned in SPC Report 342, Candidate U.S. Civil Defense Programs [Ref. 1], blast-risk areas in the U.S., based on a "large-scale" nuclear attack including a potential attack against all large cities, contained 140 million people. Clearly, one can pick any number of people at risk (from blast) from 0 to 140 million, depending on what type of attack one considers most likely. In this study, two other ways of specifying numbers of people at risk were specified, based on attacks less severe than the "large-scale" attack. The numbers of people are 75 million and 7 million. Cost estimates were prepared based on these numbers.

All cost estimates are in 1979 dollars. For all programs it is assumed that the program would be established over a period of five years, and maintained thereafter. The annual maintenance cost (in 1979 dollars) would generally be less than the annual costs required to establish the programs. Estimated costs are generally consistent with actual costs of CD systems in the Scandinavian nations.

The "bottom line" (literally) of Table 4 is that the annual cost of U.S. civil defense, per American citizen, is currently about $0.45, and, according to the estimates, would be (depending on the number of people considered to be "at risk"):

- For a Crisis Relocation Program:

  $0.65 to $1.55

TABLE 4

ESTIMATED COSTS TO ESTABLISH CD PROGRAMS
(Over 5-Year Period; 1979 $ Millions)[a]

Shelter	Current CD[b]	Crisis Relocation 140M at Risk	Crisis Relocation 75M at Risk	Crisis Relocation 7M at Risk	Expedient Shelters 75M at Risk	Expedient Shelters 7M at Risk	Dedicated Blast Shelters 140M at Risk	Dedicated Blast Shelters 75M at Risk	Dedicated Blast Shelters 7M at Risk
Survey	10	60	60	60	60	60	c	c	c
Planning[d]	0	50	30	3	525	50	c	c	c
Material[d]	0	0	0	0	5,250	500	0	0	0
Peacetime Construction	0	0	0	0	0	0	42,250	22,500	2,100
Marking	0	5	5	5	5	5	c	c	c
Stocking	0	260	140	13	110	10	700	375	35
Shelter Management	0	50	25	5	25	5	100	55	10
Nuclear Protection Planning	46	200	130	55	130	5	500	290	70
Warning	32	50	50	50	1,100	100	2,000	1,100	100
Direction and Control	39	325	205	80	205	80	335	200	80
Radiological Defense	22	90	60	30	60	30	90	60	30
Emergency Public Info., Training, Education	5	150	80	10	80	10	150	80	10
Management	300	350	335	320	335	320	1,500	650	360
Research and Development	26	80	80	80	80	80	100	100	100
5-Year Total Cost	430	1,670	1,200	710	7,965	1,255	47,725	25,410	2,895
Annual Cost (First 5 Years)[a]	96	335	240	140	1,590	250	9,550	5,080	580
Annual Cost (Dollars per U.S. Citizen)	$0.45	$1.55	$1.10	$0.65	$7.40	$1.20	$44.50	$23.60	$2.70

[a] After Program is established, annual maintenance costs are lower than these (except for Current CD).

[b] Based on FY 1979 DCPA Appropriation, totalling $96.5 million for FY 1979.

[c] Included in peacetime construction.

[d] For development of shelters during crisis.

- For an Expedient Shelter Program:
  $1.20 to $7.40
- For a Dedicated Blast Shelter Program:
  $2.70 to $45.00.

1. Current Civil Defense

Current CD in the selected high-risk areas has been described previously in Chapter III and Appendices A and B. The costs for current CD in Table 4 are simply a restatement of the authorized DCPA budget for FY 1979, which totals $96.5 million.

2. Crisis Relocation Program

This is the program for improved U.S. CD recommended by the Secretary of Defense. Full plans and preparations for crisis relocation would be established for all areas selected as "risk areas," and their corresponding host areas. Supporting systems would also be upgraded. Fallout protection for evacuees would be provided by crisis actions to upgrade fallout protection factors (PFs) of existing structures in host areas (to average of PF 50), based on peacetime planning; but to keep costs low, there would be no peacetime stockpiling of materials. Several days of crisis buildup would be necessary, to allow time for relocation.

Three potential Crisis Relocation (CR) programs were costed.

- CR-a: Full CR for CONUS (140 million people in areas to be evacuated)
- CR-b: CR for areas containing 75 million people; current CD (at least) elsewhere
- CR-c: CR for counterforce areas only, containing 7 million people; current CD (at least) elsewhere.

a. Shelter Survey

Survey would be completed of best available protection in existing structures in areas near counterforce targets. Best-available blast as well as fallout protection would be identified throughout the U.S.,

including in areas of shelter deficit, structures whose fallout protection in host areas, and blast protection for key workers in risk areas could be upgraded during crisis periods. Survey in host areas would be accelerated. (Five-year cost, $60 million, for all three possibilities for CR.)

b. Planning for Crisis Development of Shelter

Detailed planning would be conducted for crisis upgrading of existing structures in host areas to attain an average fallout protection factor of 50. for both evacuees and host residents. Host areas contain about 183 million spaces in about 390,000 facilities, for an average of 470 spaces per facility. A surveyor takes from one-half to one and one-half hours to perform the on-site shelter-use determination task, at a cost of roughly $11.00 per hour or $0.03 per shelter space. A planner locates lumber and equipment, allocates them for upgrading, and corrects, documents, and incorporates the final data into a shelter use plan, at a cost of roughly $375 for 20,000 shelter spaces, or $0.02 per shelter space. The planning cost estimate is $0.05 per shelter space.

Detailed planning would be conducted to develop 55-psi blast protection for key workers expected to commute into risk areas to keep essential industries and services operating during the crisis, by construction of high-quality expedient shelters, and/or upgrading blast resistance of basements of existing structures; cost estimate is $5/space.

CR-a: $0.05/space x 140M + $5/space x 9.0M = $50M
CR-b: $0.05/space x 75M + $5/space x 5.0M = $30M
CR-c: $0.05/space x 7M + $5/space x 0.5M = 3M .

c. Shelter Marking

All presently unmarked public shelters throughout the U.S. would be marked, including about 95,000 now identified but unmarked, as well as additional facilities identified by FY 1979-1983 surveys ($5M).

d. Shelter Stocking

Sanitation supplies, water containers, and ventilation kits (but no food or medical supplies) would be provided for evacuees (but not host residents). The per capita cost estimates are as follows:

Item	Unit Cost	Number of People Served	Cost Per Person Served
Collapsible Commode	$5.24	9	$0.58
Sanitation Kit	$10.12	100	$0.10
Water Container	$45.00	100	$0.45
Ventilation Kits[1]	$405.00	560	$0.73
			$1.86

Total cost estimates are:

CR-a: $1.86 x 140M = $260M
CR-b: $1.86 x 75M = $140M
CR-c: $1.86 x 7M = $ 13M .

e. Shelter Management

Cadres of Shelter Manager Officers/Instructors would be trained to prepare shelter plans and train Shelter Managers during crisis.

CR-a: $50M
CR-b: $25M
CR-c: $ 5M .

[1] "Kit" = 1 bicycle fan + 3 Kearny Pumps; some shelters would require only part of a "kit."

f. Nuclear Civil Protection Planning

An enhanced planning staff would be provided to develop crisis relocation plans, permitting the evacuation posture to be held for at least four weeks and, if possible, for longer periods; and to provide confidence of effective execution of plans.

CR-a: $200M
CR-b: $130M
CR-c: $ 55M .

g. Warning

National Warning System coverage would be extended, throughout the U.S., to broadcast stations; matching-fund support would be continued for current state and local warning systems. A "crisis home alerting technique" (CHAT) capability would be developed to improve nighttime warning ($50M, all CR options).

h. Direction and Control

Matching-fund support would be continued for construction of fallout-protected local Emergency Operating Centers; support would be provided at a moderate level for on-site simulated-emergency exercises for key local officials and EOC staffs essential to developing the ability to execute emergency plans; two remaining Federal Regional Centers would be constructed to provide full coverage; cost estimate $65M for U.S. In addition, austere, fallout-protected Emergency Operating Centers would be developed in host areas, located to provide a distributed, survivable Direction and Control network. The program would be enhanced to provide on-site simulated-emergency exercises for key local officials, with emphasis on host-area operations.

CR-a: 1,300 austere EOCs @ $200K + $65M = $325M
CR-b: 700 austere EOCs @ $200K + $65M = $205M
CR-c: 65 austere EOCs @ $200K + $65M = $ 80M .

i. Radiological Defense (RADEF)

Radiological Defense Officers would be trained for host areas. Low-cost ratemeters and dosimeters would be procured. Provision would be made for training Radiological Monitors and otherwise providing greater confidence of performance.

CR-a: $90M
CR-b: $60M
CR-c: $30M .

j. Emergency Public Information (EPI) and Crisis Training

For risk and host areas, mass-media EPI materials would be provided for crisis use; Community Shelter Plan information materials for citizens would be published (e.g., in telephone directories) on where to go/what to do in case of attack; a crisis-expectant training system would be established to meet citizens' demands for information in periods of developing crisis; fallout and EMP protection, emergency generators, and programming links to local EOCs would be provided for broadcast stations in host areas, to provide a distributed survivable capability to provide emergency information and instructions to the shelter population in the transattack and postattack periods.

CR-a: $150M
CR-b: $ 80M
CR-c: $ 10M .

k. Management

State/local civil defense staffs would be supported, based on the need for an effective management structure for both peacetime system development and crisis actions.

CR-a: $350M
CR-b: $335M
CR-c: $320M .

1. Research and Development

The present program would be enhanced to provide for intensive research on all aspects of Crisis Relocation and possible future blast shelter programs ($80M, all CR possibilities).

3. Expedient Shelter Program

Expedient Shelters would be most effective under a scenario involving several weeks or months of severe international tension (long enough to preclude sustained spontaneous evacuation but severe enough to induce people to follow government directives and build expedient shelters), followed by a very sudden attack.

At least one historical experience may be relevant to this point. On September 1-3, 1939, the British evacuated some 1.5 million women and children from London just before Britain declared war. About 2 million additional people evacuated spontaneously. Because no bombing occurred over the next several months (the period called the "phoney war" at the time), most evacuees returned to London. However, many people constructed shelters in or behind their homes, with the government having provided kits for Anderson or Morrison shelters free of charge for lower-income citizens. Such shelters were, of course, used when the "blitz" occurred in August 1940, and in later attacks.

Field tests have shown that the average American family can, in a matter of several hours, build an expedient fallout shelter which also can provide significant blast protection [Refs. 7 and 8]. In fact, Soviet CD publications emphasize the feasibility and utility of such shelters, including potential problems and remedies in constructing expedient shelters in winter when the ground is frozen [Refs. 9 and 10].

Under the Expedient Shelter Program analyzed in this study, the Federal Government would stockpile shelter-construction "kits" throughout high-risk areas. This stockpiling would take place over a five-year peacetime period. The stockpiling would be in government-owned warehouses, or

on government land. A survey would specify locations far enough away from potential targets that 15 psi would be sufficient protection from a 1-MT burst.

Expedient Shelters would be of several different types, depending on the extent to which the area in question were urban or rural. For simplicity, the cost estimate for this study was based on one Expedient Shelter type, the "Shored-Trench Shelter" [Ref. 11], illustrated in Figure 2 (Chapter I). The mean lethal overpressure is at least 15 psi (probably higher), and the fallout protection factor (PF) is about 200. This design calls for 100 board-feet of lumber per occupant. The 1979 lumber cost is $0.64-$0.68 per board foot. The shelter cost used here is $70.00 per occupant, which provides for "kits" including nails, plastics, and other necessary materials. Estimated costs are:

$70/person x 7M = $ 500M
$70/person x 75M = $5,250M .

Planning for this is estimated to cost another 10 percent of the above estimate.

During the five-year peacetime period, extensive public information, training, and education would occur in the high-risk areas. The public would be periodically reminded of the shelter-construction instructions, through the media and/or direct mail.

A radio warning system would be deployed, with home receivers. This would be DIDS (Decision Information Distribution System).

Planning, Direction and Control, Radiological Defense, Management, and Research/Development would be essentially the same as for the Crisis Relocation Program.

4. Dedicated Blast Shelter Program

Dedicated Blast Shelters (DBS) would be constructed over a five-year period in all high-risk areas of the U.S. This is the only program considered under which people could generally be protected from nuclear weapons effects given only 15 to 30 minutes warning of attack. The program was costed assuming that the number of people at risk were:

DBS-a: 140M
DBS-b: 75M
DBS-c: 7M .

a. Peacetime Construction

The Dedicated Blast Shelter costed for this study has a 500-person capacity, a mean lethal overpressure of 55 psi, and a fallout-protection factor (PF) of 500. A diagram is given in Figure 4 (Chapter I). The cost estimate is based on 1978 data estimates [Refs. 12, 13]. The shelter-type is a reinforced concrete arch, and the cost estimate (1979 dollars) is $30 per square foot, or $300 per person.[1] This is consistent with actual shelter costs in the Scandinavian nations. The cost includes planning, survey, and marking.

DBS-a: $300 x 140M = $42,000M
DBS-b: $300 x 75M = $22,500M
DBS-c: $300 x 7M = $ 2,100M

b. Shelter Stocking

Austere stocks, including water, sanitation kits, ventilation kits, medical supplies, and two weeks of austere but adequate food (new type, which will apparently last for decades) can be procured in very large quantities for $5.00 per person.

[1]At least one professional construction company believes that such construction could be accomplished for $20 per square foot ($200 per person), in 1978 dollars [Ref. 14].

DBS-a: $5 x 140M = $700M
DBS-b: $5 x 75M = $375M
DBS-c: $5 x 7M = $ 35M .

c. Shelter Management

Enhance shelter management program over that provided for in the CR Program, by means of more extensive preparation and training in peacetime.

DBS-a: $100M
DBS-b: $ 55M
DBS-c: $ 10M .

d. Nuclear Protection Planning

Provide enhanced planning staff to plan for maximizing the number of people who could reach shelter during 15 to 30 minute warning period, to plan for sheltered posture to be held for two to four weeks, if necessary. Provide CRP to deal with spontaneous evacuation during a prolonged crisis.

DBS-a: $500M
DBS-b: $290M
DBS-c: $ 70M .

e. Warning

A radio warning system would be deployed, including home receivers. This would essentially be the Decision Information Distribution System (DIDS) developed by DCPA.

DBS-a: 200 transmitters @ $5M + 40M receivers @ $25 = $2,000M
DBS-b: 110 transmitters @ $5M + 22M receivers @ $25 = $1,100M
DBS-c: 10 transmitters @ $5M + 2M receivers @ $25 = $ 100M .

f. Other Support Systems

For Direction and Control, RADEF, EPI/Training, and R&D, the costs and general activities are roughly estimated to be about the same as for the CR Program.

g. Management

To supervise the extensive shelter construction, much more detailed management is necessary.

DBS-a: $1,500M
DBS-b: $ 650M
DBS-c: $ 360M .

F. POTENTIAL METHODS OF FINANCING SHELTER PROGRAMS

Considerable thought has been given over the years to various potential methods of financing a U.S. dedicated shelter program. In principle, several methods are possible [Ref. 15]:

- Construction, with full federal funding of shelters, probably for dual use (the peacetime use being as a parking garage, warehouse, community center, etc.)
- Provision for mandatory inclusion of shelter space in new construction
- Federal tax incentives (partial or full subsidy) to encourage incorporating shelter into new homes and other buildings
- Full or partial financing by states
- Full or partial financing by local government
- Individual initiative.

Experience in the late 1950s revealed that very few people are willing to construct even fallout shelters at their own expense, and it is not known how much more productive a tax-incentive approach would be. Local and state governments also would generally not be able to provide a major portion of the funding. As for mandatory construction, with partial to full subsidy, this has proved a practicable approach in a number of

European countries, for developing shelters in single-family houses, apartments, and commercial structures. It is quite possible that a legally sound approach could be put together in the United States for subsidizing development of blast or fallout shelters.

Barring mandatory construction, all approaches other than full Federal funding appear to offer a negligible chance of success.

V. ANALYSIS OF EFFECTS OF POSSIBLE NUCLEAR ATTACKS

As described in Chapter II, two possible nuclear attacks are assumed. The first, "counterforce-only," consisted of the same attack against U.S. ICBMs, strategic submarine bases, and bomber bases as assumed in SPC Report No. 342, Candidate U.S. Civil Defense Programs, [Ref. 1]. The second included the "counterforce-only" attack plus, for additional defense-related R&D facilities, 1-megaton airbursts with a height of burst (HOB) optimized for coverage of 10-psi peak overpressures per Reference 2. The areas placed at risk from these attacks were previously described in Chapter II. Figures 7 and 8 illustrate the fallout patterns, which are the same for both attacks, since the airbursts do not produce appreciable fallout.

A. COMPUTER ANALYSES OF FATALITIES AND INJURIES FROM ASSUMED ATTACKS FOR ENTIRE CONUS

The effects of the assumed attacks were analyzed for four possible CD programs[1] and three possible warning times. The methods and associated assumptions used in the computer analysis are described in Reference 1. The four CD programs were based on:

- The current CD program (existing plans and facilities, some radio/TV warning and last-minute instructions--mainly affecting spontaneous evacuation).
- A fully installed crisis relocation program.
- An expedient shelter program (for protecting the population in place).
- Fully developed, dedicated blast shelters (shelter distribution and type roughly matched to population distribution).

[1]The level of deployment for each program described is matched to the assumed level of attack.

The three warning times[1] were:

- Crisis warning (1 to 2 weeks)
- Nominal 24-hour crisis period
- Tactical warning (on launch, 15 to 30 minutes).

Although, in principle, the four programs and three warning times specify 12 cases, in practice, three of the cases did not vary sufficiently from others in the set to warrant a separate computer run. Thus, nine cases were addressed in detail. The quantitative assumptions regarding evacuation and shelter effectiveness were provided by DCPA and are given in Table 5. A description of these cases follows. (Note: "Risk areas" differ substantially for the two attacks assumed.)

1. Current Civil Defense

   a. Case 1 (1- to 2-Weeks Warning)

      - It is assumed that 10 percent will spontaneously evacuate, even though no evacuation plans exist.[2]
      - Those who have home basements will use them, and those who have no home basements will seek shelter in basements of nearby large buildings.
      - If neither home basements nor large building basements are available, people will seek shelter in interior corridors of large buildings.[3]
      - If none of the above is available, people will improve an area in their place of residence.

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[1]Although the terms "1- to 2-weeks warning" and "24-hour warning" are used herein, the meaning is a crisis buildup over such a characteristic time, with the chance of attack increasing rapidly, not definite knowledge that an attack will occur at the end of the time specified.

[2]National opinion surveys indicate that up to 40 percent of the population would consider spontaneous evacuation under these circumstances.

[3]The percentages of the population who will (or will be able to) respond are implied by the percentages at various protection factor levels in Table 5.

TABLE 5

CHARACTERISTICS OF CASES ANALYZED BY COMPUTER

Program	One to Two Weeks Warning	Twenty-four Hours Warning	Fifteen Minutes Warning
Current CD	1. Evacuation: 10% Risk Areas: All home basements; 20% of balance 7/4/100[b]; 20% of balance 5/2/70; 60% of balance 5/2/5 Non-risk Areas: All home basements; 10% of balance 7/4/100; 10% of balance 5/2/70; 80% of balance 5/2/5	2. Evacuation: 5% Risk Areas: All home basements; 10% of balance 7/4/100; 10% of balance 5/2/70; 80% of balance 5/2/5 Non-risk Areas: All home basements; 5 % of balance 7/4/100; 5 % of balance 5/2/70; 90% of balance 5/2/5	3. Evacuation: None 35% to 4/2/3 Balance at home: Basements 10/4/10 Upper stories 5/2/3
Crisis Relocation	4. Evacuation: 80% Risk Areas: Key workers 55/45/500; B.A.S.[c] (min. PF = 50); Balance to 5/2/50 Non-risk Areas: B.A.S (min. PF = 50); Balance to 5/2/50	5. Evacuation: 65% Risk Areas: B.A.S.; Balance to 5/2/10 Non-risk Areas: B.A.S.; Balance to 5/2/10	6. Evacuation: None 20% to 4/2/3 Risk Areas: B.A.S.; Balance to 5/2/5 Non-risk Areas: B.A.S.; Balance to 5/2/5
Expedient Shelters	7 Not addressed based on computer analysis - see text	8. Evacuation: 5% 10% to 15/14/200 All home basements Balance to 5/2/10	9. Not addressed based on computer analysis - see text
Dedicated Blast Shelters	10. Evacuation: 50% Risk Areas: 55/45/500 Non-risk Areas: B.A.S. (min. PF = 50); Balance to 5/2/50	11. Not addressed based on computer analysis - see text	12. Evacuation: None Risk Areas: 55/45/500 Non-risk Areas: 20% to 5/2/50; B.A.S., then 5/2/5

[a]Protection Factors (PF) and degree of evacuation assumed for computer based analysis of the impact on the population for each CD program and warning time case.[b,c]

[b]Numbers are MLOP/MCOP/PF, i.e., mean lethal overpressure (psi)/mean casualty overpressure (psi)/fallout protection factor

[c]B.A.S. = best available shelter.

b. Case 2 (24-Hour Warning)

- Five percent spontaneously evacuate. The remainder will react as in bullets numbered two, three, and four under Case 1.

c. Case 3 (15 to 30 Minutes Warning)

- No one will have time to evacuate.
- General confusion will occur; families will attempt to reunite; 35 percent will be caught unprotected.
- The remainder will be in places of residence, and go into basements if available; all others will be caught in upper story space.

2. Crisis Relocation

a. Case 4 (1- to 2-Weeks Warning)

- It is assumed that good evacuation plans and capabilities exist and are implemented.
- Key workers will occupy dedicated risk area blast shelters.[1]
- Others in risk areas and all in non-risk areas will use best available shelter based on national shelter survey (NSS) data,[2] and where it is deficient, will expediently upgrade fallout shelters to a minimum fallout protection factor (PF) of 50.

b. Case 5 (24-Hour Warning)

- It is assumed that good evacuation plans exist, but only 65 percent are able to implement them [Ref. 1].
- Stay-behinds will occupy best available shelter. Where it is in insufficient supply, limited success in upgrading existing buildings will be achieved.

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[1]55 pounds per square inch (psi) mean lethal overpressure/45 psi mean casualty overpressure/500 fallout protection factor.

[2]People were assumed to go to the nearest marked NSS shelter, regardless of its specific resistance to blast or fallout.

c. Case 6 (15 to 30 Minute Warning)

- No one will evacuate.
- Twenty percent will be in transit or otherwise relatively exposed.
- As many others as possible will occupy best available shelter (until it is filled).
- The remainder will be caught in upper story space.

3. Expedient Shelters: Cases 7 Through 9

Computer evaluation of Case 8 only (24-hour warning, 10 percent in expedient shelters of 15/14/200) was carried out. Although it seems unlikely that expedient shelters for more than 10 percent of the population could be readied in 24 hours, it also seems unlikely that a 24-hour warning would not be preceded by a period of crisis such that the population would be concerned enough to take action if they knew what action to take. Based on this rationale, the results from Case 8 were compared with the results of other cases to deduce the possible effectiveness of an expedient shelter program under such conditions.[1] For Case 7, the results from Case 8 were extrapolated based on a combination of a lengthy crisis period and short warning times. It was assumed that an intense crisis occurs of sufficient duration that most people decide it would be impractical to evacuate and do not do so. Eighty percent are sufficiently uncertain so that they remain, electing to build expedient 15-psi shelters with a PF of 200 (based on government advice and stockpiled materials); an attack is suddenly launched, and people occupy that shelter prior to the time of weapon arrival.[2] Case 9 allows so little time (15 to 30 minutes) that results would differ little, if any, from those associated with Cases 3 and 6.

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[1]If the crisis relocation program were in being in conjunction with the expedient shelter program, the number of casualties for Case 8 would obviously be less than for Case 5 (same warning time, crisis relocation only) for both of the postulated attacks. (Fatalities estimated to be at least 50 percent lower for the "CF-plus" attack, Table 7.)

[2]Based on these assumptions, extrapolation indicates that the number of casualties for Case 7 would be comparable to Cases 4 and 10 for both of the postulated attacks. (This assumes that the non-risk area protection factors are the same as for Cases 4 and 10.)

4. Dedicated Blast Shelters

a. Case 10 (1- to 2-Weeks Warning)

- It is assumed that 50 percent will evacuate in spite of the availability of blast shelters. Relocation plans exist, in addition to the blast shelters, in the event there is sufficient time for relocation.
- The remainder in the risk areas will occupy dedicated blast shelters. Best available shelter upgraded to a PF of 50 will be used in the non-risk areas.

b. Case 11 (24-Hour Warning)

- This was not run on the computer. Results would fall between Cases 10 and 12, and probably closer to 12 since the warning time would not allow for a great deal of improvement in fallout shelters.

c. Case 12 (15 to 30 Minute Warning)

- None evacuate--essentially all in the risk areas occupy blast shelter (assumes very extensive public information during peacetime prior to attack).
- Twenty percent of those in non-risk areas throughout the country, aware that blast shelters are being built in counterforce areas and that fallout is probable elsewhere, should an attack take place, are assumed to have upgraded shelter space at their place of residence.
- The remainder use best available shelter; when it is filled, those remaining are caught in upper story space.

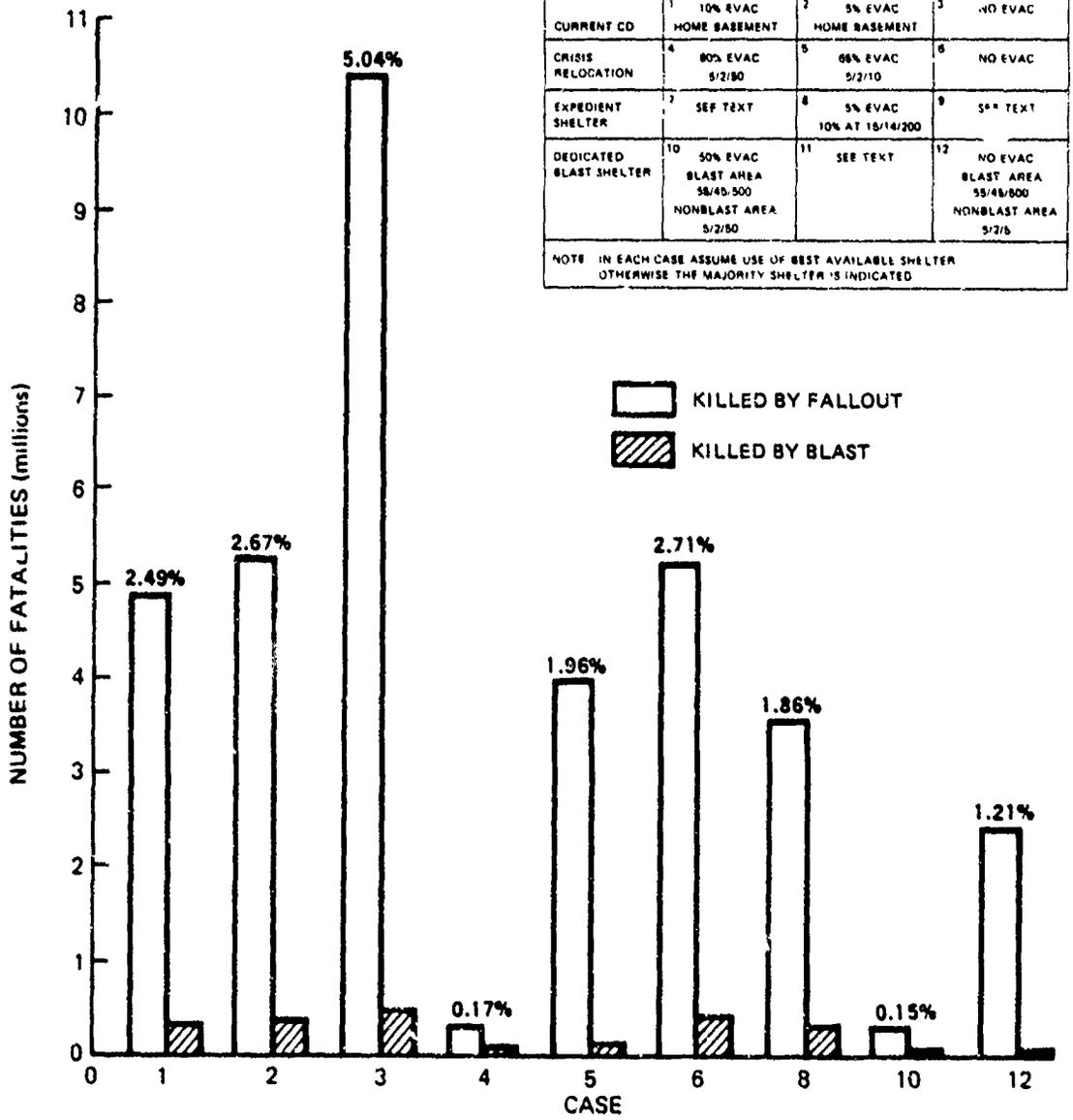
5. Results of Computer Analyses at National Level

Figures 9 and 10 depict the computer-calculated number of fatalities resulting from the counterforce-only (CF-only) and counterforce-plus-government-research-facilities (CF-plus) attacks, respectively. The reduction in numbers of fatalities, as a result of either the evacuation or dedicated blast shelter programs when associated with one-to two-weeks warning time, is impressive. The results for an expedient shelter program, based on extrapolation techniques, are certain to be equally impressive under the

CASE KEY

PROGRAM	1-2 hr WARNING	24 hr WARNING	15-30 min WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 5/2/50	5 66% EVAC 5/2/10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 10% AT 15/14/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 50% EVAC BLAST AREA 55/40/500 NONBLAST AREA 5/2/50	11 SEE TEXT	12 NO EVAC BLAST AREA 55/40/800 NONBLAST AREA 5/2/6

NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED



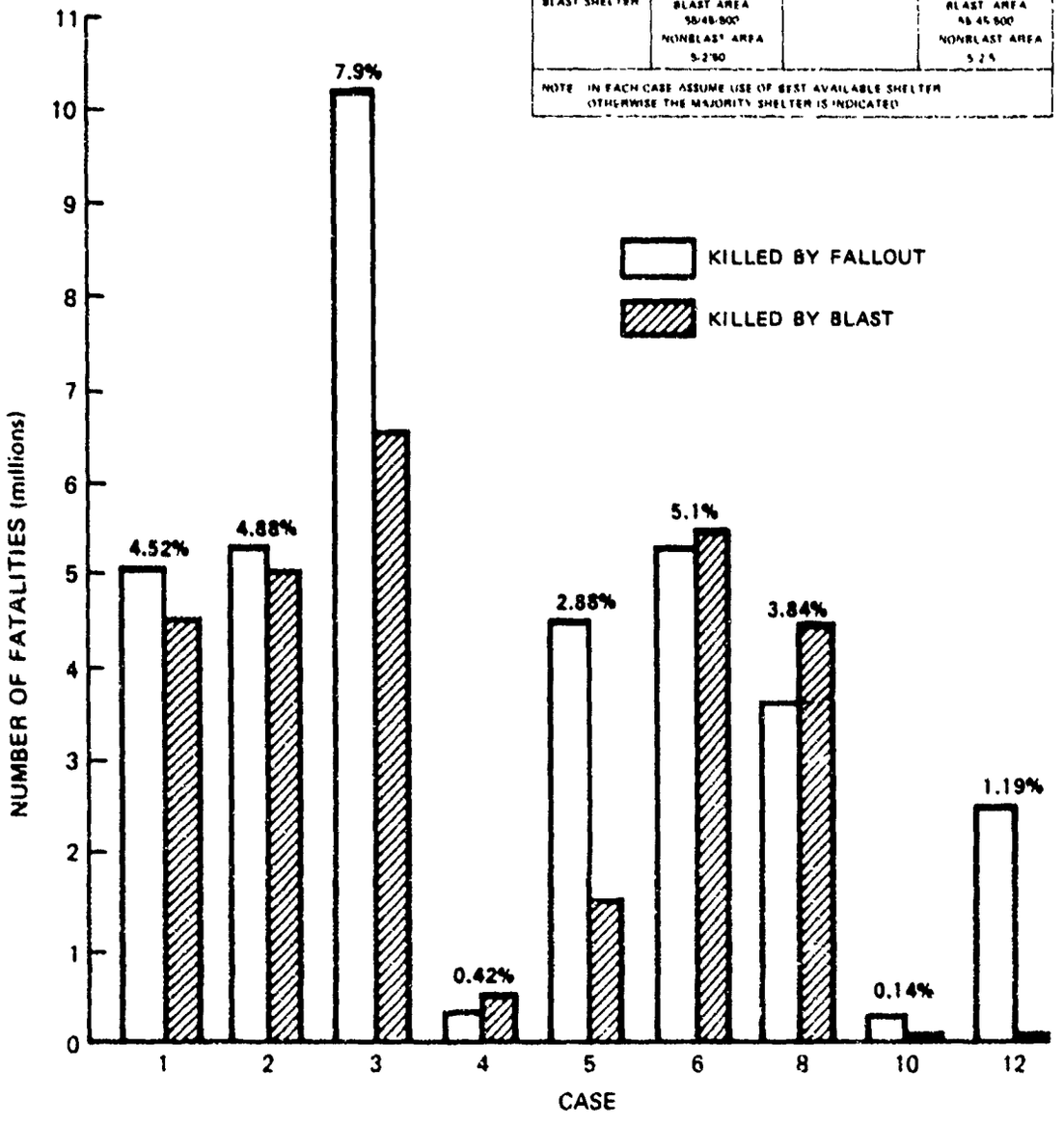
NOTE COMBINED BLAST AND FALLOUT FATALITIES AS PERCENT OF TOTAL POPULATION OF 211 8 MILLION INDICATED AT TOP OF EACH SET OF BARS

FIGURE 9. FATALITIES FOR NATIONAL COUNTERFORCE ATTACK

CASE KEY

PROGRAM	1-2 wk WARNING	24 hr WARNING	15-30 day WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC S 2-80	5 88% EVAC S 2-10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 10% AT 15-14 200	9 SEE TEXT
ISOLATED BLAST SHELTER	10 50% EVAC BLAST AREA 50/48-800 NONBLAST AREA S-2-80	11 SEE TEXT	12 NO EVAC BLAST AREA 50 45 800 NONBLAST AREA S 2 5

NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED



NOTE COMBINED BLAST AND FALLOUT FATALITIES AS PERCENT OF TOTAL POPULATION OF 211 8 MILLION INDICATED AT TOP OF EACH SET OF BARS

FIGURE 10. FATALITIES FOR NATIONAL COUNTERFORCE PLUS GOVERNMENT RESEARCH FACILITIES ATTACK

same warning time conditions. Both the evacuation and expedient shelter programs are much less effective, however, when warning times are limited to 24 hours or less. Tables 6 and 7 illustrate the computer-calculated injuries as well as fatalities. In both the CF-only and CF-plus attacks, it is apparent that fallout fatalities and injuries dominate the scene for each of the civil defense programs;[1] evacuation, blast shelters, or a combination of the two. The number of fatalities/injuries is a strong function of warning time, though to a lesser degree when blast and fallout shelter programs are in being. Since blast shelters would be built outside the pertinent radius of overpressure effects for anticipated strikes, the actual numbers of blast fatalities and injuries would be close to zero if adequate dedicated or expedient blast shelters were built in the risk areas.

B. SENSITIVITY ANALYSES OF FATALITIES/INJURIES IN THE CONTINENTAL UNITED STATES (CONUS)

Based on the results presented in Figures 9 and 10, Tables 6 and 7, and extrapolation from the more detailed analyses performed in relation to Missouri, in particular, and New Mexico to a limited degree, the following points are pertinent to evaluation of civil defense tradeoffs in the national context.

1. Blast Risk Areas

- If one assumes that the warning time will be limited to 15 to 30 minutes, only the dedicated blast shelter program is effective. (Note that there are large numbers of casualties from fallout outside the risk area, however.)

[1]The high levels of fallout produced were the result of detonating all counterforce weapons on the surface. If the assumption had been made that one of the two weapons detonated at each missile silo had been a low airburst, the total amount of fallout generated would have been reduced by about 40 percent. The latter assumption was used in the counterforce study reported upon in the Hearing before the Subcommittee on Arms Control, International Law and Organization of the Committee on Foreign Relations, United States Senate, on September 11, 1974, [Ref. 16].

TABLE 6

NATIONAL COUNTERFORCE ATTACK

Percent Killed or Injured
Total Population 211.8 Million
'Risk' Population 6.82 Million

CASE	KILLED			INJURED				UNINJURED
	BLAST	FALLOUT	TOTAL	BOTH	BLAST	FALLOUT	TOTAL	
1	.16	2.33	2.49	.01	.14	1.2	1.35	96.16
2	.17	2.5	2.67	.02	.15	1.28	1.45	95.88
3	.21	4.83	5.04	.01	.14	2.61	2.76	92.2
4	.02[a]	.15	.17	<.01	.02	.76	.78	99.03
5	.06	1.9	1.96	.01	.06	1.17	1.24	96.8
6	.2	2.51	2.71	.01	.15	1.44	1.6	95.7
8	.16[a]	1.7	1.86	.02	.14	.89	1.05	97.1
10	<.01[a]	.14	.15	<.01	<.01	.75	.75	99.1
12	.02[a]	1.19	1.21	<.01	<.01	.97	.97	97.82

[a]These values represent an upper limit based on the population density function used by the computer.

CASE KEY

PROGRAM	12 wk WARNING	24 hr WARNING	15 30 min WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 5/2/50	5 66% EVAC 5/2/10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 70% AT 15/14/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 50% EVAC BLAST AREA 56/45/500 NONBLAST AREA 5/2/50	11 SEE TEXT	12 NO EVAC BLAST AREA 55/45/500 NONBLAST AREA 5/2/5
NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED			

TABLE 7

NATIONAL COUNTERFORCE PLUS GOVERNMENT RESEARCH FACILITIES

Percent Killed or injured
Total Population 211.8 Million
'Risk' Population 75.2 Million

CASE	KILLED			INJURED				UNINJURED
	BLAST	FALLOUT	TOTAL	BOTH	BLAST	FALLOUT	TOTAL	
1	2.13	2.39	4.52	.05	2.90	1.17	4.13	91.34
2	2.35	2.53	4.88	.06	3.16	1.25	4.47	90.65
3	3.08	4.82	7.9	.15	3.14	2.23	5.52	86.58
4	.26[a]	.16	.42	<.01	.34	.83	1.17	98.39
5	.73	2.15	2.88	.01	.96	1.37	2.34	94.77
6	2.6	2.5	5.1	.09	2.90	1.26	4.25	90.66
8	2.12[a]	1.72	3.84	.02	2.93	.9	3.85	92.31
10	<.01[a]	.14	.14	<.01	.02	.73	.75	99.11
12	.02	1.18	1.2	<.01	.01	.94	.95	97.85

[a]These values represent an upper limit based on the population density function used by the computer.

CASE KEY

PROGRAM	12 HR WARNING	24 HR WARNING	15-30 MIN WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 5/2 50	5 05% EVAC 5/2/10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 10% AT 15/14/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 50% EVAC BLAST AREA 55/45/500 NONBLAST AREA 5/2/50	11 SEE TEXT	12 NO EVAC BLAST AREA 55/45/500 NONBLAST AREA 5/2/5

NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED

- If one assumes 24-hour warning, the expedient shelter program could be fairly effective (provided everyone knew what to do in advance) but much less certain than the dedicated blast shelter system. A combination of expedient shelter and crisis relocation should be relatively effective as compared to the present CD. (Once again, however, fallout fatalities are high outside the blast risk areas.)

- If one assumes 72-hours warning or more (one to two weeks would be better) the expedient shelter program could be almost as effective as the dedicated blast shelter program. Based on extrapolation, the number of blast fatalities and injuries would decrease to very nearly zero. A combination of crisis relocation with expedient shelters would almost certainly be as effective as dedicated blast shelters and might be better in the sense that less people would have to spend extended periods of time in shelters awaiting the necessary decrease in radiation levels from fallout. (Note however, that the evacuees may still be in jeopardy unless moved to areas where there will be no fallout or where adequate fallout shelter can be provided.)

- The performance of the current CD program would be inadequate under conditions of nuclear attack, particularly so in case of a full-scale attack. Full-scale attack results are compared to the consequences of the limited attacks in Figure 11 and Appendix C, Table C-1. (Note that crisis relocation may be essential in preparation for a full-scale attack, since both dedicated and expedient blast shelters are more difficult to build and less effective in urban areas.)

  -- The "counterforce-only" attack, as noted previously, includes two surface bursts of about a megaton on each ICBM silo plus one or two surface bursts on each of the SAC bases and ballistic missile submarine ports. This involves some 2,000 surface detonations, 300 of which are at the Whiteman missile complex in Missouri. The "counterforce-plus research laboratories" attack adds a significant number of additional weapons detonated over suburban or urban areas; namely one or (occasionally) two air bursts at each of some 80 research laboratories, many of which are in or very near cities. Thus, roughly 50 megatons are detonated in quite densely populated areas which results in several millions of additional fatalities under the current civil defense posture.

  -- A "full-scale" attack [Ref. 1], by contrast, includes a few thousand detonations (and megatons) in addition to those directed against counterforce targets, which

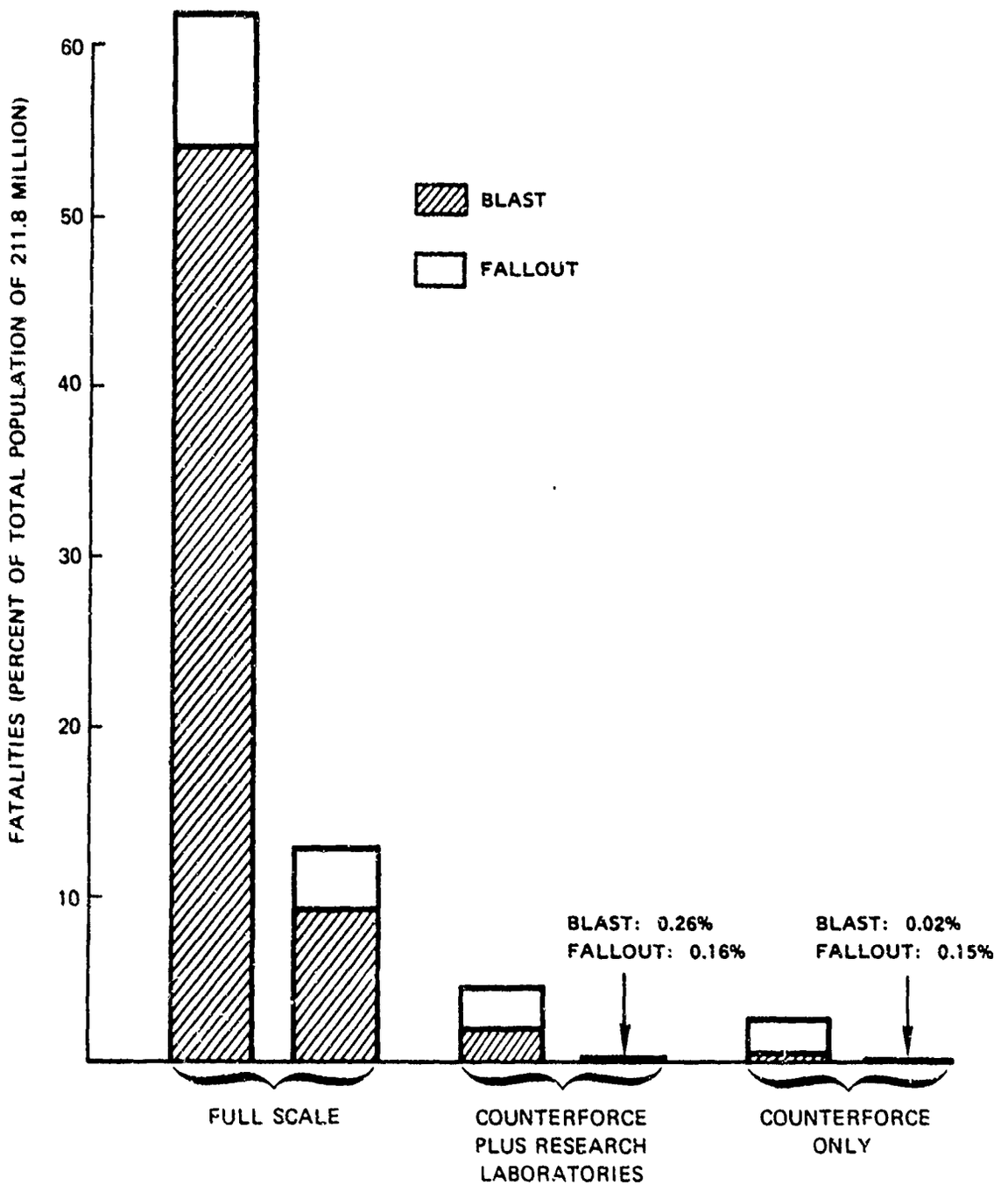


FIGURE 11. PERCENT OF TOTAL POPULATION KILLED (Left Bars Represent Current CD; Right Bars Represent Crisis Relocation)

impact metropolitan areas for the most part and results in about 30 times as many fatalities as the weapons directed against the "research laboratory targets" in the limited attack.

2. Non-Risk[1] and/or Host Areas

- While non-risk or host areas are defined, for purposes of this study, as those areas not subject to blast damage, it is evident that very large areas are at risk as a result of radioactive fallout from the surface bursts in the counterforce target areas. Since a larger or full-scale attack could involve surface or near-surface detonations in many other areas of the CONUS, there are few, if any, areas which are totally devoid of risk insofar as fallout is concerned. Most, if not all, urban and suburban areas are potentially at risk from a blast damage point of view as well.
- Fallout, if not adequately prepared for, will cause more fatalities than blast in all cases and under all attack conditions treated here. In the case of Missouri, the number of fallout fatalities exceeds the total population[2] of the blast risk area in each case. Under current CD conditions, the number of fallout fatalities in Missouri, based on wind conditions assumed, exceeded the total population of the blast risk area by a factor of 10 or more under any warning time condition. Since it costs less per capita to protect against fallout and because it takes time for fallout to arrive after a detonation (so that there is more time to react), it is clear that a balanced CD program should take this aspect into consideration.
- In addressing solutions to the problems of fallout protection, a number of factors are worth keeping in mind:

  -- The prevailing higher altitude winds (at 35,000 to 50,000 feet) are from West to East, or within 45 degrees either way some 75 percent of the time. The area covered with fallout from counterforce strikes alone is a significant portion of CONUS (see Figures 7 and 8). For a counterforce attack the majority of casualties are due to fallout carried downwind from

[1]Non-risk in terms of anticipated blast effects.

[2]Missouri blast risk area population is approximately 210,000.

the strike area to adjacent population centers. Unfortunately the winds and other weather effects are subject to infinite variations throughout the year and provide most difficult inputs to incorporate into civil defense preparations. The fallout patterns over the state of Missouri provide an excellent example to study the effects of wind variations.

-- The weapons employed in the attack considered in this report produce individual radioactive clouds with some debris extending 70,000 feet or more in height. The combined effects of 300 detonations would be expected to carry the particles even higher. These particles, in falling back to earth, pass through a number of separate air currents. These currents range in speed from up to 100 mph for the high altitude jet stream to about 10 mph for winds nearer the surface. Their directions of movement also vary and may even be opposite each other. The lower altitude (and velocity) winds are responsible for dispersing the heavier particles as they rapidly descend in the vicinity of the blast area while the lighter particles are transported by the high velocity upper air currents to points which may be hundreds of miles away.

-- The fallout patterns of Figures 7 and 8, which were produced by the computer model of the attack used in this report, are the result of the wind pattern for a particular year and a particular date in March. This wind pattern is meant to be representative of average wind conditions, but should not be considered the wind picture at all times in the event of attack. A revealing picture is presented in Figure 12 which shows the percentage of time the wind might be blowing in a particular direction at 35,000 feet. Only major directional components are presented and they account for only about 80 percent of the complete picture. What is shown, however, is that there is a considerable probability that the wind will be blowing somewhere within a 90 degree sector centered around due east. The computer analysis was conducted for a wind traveling nearly due east. From the discussion above it is seen that fallout patterns cannot be predicted with infallible accuracy. Clearly one does not want to evacuate people into a region subject to heavy fallout nor does one want to provide inadequate fallout shelter.

-- Figure 13 shows that, as program changes are made which reduce the number of fallout fatalities, the number of injuries increases in almost direct proportion. Since

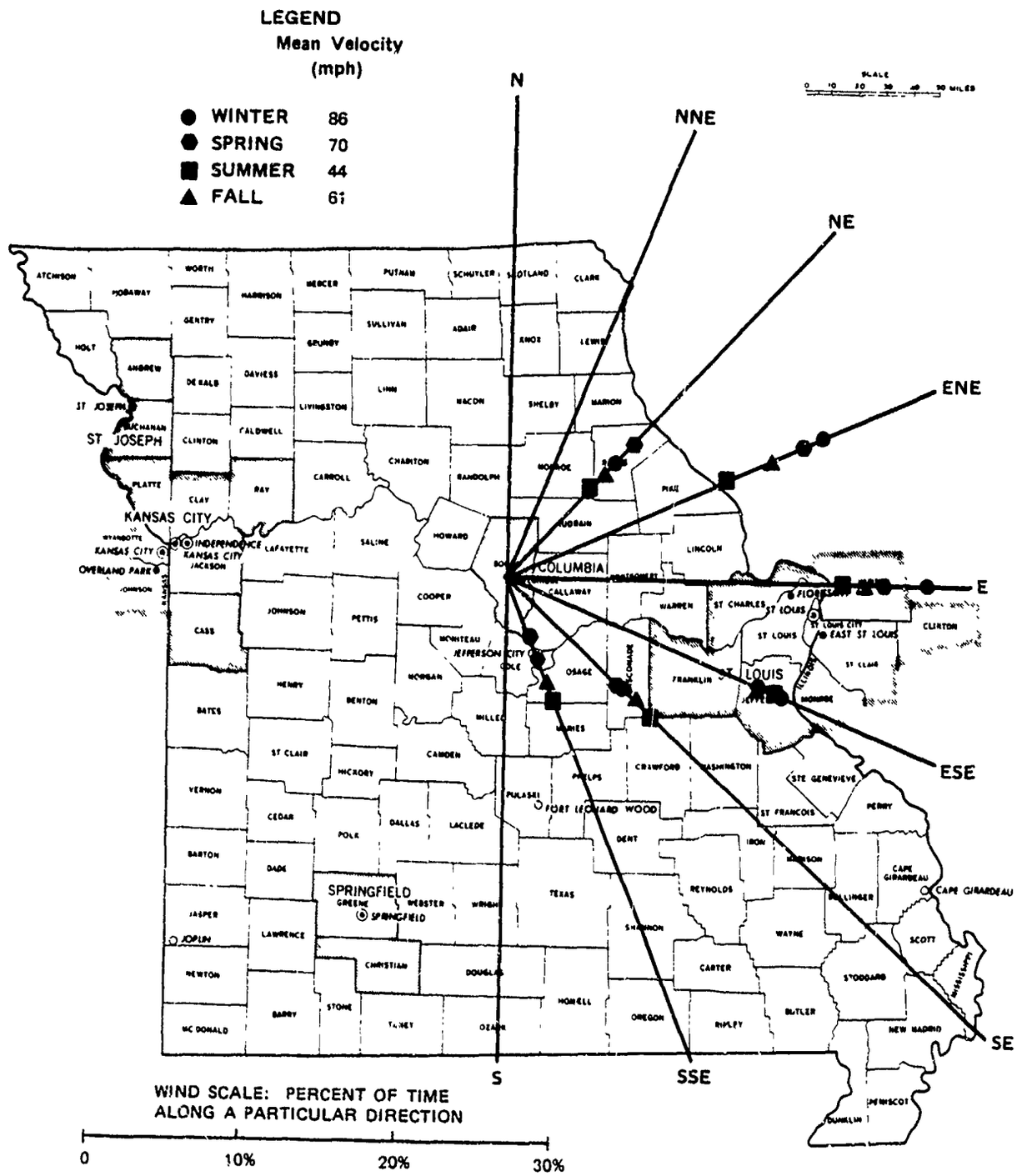


FIGURE 12. MISSOURI, DIRECTIONAL DISTRIBUTION OF WINDS AT 35,000 FT DURING EACH SEASON

CASE KEY

PROGRAM	1-2 wk WARNING	24 hr WARNING	15-30 min WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 8% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 6/2/50	5 66% EVAC 5/2/10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 8% EVAC 10% AT 15/14/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 80% EVAC BLAST AREA 50/40/500 NONBLAST AREA 5/2/50	11 SEE TEXT	12 NO EVAC BLAST AREA 50/40/500 NONBLAST AREA 5/2/5

NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED

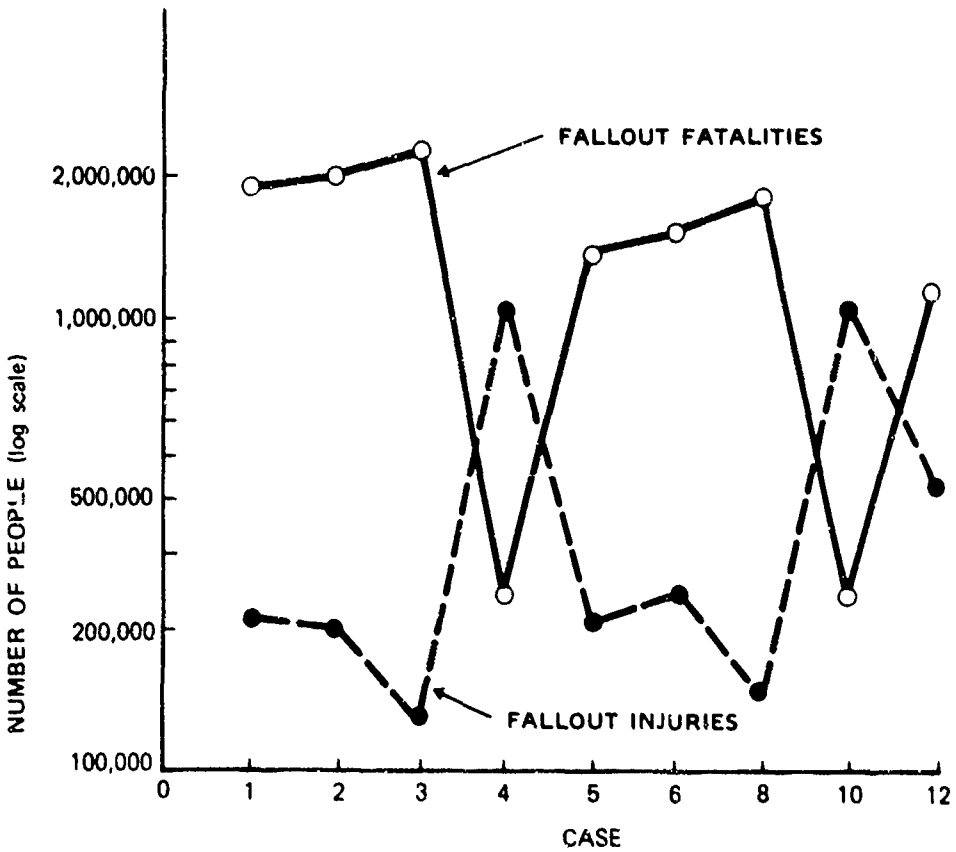


FIGURE 13. COMPARISON OF FATALITIES AND INJURIES BY CASE IN MISSOURI

the fallout protection factor criterion for this study was a PF of 50 in most cases, this implies that a PF of 50 is inadequate, at least in the areas downwind from massive counterforce attacks. That this may apply mainly to the areas which are downwind from multiple surface bursts is reinforced by the observation that this pattern is much less pronounced in the national results (Tables 6 and 7) than for Missouri. This could, however, be attributed to the fact that the heavy fallout areas resulting from attacks in the northern U.S. are less heavily populated. Based on evaluation of results in Missouri which are addressed later, it is clear that a PF of 500 is more than adequate and that a PF of 200 is probably adequate, particularly since the ground roughness factor has not been included.

-- Figure 14 shows accumulated dose as a function of time, assuming no fallout protection, and the dose rate in roentgens as a function of time. This is for a particular place in Missouri and is representative of heavy fallout but is by no means the worst case. It does show, however, that individuals will have to stay in shelters for considerable lengths of time before venturing outside for more than a short period of time. It has been suggested that one might, if close enough to an uncontaminated area, leave the shelter to move there. This would involve evaluating the tradeoff between longer and shorter exposure times at lower and higher exposure rates, respectively.

C. SENSITIVITY ANALYSES OF FATALITIES/INJURIES IN MISSOURI AND NEW MEXICO

In addition to the computer analyses of the impact on CONUS, detailed computer analyses were provided by county and simple sensitivity analyses performed to estimate variation in fatalities and injuries as a function of protection factor and warning time in Missouri and New Mexico. Missouri and New Mexico represent individual state cases which are toward either extreme of the range of damage anticipated from the postulated attacks, although there are a few states which escape injury completely.

Missouri represents a case of heavy potential damage for most scenarios, and is an extreme case particularly in the CF-only attack postulated here since other affected areas are sparsely populated in comparison. The sensitivity analyses, as applied to Missouri, are concerned in large part

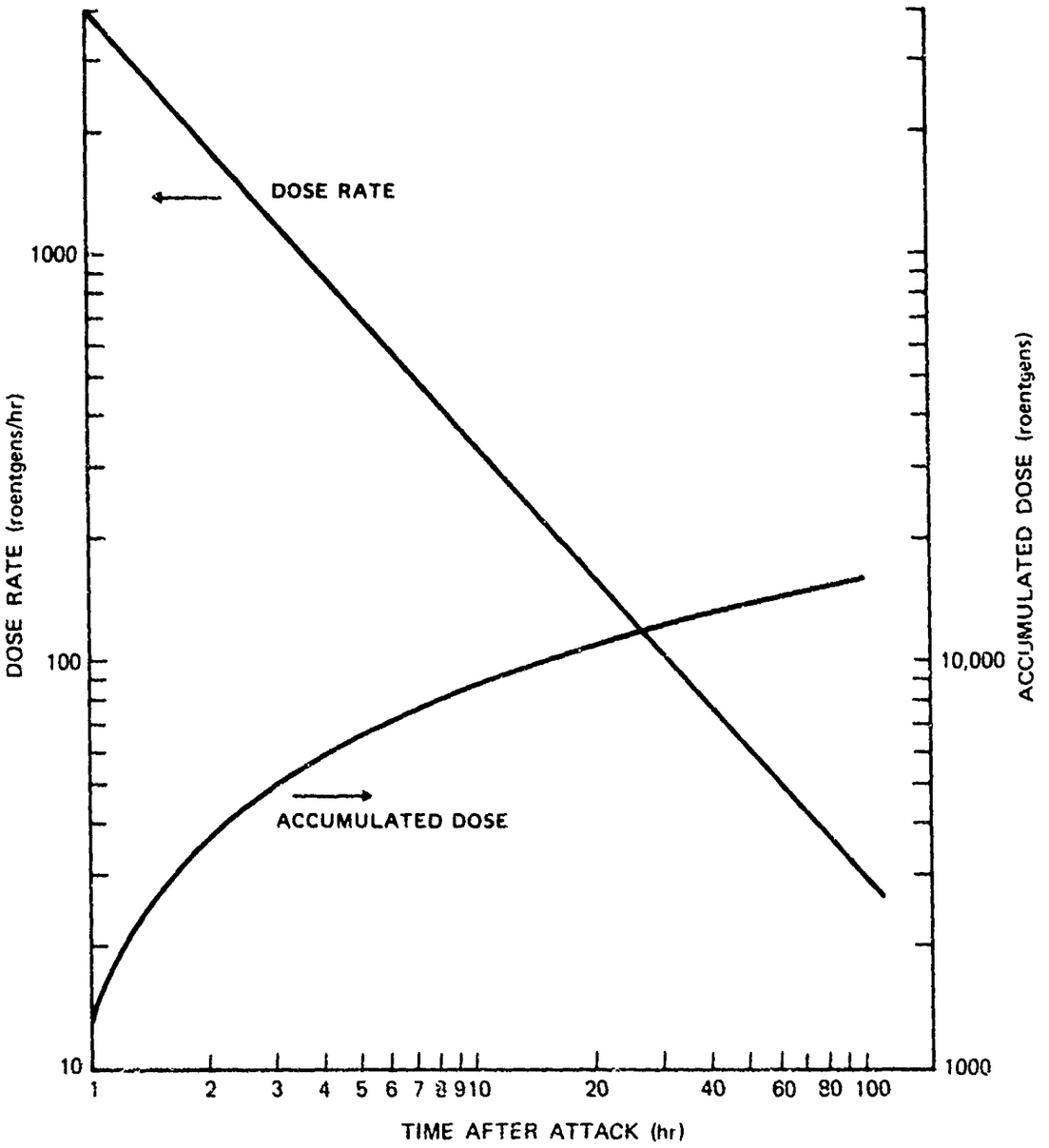


FIGURE 14. THE DOSE RATE AND ACCUMULATED DOSE FOR A POINT IN CAMDEN COUNTY, MISSOURI AS A FUNCTION OF TIME SINCE ATTACK OCCURRED

with the impact of crisis relocation, the requirements for shelter in the blast risk areas and the consequences of fallout within the rest of the state.

New Mexico is considered to be at the low end of the potential damage spectrum because there are only a few targets under any strike scenario, and, with the exception of Bernalillo County (Albuquerque), the population is comparatively sparse. Because of the nature of the potential targets in New Mexico, it is assumed less likely that surface detonations would be deliberately employed; therefore, fallout would not create nearly the potential problem that it does in Missouri where, because of the number of missile sites, large numbers of relatively high-yield surface detonations may be anticipated under any but the most limited of attack scenarios.

The range of possibilities and the sensitivity of results in terms of potential fatalities and injuries, as well as possible modification of response in terms of civil defense planning or activity, are discussed in the sections which follow.

1. Missouri

Figure 15 illustrates the blast risk area, and the expected area of appreciable fallout from the attack postulated. The population distribution, before and after the evacuation assumed for the computer analysis (based on 1975 Bureau of Census estimates), is shown in Figures 16 and 17. This evacuation model distributes the population evacuated from the blast risk areas uniformly in proportion to the existing population throughout the remaining counties of the state. This is quite different than present plans which are shown in Appendix A. This also adds population to counties which suffer from heavy fallout based on these attacks. An evaluation of possible evacuation schemes to reduce the population in areas at risk from fallout is included in Appendix C.

Table 8 shows the results of the DCPA computer runs for Missouri fatalities for the set of programs and warning times. For Missouri, the results are the same for CF-only and CF-plus attacks. These results are

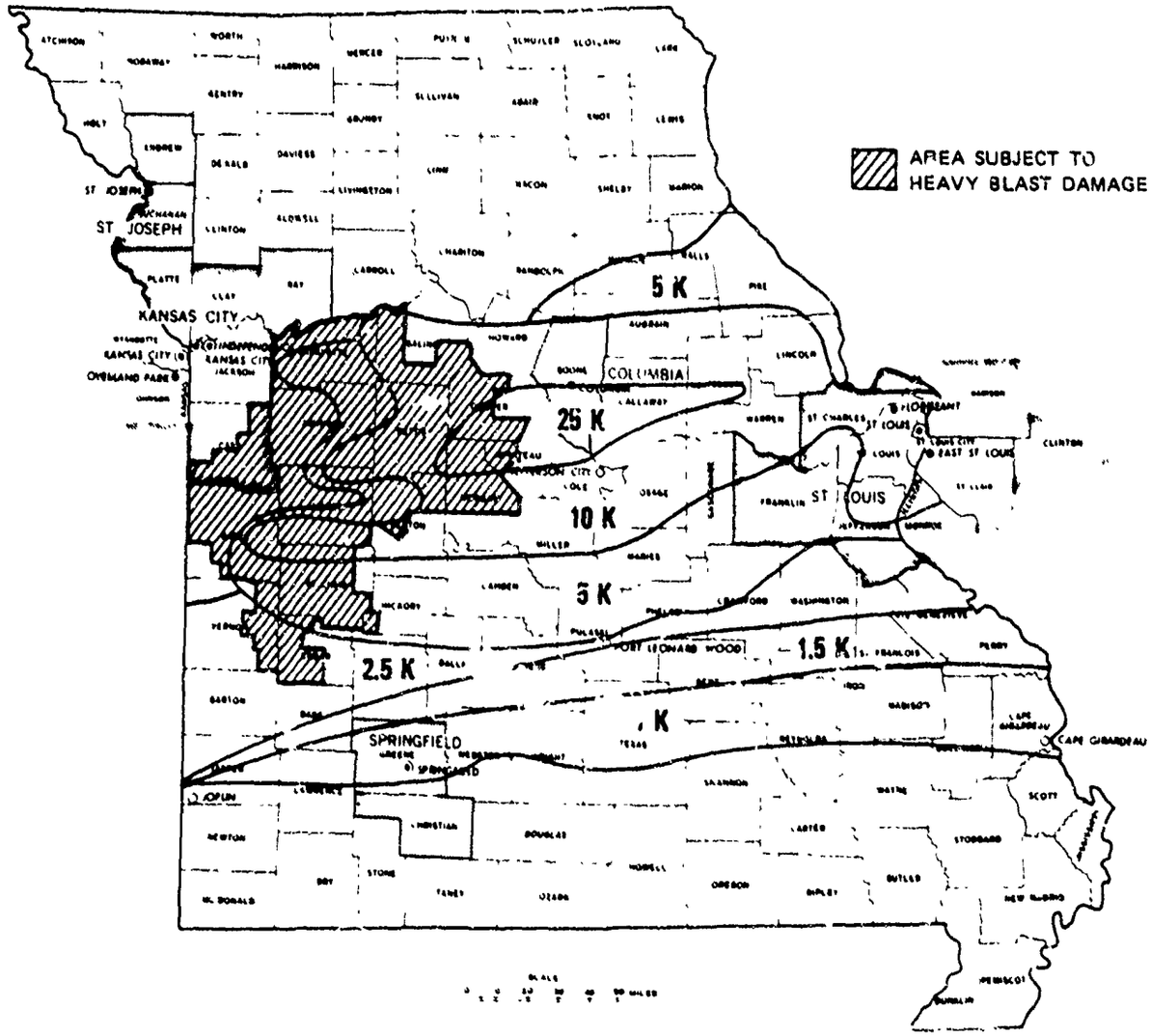


FIGURE 15. MISSOURI, BLAST RISK AREAS AND ESTIMATED FALLOUT PATTERN
(Accumulated Dose in thousands of Roentgens)

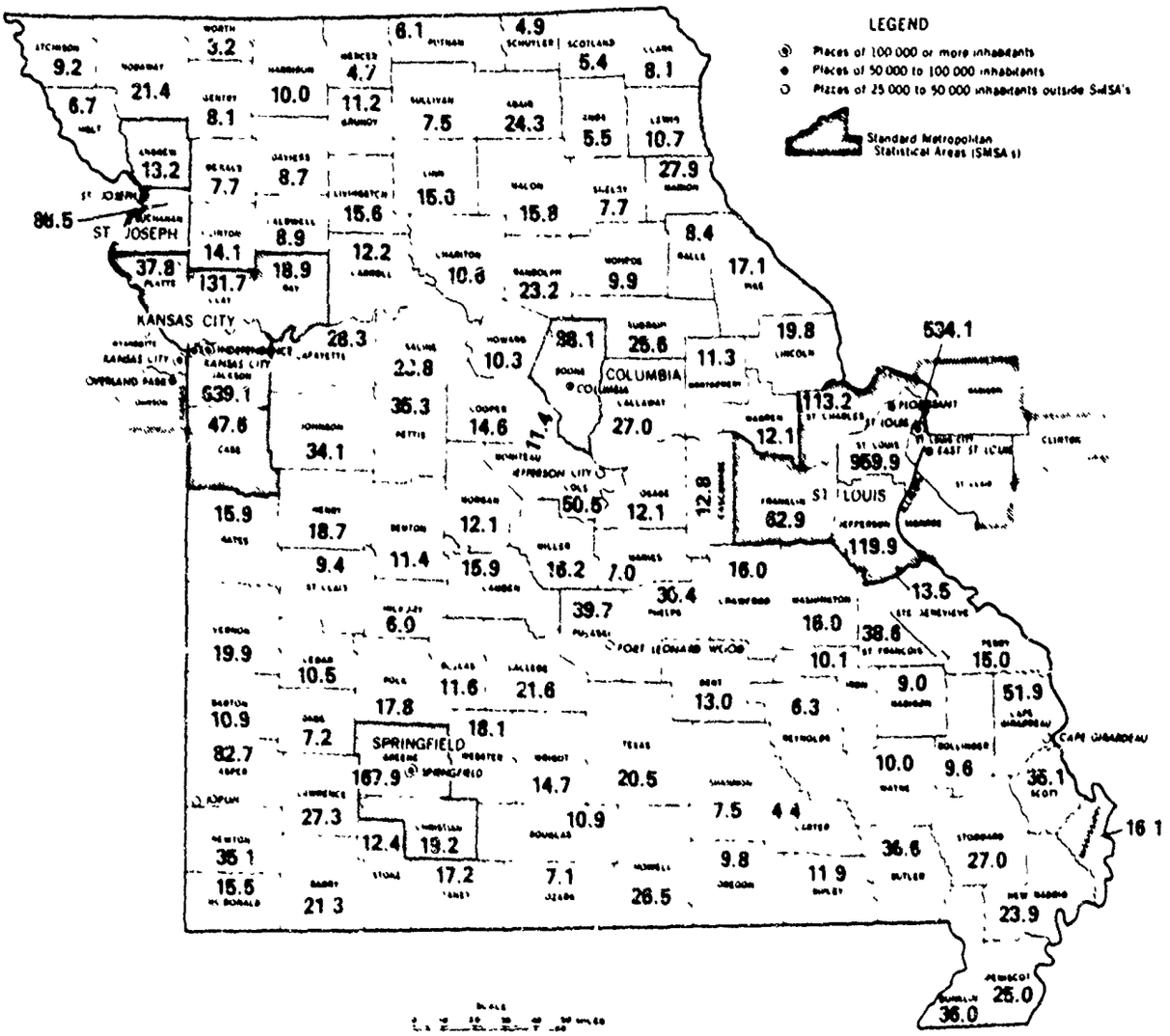
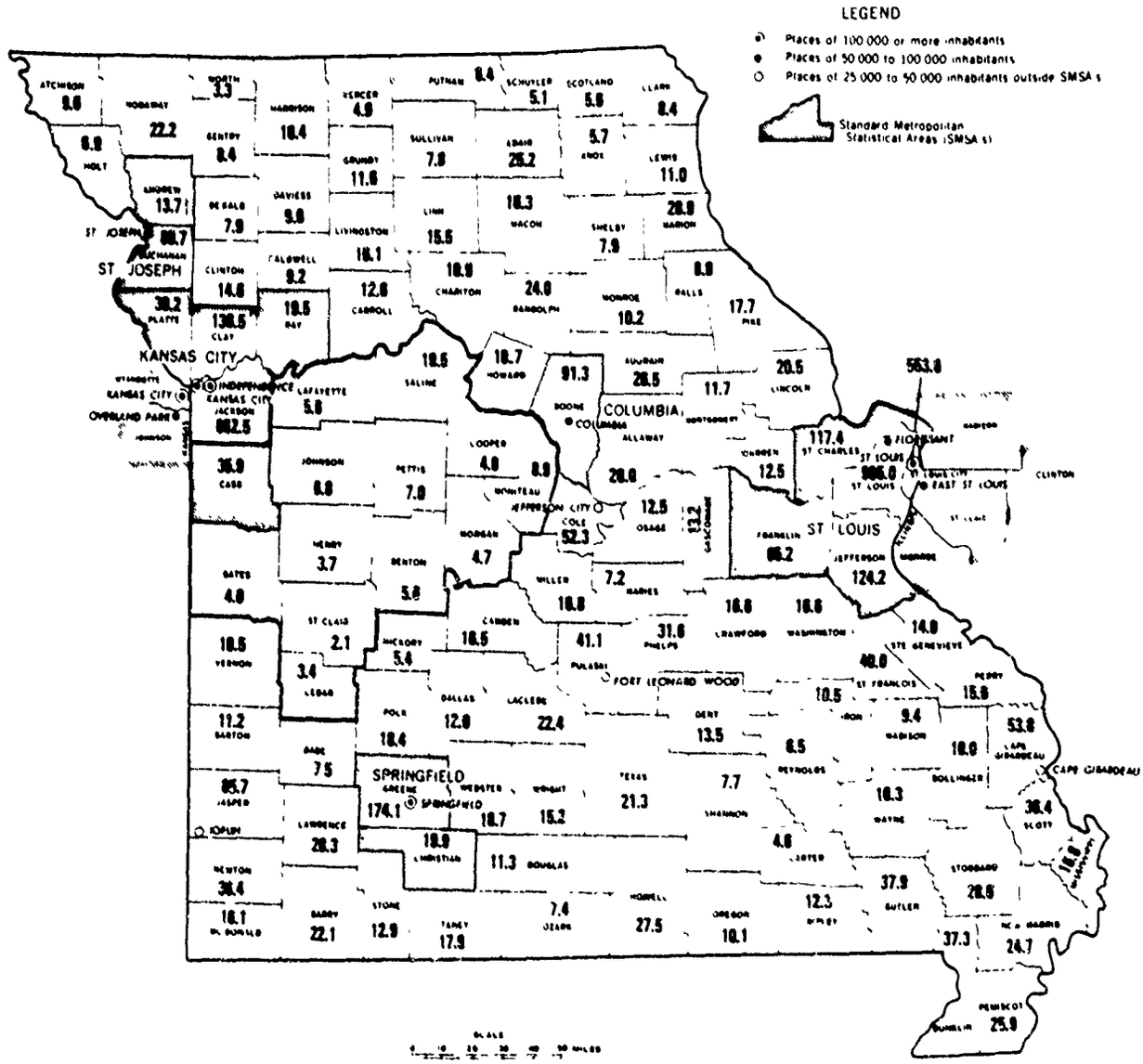


FIGURE 16. MISSOURI, INITIAL POPULATION IN THOUSANDS, DCPA ESTIMATES



EVACUATED AREA INDICATED BY DARK BORDER
POPULATION IN THOUSANDS

FIGURE 17. MISSOURI, FINAL POPULATION FOR EVACUATION PLAN A (DCPA ALGORITHM FOR 80% EVACUATION FROM INDICATED COUNTIES)

TABLE 8

MISSOURI FATALITIES BASED ON DCPA COMPUTER ANALYSES
(Percent of State Population of 4.8 Million)

Program \ Warning Time	1-2 Weeks	24 Hours	15-30 Minutes
Current CD	42.4	44.2	51.1
Crisis Relocation	5.2	30.7	33.5
Expedient Shelters	a	40.3[a]	a
Dedicated Blast Shelters	5.0	--	24.1

[a]The assumed scenario cannot be characterized by a single warning time; see text.

NOTE: Same results for "counterforce-only" and for "counterforce-plus research laboratories" attacks.

shown graphically in Figures 18 and 19, which show the reduction in the number of casualties and in the number of fatalities, respectively, as a function of upgrading the protection afforded for the various warning times. These bars represent the gain, measured in number of lives, achieved by greater protection and increased warning time. Figures 13, 20, and 21 demonstrate that as the number of fatalities are decreased, the number of injured increases, except for the dedicated blast shelter case where the population in the "at risk" areas has much greater fallout protection. This shows that the PF factor of 50 for the host areas decreases the number of fatalities by a large amount but that the number of injured increases by almost as large an amount, indicating that protection factors greater than 50 would be of advantage downwind from counterforce strike areas.

Missouri represents a case in which an essentially counterforce attack can result in casualty figures comparable to a counterpopulation attack. This is the most extreme instance where a definite strategic target of large-scale proportions lies near a region of moderate-to-heavy population density. The spacing of the individual detonations is such that the superposition of 300 single explosions would undoubtedly widen the lethal zone beyond what might normally be expected from a simple addition of each weapon's lethal zone. Most above-ground structures, within the area encompassed by the Minuteman sites, would be damaged or destroyed. This area then represents a core towards which civil defense planners must direct their attention to minimize loss of life.

While the immediate blast areas represent definite risk zones, the amount of radioactive fallout will assure that the zone of fatalities will extend well beyond the zone of blast destruction. The limits of this larger lethal area are much less predictable. Depending on atmospheric conditions, the radioactive envelope might be confined to an intensely active region near the points of attack, or it might extend to a much larger area of moderate-to-heavy radiation. In the latter case, the location and size of this area would depend on the wind directions and speed at relevant altitudes. One readily observes from the fallout pattern (Figure 15) and

CASE KEY

PROGRAM	1-2 wk WARNING	24 hr WARNING	15-30 min WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 5/2/50	5 65% EVAC 5/2/10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 10% AT 15/14/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 50% EVAC BLAST AREA 50/45/500 NONBLAST AREA 5/2/50	11 SEE TEXT	12 NO EVAC BLAST AREA 55/45/500 NONBLAST AREA 5/2/5

NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED

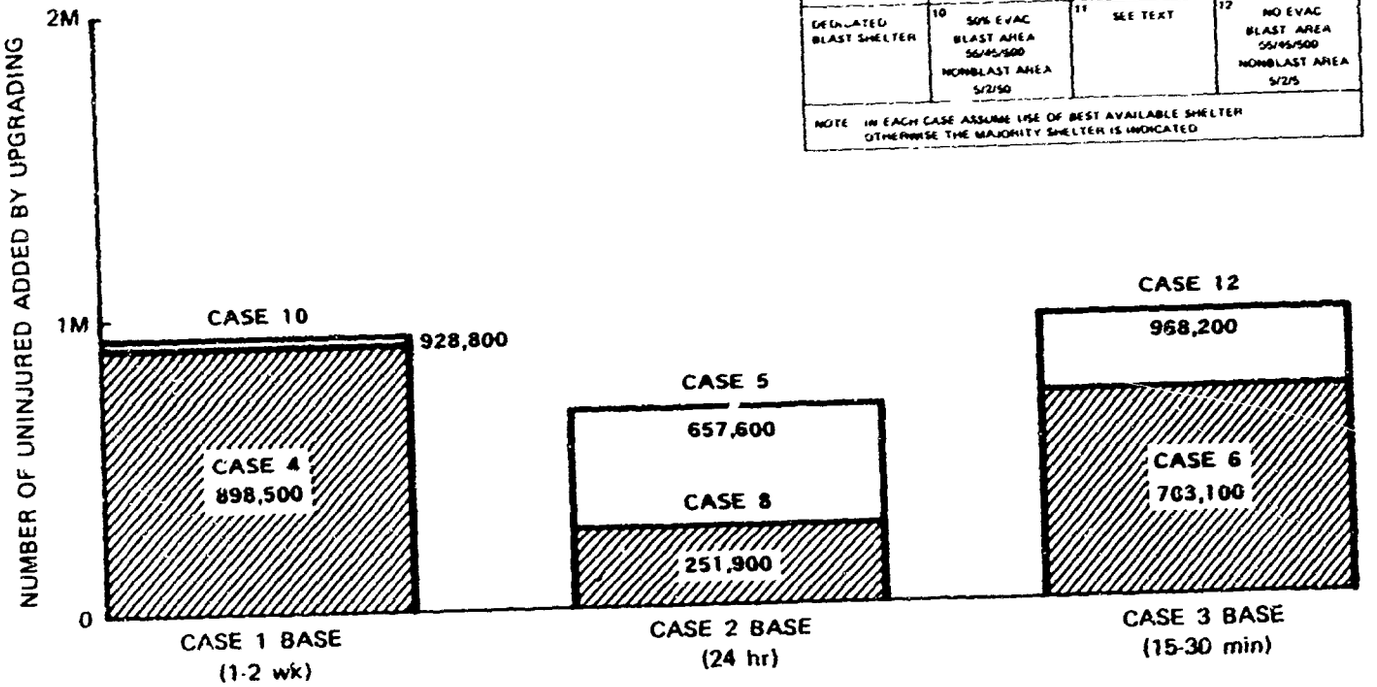


FIGURE 18. NUMBER OF UNINJURED ADDED WITH INCREASED SHELTER PROTECTION FOR DIFFERENT WARNING TIMES IN MISSOURI

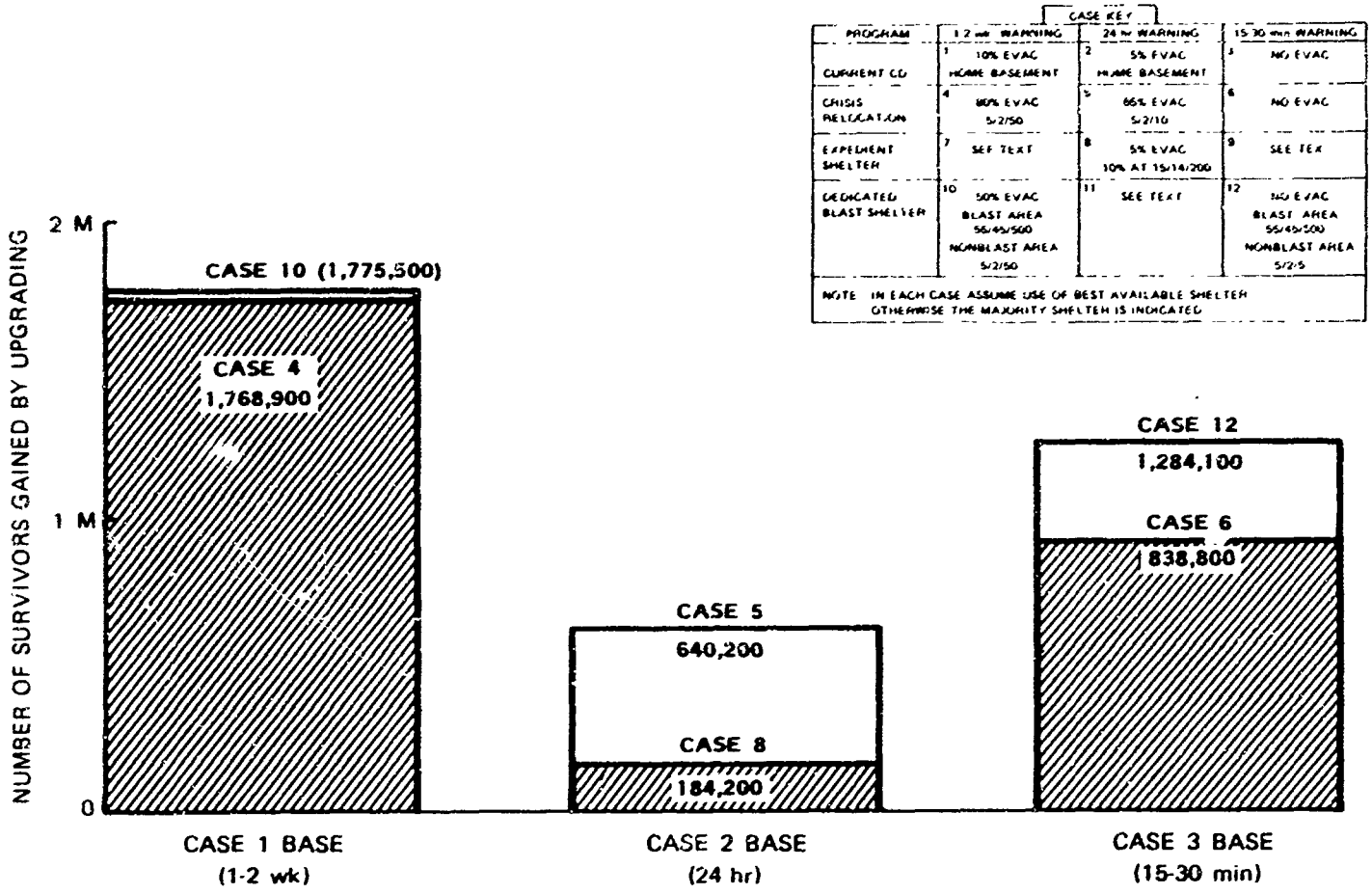


FIGURE 19. NUMBER OF SURVIVORS GAINED WITH INCREASED SHELTER PROTECTION FOR DIFFERENT WARNING TIMES IN MISSOURI

CASE KEY

PROGRAM	1-2 wk WARNING	24 hr WARNING	15-30 min WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 5/2/80	5 66% EVAC 5/2/10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 10% AT 15/14/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 50% EVAC BLAST AREA 55/48/600 NONBLAST AREA 5/2/50	11 SEE TEXT	12 NO EVAC BLAST AREA 55/45/600 NONBLAST AREA 5/2/5
NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED			

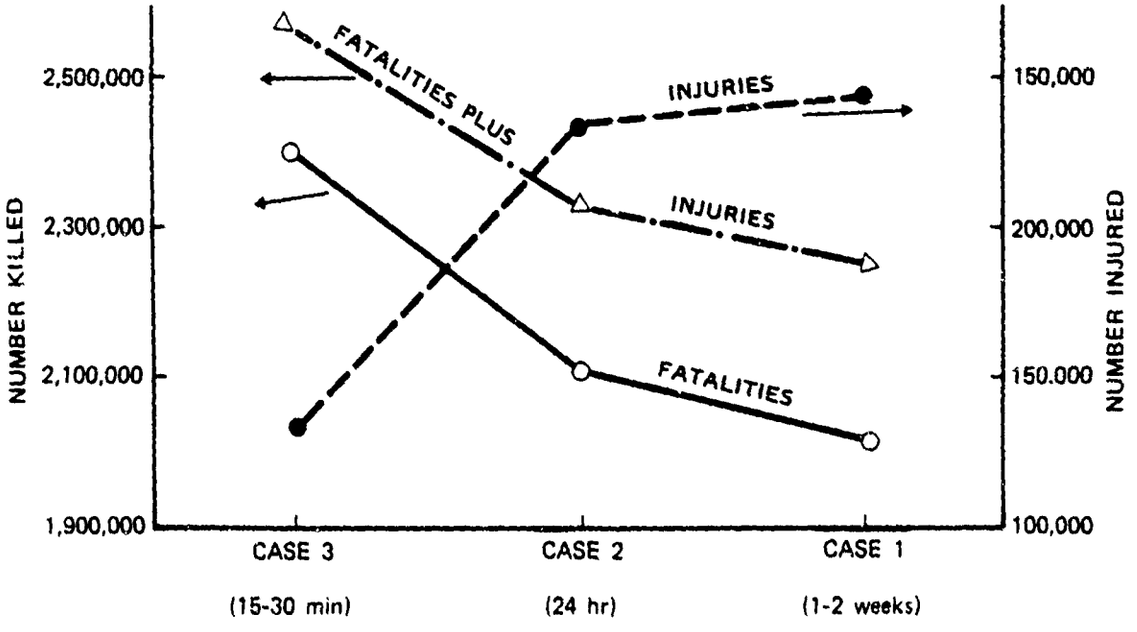


FIGURE 20. CASUALTIES VS WARNING TIME IN MISSOURI

CASE KEY

PROGRAM	1-2 wk WARNING	24 hr WARNING	15-30 min WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 5/2/80	5 80% EVAC 5/2/10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 10% AT 15/14/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 50% EVAC BLAST AREA 58/48/500 NONBLAST AREA 5/2/80	11 SEE TEXT	12 NO EVAC BLAST AREA 58/48/500 NONBLAST AREA 5/2/5

NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED

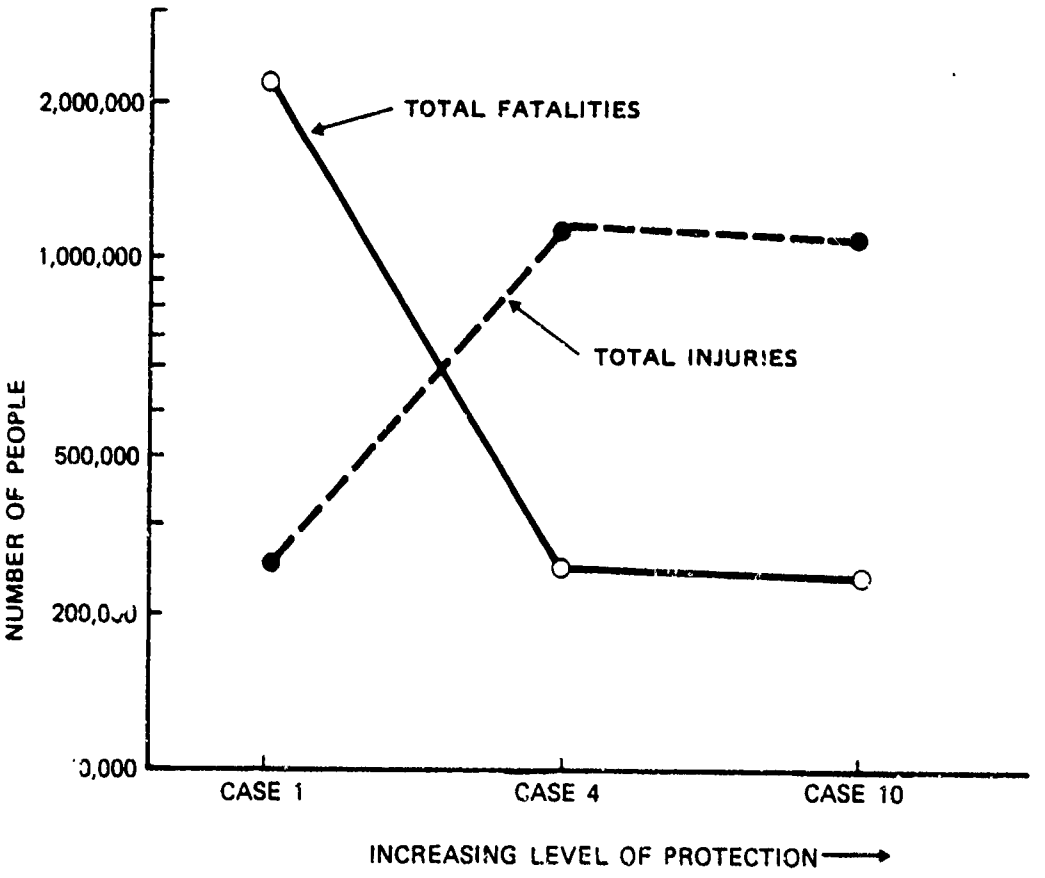


FIGURE 21. CASUALTIES VS LEVEL OF PROTECTION AND EVACUATION IN MISSOURI

the number of fatalities (Table 8) for Missouri that a large percentage of the casualties are the result of fallout outside those areas designated as "risk" areas. These numbers would be greatly reduced if provisions were made for evacuation and/or fallout protection in the affected counties.

Evacuation plans and/or shelter programs of many kinds have been analyzed over the last few decades. During that period, a number of common, generally acceptable factors have been established. Some of them are that:

- In displacing large groups of people from a risk area to an area not considered at risk, the total population of the host area, after relocation, should not exceed roughly six times the normal (census) population of the area. (There are states or areas within states, such as California, where this criteria cannot be met because the risk areas are so heavily populated compared to the host areas.)
- The number of individuals who will remain in a risk area rather than evacuate (and/or because they cannot move for one reason or another, such as being a member of the critical workforce) would probably be roughly 20 percent of the initial population. Therefore, the expected number of individuals to be relocated from "risk" to host areas is roughly 80 percent.
- Protection factors (against radiation from fallout) of 50 are relatively easy to achieve in areas where homes have basements (Table 9), and factors of several hundred are achievable in the open (areas where there are few or no basements) with an appreciable amount of hard work (manual labor) in most areas and under most conditions.
- Even after evacuation from "risk" areas (which are at risk because of blast and/or shock), evacuees may, and for many scenarios will, need fallout protection.
- Tradeoffs between the effectiveness of evacuation and the advisability of advanced preparation of hardened shelters (against blast and/or high levels of fallout requiring protection factors of several hundred) are a strong function of the amount of warning time. Since key workers will have to stay in the "risk" areas, it is generally acknowledged that an effective civil defense program "should" include blast and fallout shelter systems for those workers, at least.

In performing sensitivity analyses, SPC utilized a computer model for relocation which includes the constraints above, i.e., that 80 percent of the population in "risk" and high density counties is moved to "non-risk"

TABLE 9

PROTECTION FACTORS OBTAINED BY AN EARTH COVER OVER A FULLY SUBMERGED[a] BASEMENT

Protection Factor	Earth Thickness (Inches)
25	6-1/2
50	9
100	12
250	15-1/2
500	18-1/2
1,000	21-1/2

[a] If basement walls rise above ground level, a comparable amount of dirt would have to be piled along the outside of these walls.

counties within the state, that the final population of any county not be greater than six times the initial (normal) population, that the residents of medium density counties are left in place (no county is partially evacuated), and that, within the constraints above, the final population density (population per square kilometer) is made as uniform as possible. The algorithm is designed to carry out an iterative process until all of the criteria are met. Note that if there are too many counties at "risk," host counties may become saturated at six times their initial population levels and leave a balance of population with nowhere to go within the state under these criteria. This is unlikely to happen if the "at risk" areas are confined to blast and shock effects only, unless a state has an extremely large number of such risk areas; but when fallout is considered, particularly in relation to low protection factors (short warning times), such a surplus could occur. Options may be to move the excess evacuees into counties of neighboring states or to take preparatory measures to increase the fallout protection factors. In the case of short warning times, this implies an "in being" fallout shelter program established to protect population "in place" as a hedge against the eventuality of full-scale nuclear exchange.

As discussed earlier in this chapter, winds must be considered in evaluating potential fallout characteristics. For the yields considered in this analysis, winds at 35,000 to 50,000 feet (around 100 millibars) are most significant much of the time. The detonation cloud forms at the height of the jet stream which is the dominant wind at these altitudes. Figure 12 depicts these winds based on a selected pattern for each season of the year. The fallout pattern of Figure 15 resulted from the March winds which flow almost due east.

A simple analysis was conducted to determine the most probable affected areas within the normal variation of wind patterns. By taking the 10,000 roentgen contour of Figure 15 and rotating it through the directional variations indicated in Figure 12, it is possible to accumulate a probability value for any county's chances of receiving 10,000 R or more under normal circumstances. These probabilities are shown in Figure 22. They are probably accurate to within 10 percent. Such a diagram provides a reasonable basis for indicating which counties to avoid as host areas for evacuation planning and which counties are most in need of considerable fallout protection. It should also be noted that it would be prudent practice to weight the probability of risk. Thus, the need for fallout protection in the heavily populated St. Louis area, which has only 30 percent risk from the postulated attack on the Whiteman missile complex, might be deemed equal or greater than that for an adjacent area having 40 to 50 percent risk but a lower population or population density.

Although it may be both economically and practically impossible to provide desirable protection for all contingencies, Figure 22 identifies areas where unprotected people would be subject to lethal radiation doses if an attack were to take place during an appreciable part of each year (10,000 roentgen or higher). Clearly those regions suffering moderate fallout in the March wind pattern would experience heavy fallout if the winds shifted in the corresponding direction. Casualties would be reduced under most conditions by directing an evacuation program opposite that of the most probable winds. Increasing the level of fallout protection throughout those areas encompassed by the band of probable wind shifts would be

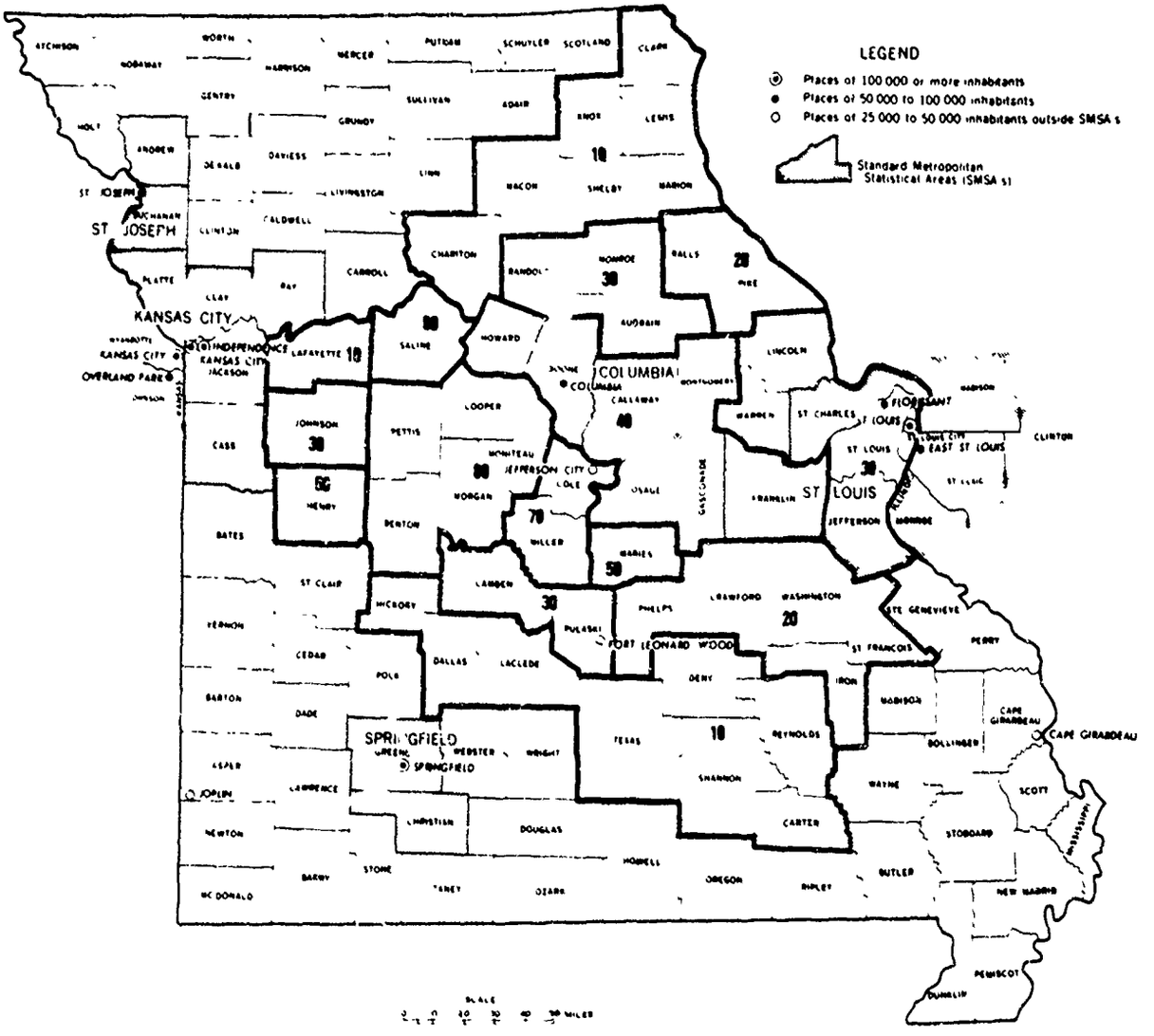


FIGURE 22. MISSOURI. PROBABILITY OF RECEIVING AN ACCUMULATED DOSE OF 10,000 R OR GREATER (to nearest 10%)

of major benefit. The level of protection necessary is, for the most part, not difficult to achieve when simultaneous blast protection is not required.

Table 10 provides a summary of results of various CD program variations in terms of estimated fatalities for Missouri and New Mexico. In the Missouri portion of the table, the impact of reducing the number of people at risk in the counties subject to heavy fallout is clear. A more detailed description of these results is presented in Appendix C. Note that provision of adequate fallout shelters would serve the same purpose as relocation in terms of reduction in fatalities.

2. New Mexico

As indicated in the introduction, New Mexico represents a special case on the low end of the expected damage scale for most, if not all, scenarios. The scenario used for this analysis involves five strikes against New Mexico, two each at Kirtland AFB and the White Sands Test Center, and one at Los Alamos. These are all one megaton detonations fired at the optimum HOB to maximize the 10-psi overpressure radius of effect. Under these targeting criteria and normal weather conditions, the amount of fallout would be negligible. There is at least some possibility of a surface detonation even if not planned by a potential attacker. Since surface or near-surface detonations produce fallout, this possibility may be a consideration in developing relocation plans and/or fallout shelter programs. Under this scenario, for example, surface detonations at Los Alamos might cause appreciable fallout in Santa Fe.

TABLE 10

SENSITIVITY ANALYSIS SUMMARY FOR MISSOURI AND NEW MEXICO
(1-2 Weeks Crisis Buildup; Assumes March Winds)

	Attack/Program Variation	Estimated Fatalities		
		Blast	Fallout	Total
Missouri	Current CD (Case 1)	52,600	1,963,000	2,016,000
	Present CD Evacuation Plan[a]	0	119,000	119,000
	80-Percent Evacuation of Blast Areas	8,000	239,000	247,000
	80-Percent Evacuation of Blast Areas Plus Population Centers	8,000	172,000	180,000
	80-Percent Evacuation of Blast Areas, Population Centers and Heavy Fallout Areas	8,000	113,000	121,000
	80-Percent Evacuation of Blast Areas, Population Centers and Most Downwind Areas[c]	8,000	59,000	67,000
New Mexico	Current CD (Case 1) CF Only	0	4,200	4,200
	Current CD (Case 1) CF Plus	152,100	4,400	156,500
	Current CD (Case 1) Surface Burst[b]	75,000	20,000	95,000
	Present CD Evacuation Plan[a]	12,500	0	12,500
	80-Percent Evacuation of Blast Areas	12,900	0	12,900

[a]The evacuation plans mentioned here are described in more detail elsewhere in the chapter and in Appendix C.

[b]Most attacks assume airbursts for the New Mexico targets. This case is provided as a comparison. The results were obtained by extrapolating the airburst figures for a reduced blast radius and assuming an idealized fallout pattern. For the March winds assumed, the fallout fortuitously avoids most nearby populations. Shifts in the wind could increase the fallout deaths beyond the total fatalities for the airburst case. The blast fatalities probably represent an upper limit.

[c]The areas involved also contain most of the region covered by wind shifts.

a. Estimate of Blast and Shock Fatalities/Casualties[1]

Locations of the five detonations within New Mexico are shown in Figure 23. The two detonations each at Kirtland AFB (Albuquerque) and White Sands are so close together that it is difficult to distinguish them at this scale. Figure 24 shows the approximate distance between centers at Albuquerque. The extent of the overpressure zones for the detonations at White Sands and Los Alamos is presented in Appendix C. Table 11 shows the expected fatalities for New Mexico for the various cases. A more detailed breakdown of estimated fatalities and injuries is provided in Appendix C. The results may be low by as much as a factor of 2, since, in Albuquerque, much of the area subjected to sequential (or simultaneous) 2- to 5-psi peak overpressures from two bursts might suffer the same or a greater degree of effect as at 5 psi from a single detonation. Note that this overlapping zone encompasses most of the area of the city while the 5 psi limits for the two detonations encompass less than half of it.

Table 10 depicts the results depending on evacuation models. The larger number of casualties under the present plan for New Mexico results from the evacuation of part of Bernalillo County into Los Alamos. The DCPA computer analysis and SPC results are based on an assumption that Los Alamos is evacuated (80 percent) as a result of being a county at risk, rather than a host county.[2]

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[1] In massive general attack scenarios, serious injuries result in fatalities because of the physical impossibility of treating them with limited medical capability. For these attack scenarios, however, assuming that evacuation and protection systems are effectively utilized, many of the injured could be treated, perhaps, at medical facilities outside the affected areas.

[2] This is a result of the differences in scenarios between the "counterforce plus government research facilities" attack and that of TR-82 [Ref. 3] which is a heavier attack based on another set of premises.

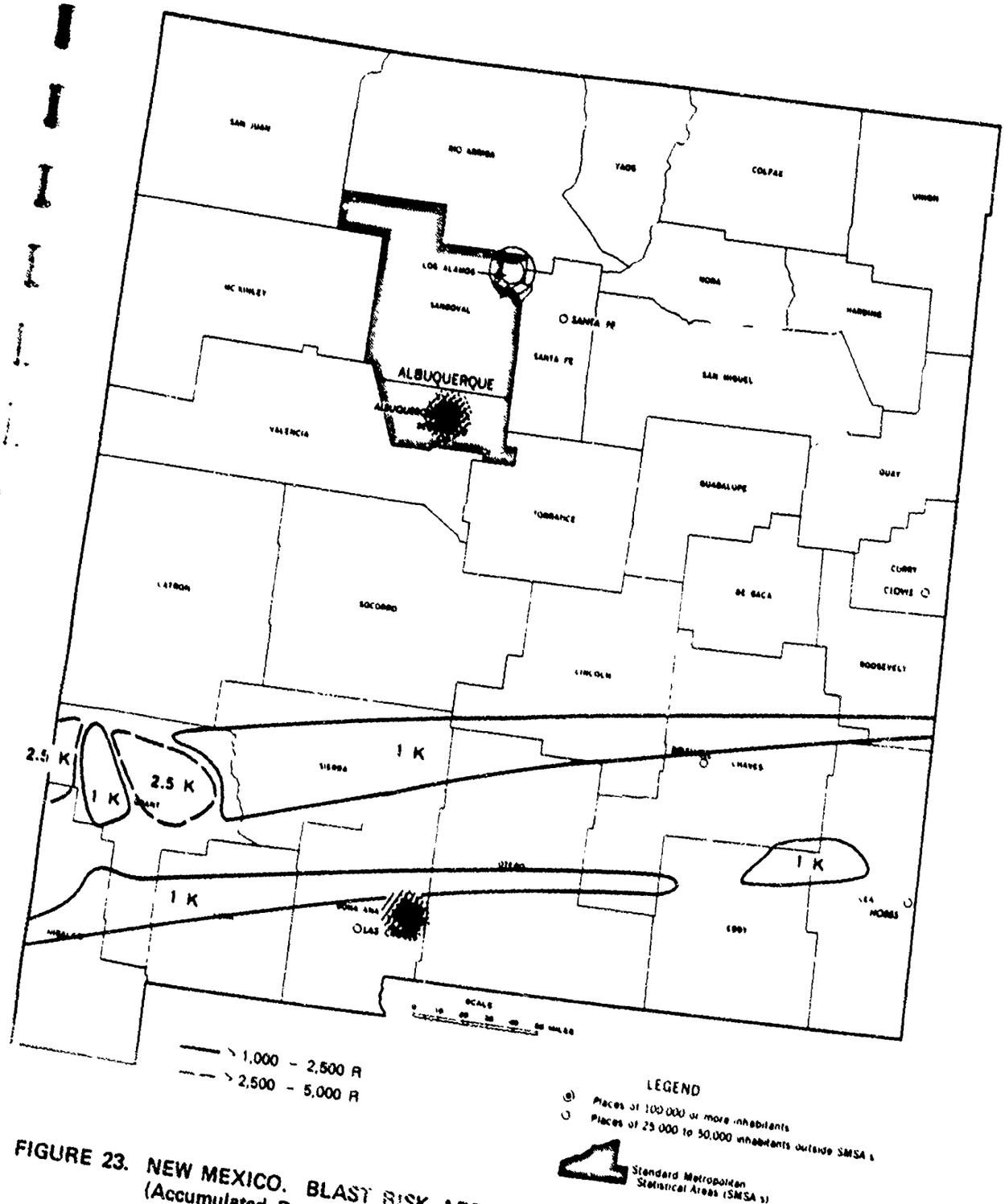

FIGURE 23. NEW MEXICO. BLAST RISK AREAS AND FALLOUT FROM ARIZONA (Accumulated Doses in Thousands of Roentgen)

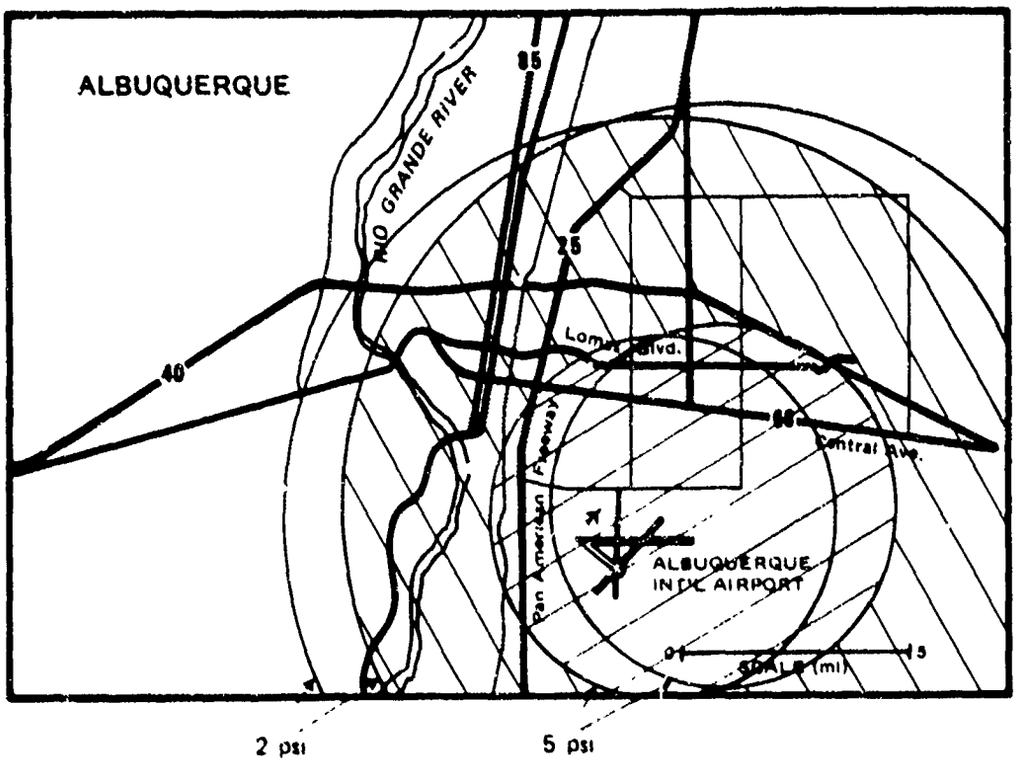

FIGURE 24. ALBUQUERQUE RISK AREA

TABLE 11

NEW MEXICO FATALITIES
(Percent of State Population of 1.1 Million)
Counterforce Plus Research Facilities

Warning	1-2 Weeks	24 Hours	15 Minutes
Current CD	13.7	14.9	18.3
Crisis Relocation	1.1	3.4	13.6
Expedient Shelters	--	13.6[a]	--
Blast Shelters	0	--	.3
Counterforce Only			
Current CD	0.37	0.41	1.6
Crisis Relocation	0	0.04	.7
Expedient Shelters	--	0.04[a]	--
Blast Shelters	0	--	0.35

[a]The assumed scenario cannot be characterized by a single warning time; see text.

b. Fallout Considerations

Based on the scenario (only airbursts), the fallout should be negligible; however, should there be a surface burst, the fallout could be rather intense. Based on winds at high altitude for these areas, the fallout would most likely occur to the east to southeast of the target area. Should the high-altitude winds be less than 5 mph, lower altitude wind factors would dominate and the fallout would be more intense over a shorter downwind distance of undefined direction.

c. Cross Impact With/On Other States

In addition to possible fallout from the detonations within New Mexico, there may be lower intensity fallout dispersed across New Mexico from detonations in Arizona as indicated in Figure 23. The pattern shown results from representative high-altitude March winds and would vary in location depending on the time of year.

D. COMPUTER ANALYSES OF PROPERTY DAMAGE

Under the attack against counterforce targets plus research facilities, damage estimates were made by DCPA for a number of categories in the infrastructure of the civil sector. These categories were selected from the list of categories in the READY data base, which is prepared and maintained by the Federal Preparedness Agency (FPA). Only unclassified, non-proprietary data bases were used for this report.

The list of categories and subcategories chosen is given in Table 12. For each category, the results of computer calculations of impact are indicated. National results are shown in aggregated bar-graph form in Figure 25, which illustrates estimated levels of national damage for selected categories. Two degrees of damage are shown: destroyed or severe

TABLE 12

LEVELS OF DAMAGE FOR SELECTED INFRASTRUCTURE CATEGORIES - NATIONAL SUMMARY

(Percent of Total in Parentheses)

	Pre-Attack Total	Destroyed or Severe Damage	Moderate or Fire Damage	Light or No Damage	Operating Area Disrupted
Principal Highway Structures	62,500 (100)	940 (1.5)	422 (0.7)	61,100 (97.7)	1,420 (2.3)
AM, FM, TV Broadcast Stations	12,500 (100)	37 (0.3)	58 (0.5)	12,400 (99.2)	95 (0.8)
Housing Units	75,500,000 (100)	3,270,000 (4.3)	3,660,000 (4.8)	68,600,000 (90.8)	6,920,000 (9.2)
Railroad Rolling Stock					
Freight Cars	2,000,000 (100)	33,100 (1.6)	99,400 (4.9)	1,880,000 (93.4)	133,000 (6.6)
Passenger Cars	27,800 (100)	510 (1.8)	2,040 (7.3)	25,200 (90.8)	2,550 (9.2)
Line Haul Locomotives	11,900 (100)	118 (1.0)	40 (0.3)	11,700 (98.6)	167 (1.4)
Switching Locomotives	8,000 (100)	110 (1.4)	46 (0.6)	7,800 (98.0)	163 (2.0)
Motor Trucks	11,700,000 (100)	281,000 (2.5)	372,500 (3.3)	10,700,000 (94.3)	653,000 (5.7)
Petroleum Trucks	48,700 (100)	1,200 (2.5)	1,600 (3.3)	45,800 (94.2)	2,900 (5.8)
Farm Trucks	2,830,000 (100)	36,500 (1.3)	36,000 (1.3)	2,800,000 (97.4)	72,600 (2.6)
All Other Trucks	8,500,000 (100)	243,000 (2.9)	334,800 (3.9)	7,920,000 (93.2)	578,000 (6.8)
Emergency Operating Centers	3,600 (100)	65 (1.8)	67 (1.9)	3,500 (96.1)	142 (3.9)
Primary	2,800 (100)	50 (1.8)	46 (1.7)	2,700 (96.3)	102 (3.7)
Secondary	508 (100)	7 (1.4)	8 (1.6)	491 (96.7)	18 (3.5)
Warning	2,670 (100)	32 (1.2)	33 (1.2)	2,600 (97.5)	69 (2.6)
Radiological	2,570 (100)	33 (1.3)	36 (1.4)	2,500 (97.2)	71 (2.8)
Public Information	1,360 (100)	14 (1.0)	20 (1.5)	1,300 (97.5)	34 (2.5)
Communications	2,510 (100)	40 (1.6)	44 (1.7)	2,400 (96.5)	90 (3.6)

TABLE 12

Continued

	Pre-Attack Total	Destroyed or Severe Damage	Moderate or Fire Damage	Light or No Damage	Operating Area Disrupted
Manned Civil Aviation Facilities	1,270 (100)	64 (5.0)	14 (1.1)	1,190 (93.6)	81 (6.4)
Air Route Traffic	24 (100)	0 (0)	0 (0)	23 (95.8)	1 (4.2)
Flight Service Status	398 (100)	11 (2.8)	3 (0.8)	382 (96.0)	16 (4.0)
Control Tower	310 (100)	18 (5.8)	8 (2.6)	283 (91.3)	27 (8.7)
RAPCON or TATCC	36 (100)	13(36.1)	1 (2.8)	21 (58.3)	15(41.7)
Regional Office	7 (100)	1(14.3)	0 (0)	6 (85.7)	1(14.3)
Airport Eng. Office	26 (100)	2 (7.7)	1 (3.8)	23 (88.5)	3(11.5)
Flight Insp. Office	20 (100)	3(15.0)	0 (0)	17 (85.0)	3(15.0)
Systems Maintenance	540 (100)	26 (4.8)	2 (0.4)	512 (94.8)	28 (5.2)
Medical Care Facilities (Short-Term)	6,690 (100)	141 (2.1)	298 (4.5)	6,250 (93.4)	440 (6.6)
Total Bed Count	1,050,000 (100)	27,000 (2.6)	59,800 (6.7)	952,000 (90.8)	96,800 (9.2)
Medical Care Facilities (Long-Term)	7,360 (100)	149 (2.0)	341 (4.6)	6,870 (93.3)	492 (6.7)
Total Bed Count	1,420,000 (100)	30,500 (2.2)	92,800 (6.6)	1,290,000 (91.3)	123,000 (8.7)

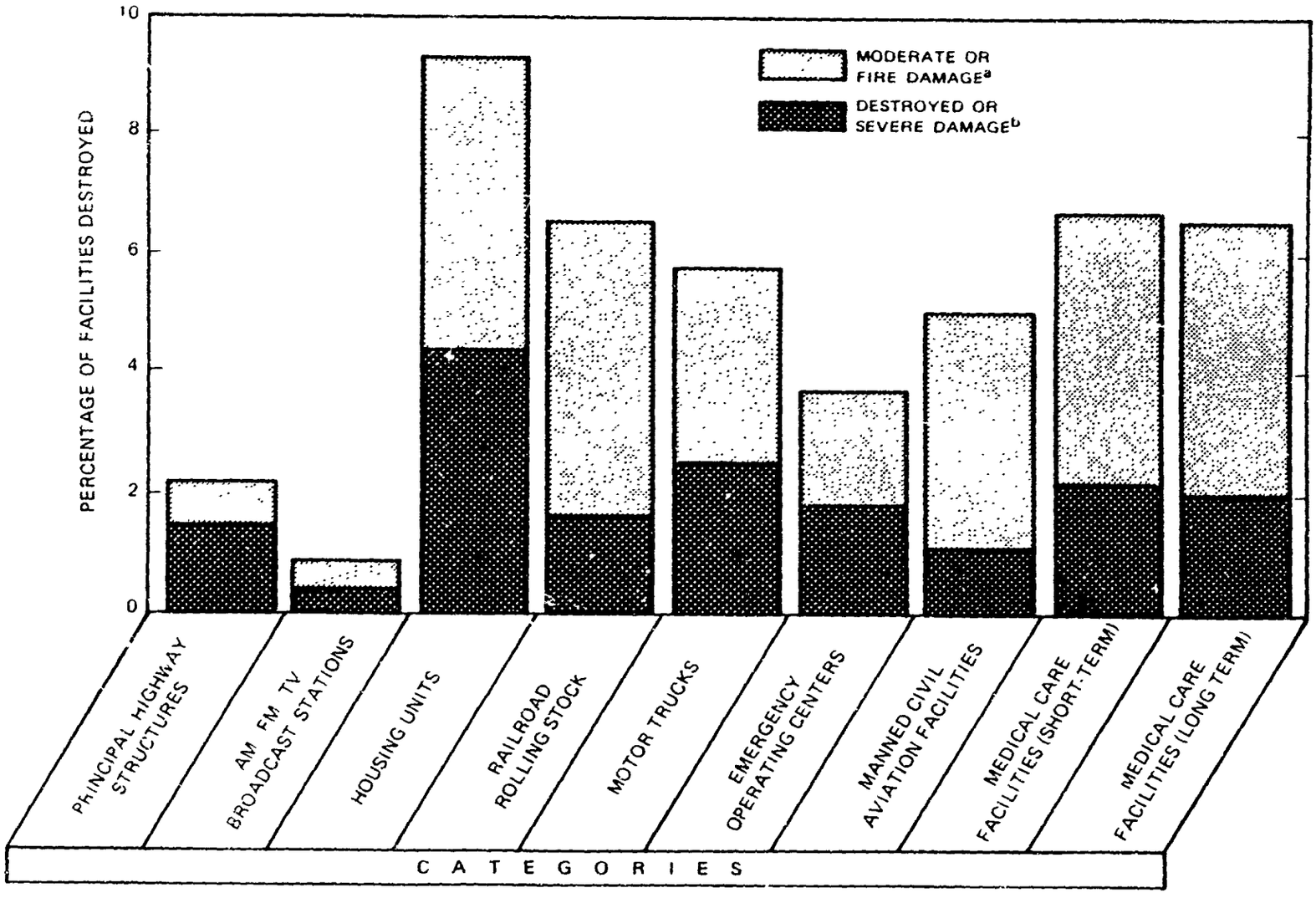

FIGURE 25. LEVELS OF DAMAGE FOR SELECTED INFRASTRUCTURE CATEGORIES – NATIONAL

[a]USEABLE OR EASILY REPAIRED

[b]USELESS OR REQUIRES EXTENSIVE REPAIR

damage, and moderate or fire damage.[1] When summed, these categories give the estimated total quantity of material immediately inoperable in the wake of the attack. Further detail is provided in Table 12 which breaks down certain pertinent categories into subclasses, giving their corresponding levels of damage. Of the major categories, hardest hit was housing, where 9.2 percent of all units were either destroyed or sustained at least moderate damage. Also significant was the damage inflicted to available hospital beds, where 9.2 percent of the total bed count for short-term facilities and 8.7 percent of the count for long-term facilities were immediately unusable. Of further note is the relatively slight damage to AM, FM, and TV broadcast stations where less than one percent of the national total was significantly damaged. The national consequences are comparatively light because of the scenario utilized. Although this attack scenario is representative of an intermediate attack, insofar as its impact on people is concerned, the same number of weapons applied to research facilities, if applied to destruction of facilities could create a great deal more infrastructure damage.

Figures 26 and 27 illustrate estimated levels of damage to selected categories of material for Missouri and New Mexico, respectively. In the case of Missouri, which, by virtue of its ballistic missile facilities, can plausibly be regarded as a target in virtually any attack scenario, the estimated levels of significant damage for all categories is less than 10 percent. This is a low figure of damage, but only CF targets were struck in Missouri and the main state infrastructure exists elsewhere. The comment relative to national consequences apply. For New Mexico, while the severity of the projected attack was less than that for Missouri, the level of significant damage inflicted was discernibly greater in several categories. The reason for this is that a disproportionate percentage of New Mexico's few highly developed/populated centers were selected as targets.

[1]Moderate or fire damage implies that repair is possible. Criteria for the amount of damage is very complex and involves "hardness" factors and probability as to location, orientation and mode of operation at the time of impact.

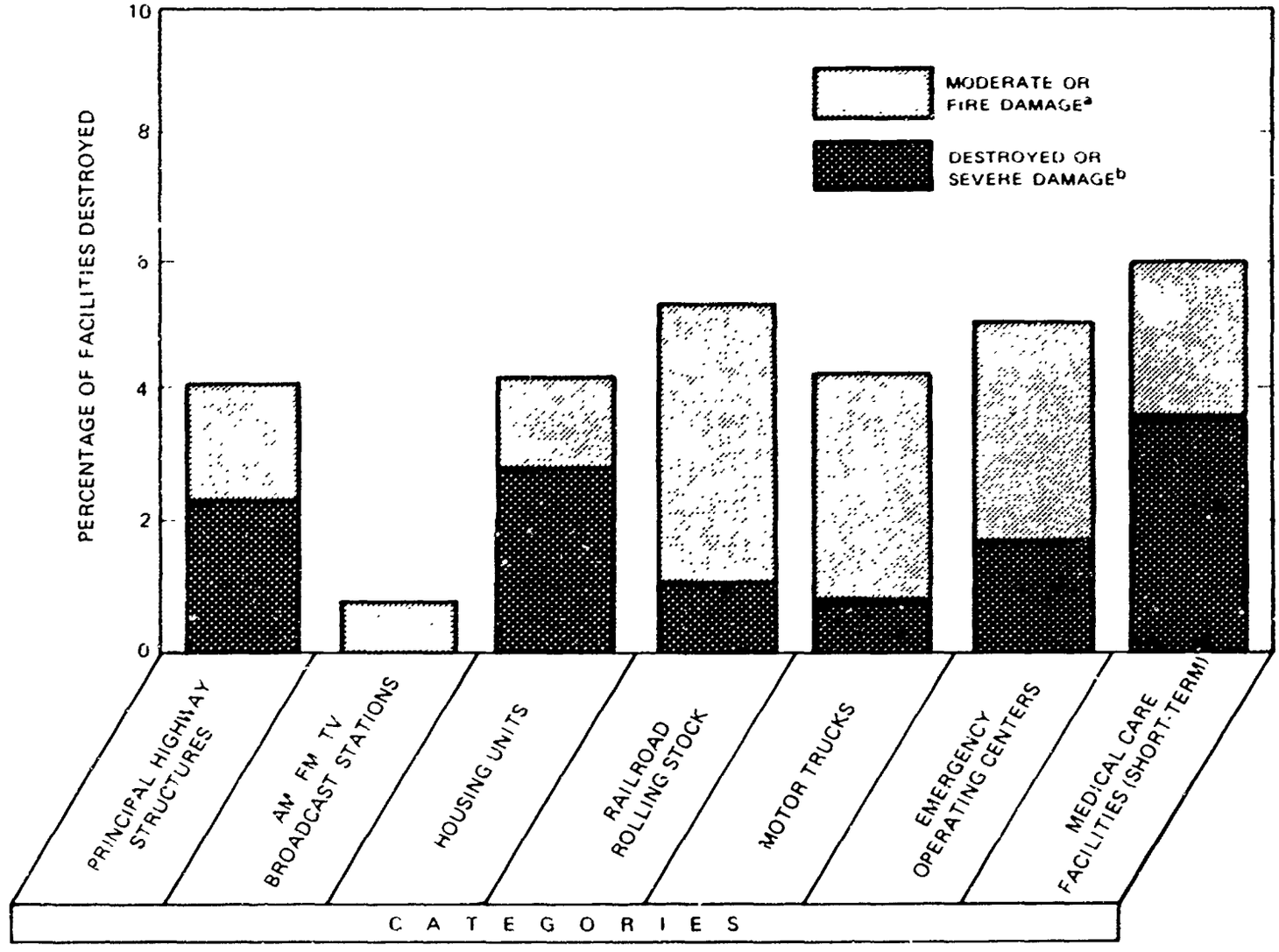

FIGURE 26. LEVELS OF DAMAGE FOR SELECTED INFRASTRUCTURE CATEGORIES – MISSOURI

[a]USEABLE OR EASILY REPAIRED

[b]USELESS OR REQUIRES EXTENSIVE REPAIR

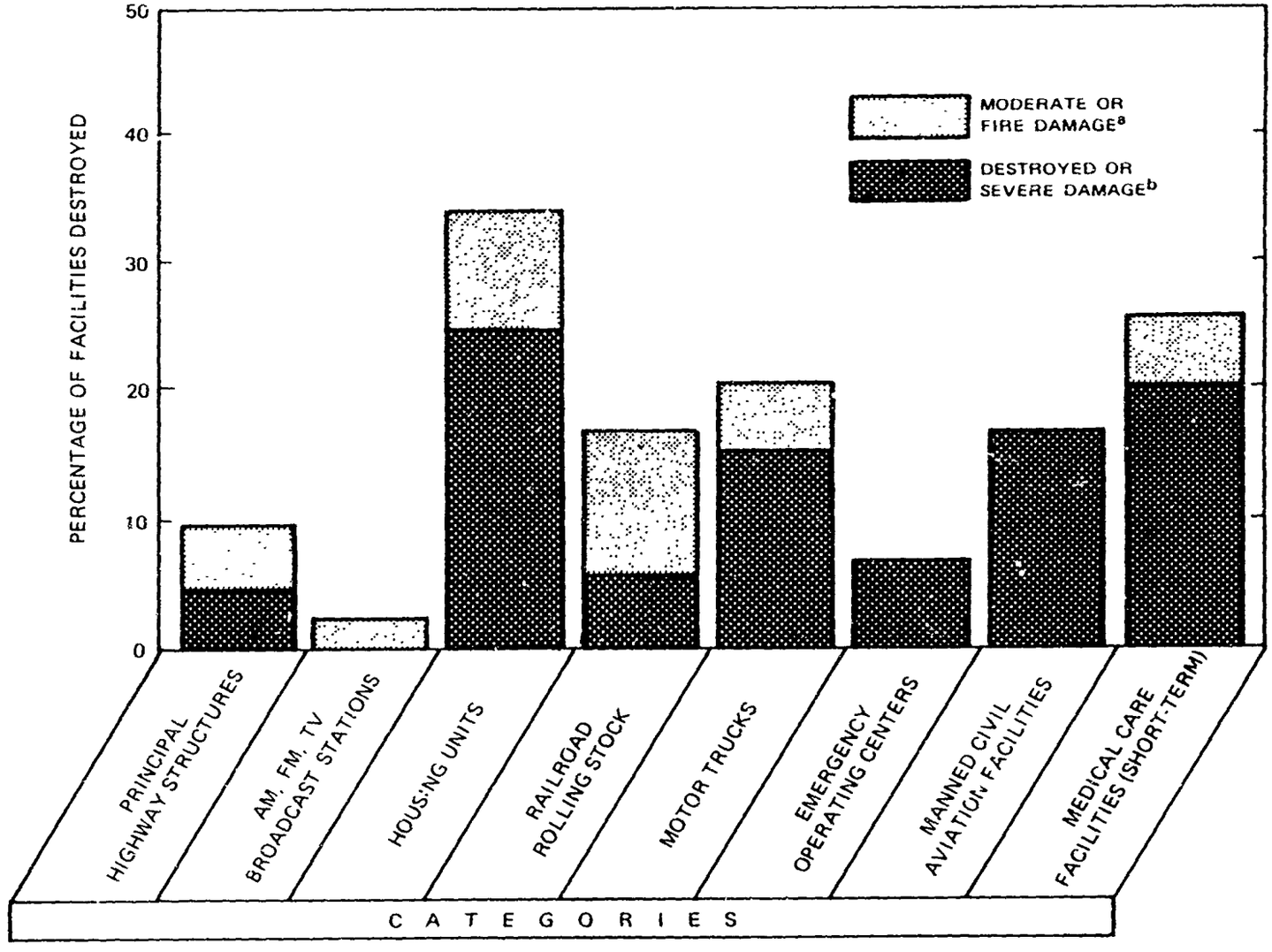

FIGURE 27. LEVELS OF DAMAGE FOR SELECTED INFRASTRUCTURE CATEGORIES – NEW MEXICO

[a]USEABLE OR EASILY REPAIRED

[b]USELESS OR REQUIRES EXTENSIVE REPAIR

The most notable cases of damage occurred with housing units, trucks, and short-term medical facilities. This is more typical of probable results had the attack been against infrastructure.

E. SUMMARY OF ATTACK ANALYSIS AND POSSIBLE APPROACHES FOR IMPROVING CIVIL DEFENSE

This section follows the pattern established in addressing National, Missouri, and New Mexico considerations in that order.

1. Summary

a. National

- The results of these limited attack scenarios imply that almost any scenario is liable to affect a large part of the U.S. population, and that a pure counterforce attack could have almost as large an impact on Missouri in regard to casualties, as on all the rest of the U.S. put together.
- Although the matrix approach based on specific CD programs and rather specific warning times is necessary to obtain quantitative results, it appears that a mix of the CD methods described may result in the best overall program approach for a given commitment of resources.

b. Missouri

- The impact of any attack scenario will be dominated by the fallout from the probable counterforce attack against the Whiteman missile complex.
- Wind conditions at altitudes most pertinent to fallout patterns are such that the St. Louis area is in jeopardy much of the time. The Kansas City area is so close that it too should probably be evacuated since there are several weeks each year when the lower altitude winds, which are highly variable, dominate. In addition, the counties from roughly Northeast to Southeast of the Whiteman area are in jeopardy from fallout an appreciable amount of the time each year.

- In addition to the potential fallout problems in the St. Louis and Kansas City areas, the possibility that they would be targets under other limited attack scenarios, and the virtual assurance that they would be targets in a full-scale nuclear attack, implies that these areas should be evacuated and/or sheltered. Obviously, if acuated, the personnel should not be moved into high-risk fallout areas due to the almost certain counterforce portion of any but the most limited of attacks.

c. New Mexico

- While there are fewer potential targets in New Mexico than in many other states, the bulk of the state's residents reside in a few small areas. Thus there is potential for high risk from a very few weapons. While there is a great deal of uninhabited space which would appear to allow for effective dispersion, much of the state is desert and thus not suitable as host areas.
- The scenarios utilized do not consider all of the potential target areas covered in TR-82 [Ref. 3] and contain no low-altitude or surface detonations. The possibility that these study scenarios may not address situations which have a significant probability of occurring suggests that CD plans not be based solely on the results of this study.

2. Possible Approaches for Improved Civil Defense

- Although a full-scale "in being" and "in place" blast and fallout shelter program appears to be most effective, it could be of value to consider a phased (addressing the most critical areas such as Missouri early-on) and mixed approach (mixture of crisis relocation, fallout shelters, blast shelters in CF-risk areas, and after-the-fact movement schemes) as a means of achieving the same end results while retaining greater flexibility in adapting to whatever attack may actually occur. Tables 13 and 14 provide a breakdown of fatalities by "risk" versus "non-risk" or host areas which permits assessment of the consequences of establishing an optimized mix of approaches based on cost compared to benefit in terms of limiting casualties.
- Perhaps assumptions should be made as to warning time scenarios in which, as tension increases, people who are free to do so would be advised to relocate some 72 hours or as

TABLE 13

FATALITIES (MILLIONS) IN RISK AND NON-RISK AREAS: COUNTERFORCE ATTACK

		1-2 Weeks "Warning"			24-Hours "Warning"			15-30 Minutes "Warning"		
		Risk	Non-Risk	Total	Risk	Non-Risk	Total	Risk	Non-Risk	Total
			CASE 1			CASE 2			CASE 3	
Current CO	Blast	0.40	0.00	0.34	0.37	0 00	0.37	0.45	0.00	0.45
	Fallout	0.20	4.73	4.93	0.24	5.05	5.29	0.47	9.75	10.22
	Total	0.54	4.73	5.27	0.61	5.05	5.66	0.92	9.75	10.68
			CASE 4			CASE 5			CASE 6	
Crisis Relocation	Blast	0.05	0.00	0.05	0.13	0.00	0.13	0.41	0.00	0.41
	Fallout	0.00	0.31	0.31	0.06	3.97	4.03	0.26	5.05	5.31
	Total	0.05	0.31	0.36	0.19	3.97	4.16	0.68	5.05	5.72
			CASE 7			CASE 8			CASE 9	
Expedient Shelters	Blast				0.34	0.00	0.35			
	Fallout				0.19	3.40	3.59			
	Total				0.54	3.40	3.94			
			CASE 10			CASE 11			CASE 12	
Dedicated Blast Shelters	Blast	0 02	0.00	0.03				0.05	0.00	0.05
	Fallout	0 00	0.30	0.30				0.00	2.51	2.51
	Total	0 02	0.31	0.33				0.05	2.51	2.56

TABLE 14

FATALITIES (MILLIONS) IN RISK AND NON-RISK AREAS:
COUNTERFORCE-PLUS-RESEARCH-FACILITIES ATTACK

		1-2 Weeks "Warning"			24-Hours "Warning"			15-30 Minutes "Warning"		
		Risk	Non-Risk	Total	Risk	Non-Risk	Total	Risk	Non-Risk	Total
Current CD			CASE 1			CASE 2			CASE 3	
	Blast	4.51	0.00	4.51	4.97	0.00	4.97	6.52	0.00	6.52
	Fallout	0.22	4.84	5.06	0.26	5.10	5.36	0.69	9.52	10.20
	Total	4.73	4.84	9.57	5.24	5.10	10.34	7.20	9.52	16.72
Crisis Relocation			CASE 4			CASE 5			CASE 6	
	Blast	0.55	0.00	0.55	1.55	0.00	1.55	5.50	0.00	5.50
	Fallout	0.00	0.32	0.35	0.06	4.50	4.56	0.36	4.94	5.29
	Total	0.55	0.33	0.88	1.61	4.50	6.11	5.86	4.94	10.80
Expedient Shelters			CASE 7			CASE 8			CASE 9	
	Blast				4.49	0.00	4.49			
	Fallout				0.20	3.44	3.64			
	Total				4.69	3.44	8.13			
Dedicated Blast Shelters			CASE 10			CASE 11			CASE 12	
	Blast	0.02	0.00	0.03				0.05	0.00	0.05
	Fallout	0	0.29	0.29				0.00	2.50	2.50
	Total	0.02	0.29	0.31				0.05	2.50	2.55

long as possible in advance, and everyone (except key workers) told to relocate, complete their shelters or stay near available shelter some 24 to 48 hours in advance (when the potential enemy starts to relocate).

VI. PUBLIC RESPONSE AND CIVIL DEFENSE EFFECTIVENESS

The casualties produced by a nuclear attack would reflect, in large measure, the following three factors:

- The distribution of weapons effects
- The distribution of population at the time of attack
- The population's protection against weapons effects at the time of attack and during a subsequent period of fallout hazard.

The attacker largely determines the distribution of effects. Particularly in counterforce areas, however, the logical aiming points are readily inferred, and the attack effects assumed in the preceding chapters are reasonable assumptions.

The other two factors--the population's distribution and its protection--are the domain and concern of civil defense programs. Given that the population is highly vulnerable in its normal state, CD programs must seek to do two things:

- Provide shelter protection
- Move people to adequate shelter by the time of attack.

Both shelter and movement are, of course, required by any CD program, but their interrelation varies markedly among programs. Nearby, highly protective and expensive blast shelters require little movement. Large-scale evacuations, on the other hand, could (time permitting) allow use of more modest fallout sheltering in distant, lower-risk areas. Such trade-offs are central to analytical comparisons of alternative CD programs.

Finally, comparisons and analyses of effectiveness rest, ultimately, on assumptions and knowledge concerning public behavior. If CD programs involve high investment in physical shelters, they must also include reliable warning, education, and information efforts which could ensure

maximum utilization of those shelters. Similarly, CD programs that call for extensive public movements (evacuation) or other public actions (such as building expedient shelters) must display a capacity to explain the needed actions and motivate the public behavior on which such programs depend for their effectiveness.

The following sections of this chapter address the problem of relating public behavior to CD programs. Specifically, these sections describe:

- Behavioral and communications factors which would influence public response under the several programs being considered
- Public attitudes and the response to CD programs, with special emphasis on the effects of a "crisis expectant" period
- Strategies for increasing public response to CD programs, given the variety of conditions that could influence public interest up to the time of a crisis and attack.

The chapter following will then describe CD approaches to involving the public in the four programs.

A. BEHAVIORAL AND COMMUNICATIONS FACTORS AFFECTING PUBLIC RESPONSE

Public behavior is discussed here in relation to the structural characteristics of the four programs being compared. What does each program require in the way of public knowledge and action? And to what extent does each program require the management of public behavior in order to produce a desirable outcome? With respect to the distribution of people and their shelter protection under each program, this section also addresses the potential variations in the casualty estimates for each program. That is, how widely might casualties vary, given a program's requirements for public knowledge and action?

The following sections describe:

- Selected factors affecting public response to CD communications
- The sequence of communications implicit in CD programs
- The precrisis conditions which would or could affect public response
- Conclusions about the potential variance in public response under each of the CD programs.

In considering these topics, the discussion also avoids (whenever possible) the general problem of making absolute estimates of response in some future time and set of circumstances. Rather, the discussion considers those aspects of the four programs which could lead to differential levels of response on the part of people asked to execute them.

1. Selected Factors Affecting the Public Response

The response to a CD message calling for public action would be heavily influenced by the state of public knowledge about the requested action, the "execute" or warning message[1] which sought to trigger public action, and intervening organizational factors which improved the public's knowledge, simplified the responsive action, or otherwise lent credibility to the communication.

- At any point in time, the public possesses a base of knowledge from which to interpret, judge, and act on CD alert or warning messages. Ideally, every citizen would have in mind a specific shelter location or evacuation destination, a straightforward procedure and route for reaching that point, and an internalized or taken-for-granted intention to respond quickly to a specific warning message. The several CD programs should be assessed for their potential to build up that base of knowledge--or their capacity to simplify the necessary response so that less knowledge is required.
- The organizational effectiveness of CD would, in fact, have an important impact on the public's appraisal of CD communications. During a crisis, effective operating procedures can serve to simplify the public actions required, thereby encouraging greater participation. And the appearance of an effective, operating organization will itself promote a greater and more appropriate response.
- Organizational outreach is critical both before and during a crisis. Before a crisis, training and education efforts can produce a cadre of knowledgeable officials and citizens, dispersed through the public, who can increase awareness,

[1]The "execute" message directs the people to execute the CD plan (i.e., evacuate and/or take shelter. The warning message tells the people that an attack has been launched. The two messages may or may not come simultaneously.

acceptance, and knowledge of the program as they participate in diverse organizations and social groups. During a crisis, these people--as well as formal emergency organizations--can become visible actors in the civil defense operation. Again, public response is favorably impacted both by the enhancement of the visible organization and by the increased penetration of organizations and groups represented in the CD effort.

- The "execute" and warning messages, requesting the public to take action in accordance with a CD program, will vary in effectiveness as a function of such factors as the complexity of the message and the complexity or difficulty of the action requested. These factors, of course, will vary with the program's requirements for public action--the decisions or choices required or allowed; the effort, time and sacrifice involved; and of course the credibility of the threat. The nature of the execute and warning messages, finally, must reflect the state of knowledge for interpreting them and the organizational capability to guide and assist the public.

The four civil defense programs analyzed here can be compared, at least roughly, with an eye to their relative effectiveness along these dimensions. Before examining the programs, however, it is necessary to consider (1) the sequence of planned civil defense communications and (2) certain preconditioning periods which could influence public knowledge and responsiveness.

2. The Sequence of Civil Defense Communications

The CD public education, training, and emergency public information (EPI) programs described in the next chapter envision the following sequence of communications affecting the public or key actors.

- Public education and training efforts designed to improve the state of public knowledge, prepare an organizational capability, extend CD's "outreach."
- Provision of basic survival information on demand--that is, without a formal decision to execute a CD program. This information describes threats and responsive activities, but does not instruct the public to take any action. Provision of such information would serve primarily to improve the state of knowledge and CD's penetration of the public audience.

- The message to "execute" a particular CD program. Such messages follow an official decision to implement a program. Unless they are coincident with warning (the "out-of-the-blue" attack), they constitute "interim warning" and may call for more or less interpretation by viewers or readers.
- Attack warning. Where a previous message to execute has gone out, the warning essentially "interrupts" the behavioral process set in motion by the earlier message.

This sequence of educational and EPI messages would presumably be the most important factor in producing the distribution of protected population at the time of attack. Note, however, that these communications may "compete" with, or be supported by, other relevant (media) communications up to the time of the "execute" or warning messages. The two sets of precrisis conditions discussed below deserve special mention.

3. Precrisis Conditions Affecting Public Response

The process of building a CD program and a sustained period of international tension or crisis represent two predictable sources of influence on public responsiveness:

- The installation of the crisis relocation program, of stockpiled expedient-shelter materials, or (especially) of dedicated blast shelters would constitute major public educational events, generating discussion that could only improve the state of public knowledge, and in certain cases provide detailed knowledge anticipating the "execute" or warning messages. The programs can be compared for their relative impacts on these factors.
- A prolonged period of intense crisis--a crisis-expectancy period--is viewed by most analysts as a probable precursor of any civil defense action. Such a period might include ever-more-threatening or recurring crises, might include sharp gyrations between crisis and calm, and could pose the problem of diminished credibility based on "false starts" or other problems encountered in prior crises. The programs can be compared for their promise of surviving as credible plans, and of providing the most benefit during a crisis-expectancy period.

4. Comparing Programs for Potential Variations in Public Response

The above-suggested criteria for comparing probable public responses include (1) a program's contribution to the state of knowledge, (2) organizational ramifications which could both reduce the complexity of requested behavior and contribute to awareness and general knowledge, and (3) the specificity and simplicity of the "execute" and warning messages required. Application of such criteria must take account of the general sequence of CD communications efforts (including the possibility that large numbers of the public would be acting spontaneously, prior to an "execute" message). Finally, the programs can be compared for the probable effects of their implementation (the building phase), and for their probable credibility through successive phases of a crisis expectancy period.

Table 15 suggests how the above-noted factors could be taken into account in a cross-program comparison. In assessing any CD program, of course, one should not forget that an actual public response would always (1) reflect numerous situational factors and (2) constitute a dynamic process rather than a single event. People would be observing, assessing, and reacting to events as they happened; new "preconditions" would continually be established and would influence subsequent behavior. These problems are discussed in Section B below. Such caveats aside, the table indicates many areas of variation and uncertainty applicable to predictions of the public response.

As would be expected, the expensive blast shelter program provides the surest result and produces the least potential variance--a clear result of its short response time, simple and straightforward response action, and more limited demands for organizational effectiveness. The need for an evacuation program to provide for non-complying residents would further accentuate the blast program's superiority.

The current CD program is clearly poorest, lacking even the educational benefits of a "building" period and exhibiting the least investment in organizational development and outreach. The variance in casualties is also large, because the public's election to evacuate spontaneously--given sufficient time, continued motivating events, and a successful

TABLE 15

SELECTED FACTORS ACCOUNTING FOR VARIANCE
IN PUBLIC RESPONSE AND IN RESULTING CASUALTIES

	Current CD	Crisis Relocation	Expedient Shelters	Dedicated Blast Shelters
Knowledge Base				
Knowledge required to respond to "execute" message	Medium	Most	Medium	Least
Knowledge-improvement from program-building	None	Potentially High	Potentially High	Great
Knowledge-improvement during crisis expectancy period	Uncertain	High	High	Most Specific (Best)
Action/Messages				
Complexity of required public action	Worst Case	Complex	Moderately Complex	Simple
Personal skill and "investment" required	Worst Case	High	Very High	Least
Complexity of "execute" (including warning?) message	Worst Case	Complex	Moderately Complex	Simple
CD Organization				
Extent of CD organization required	--	Large	Moderately Large	Moderate
Criticality of organizational effectiveness	--	Critical	Moderately Critical	Moderate
Required investment in CD organization	--	High	Moderately High	Moderate
Minimum acceptable investment in public education	--	High	Moderately High	Moderate
Minimum acceptable investment in EPI	--	High	Moderately High	Moderate
Other Considerations				
Potential to re-use program after false start	Low	Uncertain	Moderately High	High
Potential to sustain protected posture over time	Low	Uncertain	Moderately High	High
Potential to utilize spontaneous public action	Low	Moderately High	Moderately High	High
Potential variation in casualties as a function of public response	Highest	Second Highest	Third Highest	Lowest

distribution into host area facilities or expedient shelter--could produce low casualties. But the number of factors which would have to "come together" to produce this outcome makes it unlikely. Furthermore, the current program suffers doubly by virtue of its reliance on fallout shelters, which often would not protect against blast effects in counterforce areas.

The Expedient Shelter Program (based on stockpiling of materials) suffers from the difficulty of predicting the crisis demand for materials--hence, the uncertainty of how much of original program costs would be translated into program activity. But incorporation of this option into a crisis relocation program, supported by sound organizational efforts, would respond to important motivational factors and could serve to reduce the movement and reception area problems posed by evacuees. At least in rural counterforce areas, this program also suggests an interesting cumulative payoff. Successive crises, or tensions following a premature return of evacuees, might encourage increasing percentages of the population to construct their own shelters.

The Crisis Relocation (evacuation) Program is potentially highly effective, but it places a premium on organization, planning, and management--with the attendant risks. Additional sources of uncertainty include the absolute requirement for an evacuation period, the requirement for orderly host area management and supply over extended periods, and the reliance on both management and situational factors to prevent premature returns and motivate second or third movements, should crises recur.

In appraising the programs, finally, one should note the qualitative and quantitative differences between areas which are assuredly counterforce targets, and areas (including most urban areas) which are not so apparently in that category. These judgments have reflected concern, primarily, with counterforce areas in which blast shelter is a predictable requirement for in-place survival. The potentials of the several programs might compare somewhat differently in regions for which first-wave, counterforce-type attacks are not likely, or not so perceived by the population.

In any region and under virtually any attack circumstances, however, the four programs present the varying requirements for management and communications that have been outlined here. Given these differing structural characteristics and the built-in behavioral assumptions, it remains to consider the extent of public response which might be expected.

B. PUBLIC ATTITUDES AND RESPONSE: THE SIGNIFICANCE OF THE "CRISIS EXPECTANT" PERIOD

Civil defense programs envisioning a nuclear attack on the United States clearly would require a rapid and massive mobilization of the public and local leadership. Given that the structure of the several CD programs would affect the relative response to each program, what then can be said about the extent of the total response, its appropriateness, and the difficulty of managing the response and directing public activity? This section discusses what is known about public attitudes toward CD and how such attitudes might change during a crisis-expectancy period characterized by much higher levels of international tension.

1. Current Public Attitudes

Currently, and for at least the past twenty years, the American public has overwhelmingly endorsed the concept of civil defense, generally overestimated expenditures on CD programs, and generally favored increasing those expenditures even beyond those exaggerated levels. On the other hand, the public possesses little knowledge of civil defense, little familiarity with CD organizations, and only a vague though horrible image of what a nuclear disaster would be like [Ref. 17].

The Gallup Poll in December 1978 included several questions on civil defense. The results (summarized in the Washington Post, 4 February 1979) were to the effect that the public knows relatively little about the status of U.S. civil defense, but 52 percent of persons interviewed said we should do more than we are presently doing. This view should be put in the context of what people think we are now doing. A DCPA-sponsored

survey in October-November 1978 [Ref. 18] found that the average estimated expenditure for U.S. civil defense was about $1 billion annually, an overestimate by a factor of ten.

This same survey, performed by the University of Pittsburgh's Center for Social and Urban Research, produced similar findings to those of the Gallup Poll, but in more detail. Interviews, each lasting some 70 minutes, with a sample of 1,620 adult Americans indicated that the public remains favorable to the CD concept and would be receptive to the concept of evacuation. For example:

- 67% believe there could be crisis circumstances under which the President might urge people to evacuate high risk areas.
- 78% believe the U.S. should have crisis relocation plans.
- 70% say that if the President directed relocation, they would comply. 43% indicate that, in a serious crisis, they might well leave spontaneously, before any direction to do so.
- 75% believe the nation's communities would be helpful to evacuees.
- 82% believe their own communities would be helpful, if asked to host evacuees. (In fact, 73% say they would be willing to take evacuees into their own homes.)
- 88% have a car available. (Of those without a car, 2/3 were sure they could rely on friends, neighbors, or relatives to take them along.)
- 58% say they have friends or relatives they are sure they could stay with, within 100 miles and not in another city.
- 78% believe the U.S. should not unilaterally do away with civil defense.
- 66% oppose the idea of a U.S.-Soviet agreement for both sides to do away with civil defense.

Interestingly, a late-1978 survey of the Missouri counterforce target area, conducted under the auspices of Congressman Ike Skelton's office, revealed remarkably similar attitudes.

Even such high levels of acceptance do not, of course, translate directly into an intelligent, organizable response to specific CD programs. Civil defense is a low-salience issue, especially because the awesomeness of a nuclear disaster elicits a common popular response to any disaster-preparedness message--the denial of the possibility as long as the

environment allows such denial. Furthermore, Americans have not, by and large, been exposed to a truly comprehensive CD effort. It is difficult for respondents to picture what such an effort might entail, and still more difficult to predict their response in very reliable terms.

The existing public attitudes, however, clearly provide a positive base from which crisis-period attitudes and behavior would evolve.

2. Effects of a Crisis-Expectancy Period

As noted in Section A of this chapter, the execution of any of these CD programs would be expected to follow a period of greatly increased international tension--of which the public would almost inevitably be aware. In this probable contingency, public interest in survival and preparedness would rise dramatically. So would public interest in CD programs and CD information.

The question would be not whether CD elicited broader support--the current attitudes and their stability over two decades virtually guarantee that--but whether CD would respond well enough to demonstrate and attest its capability to manage the situation. Recurring crises and events--quite possibly including the detonation of nuclear weapons outside the United States--would eventually trigger waves of public interest that contrast sharply with the current favorable, but uninformed, attitude in CD concepts. This public reaction would be characterized by:

- Stress, eventually reaching very high levels and necessitating new thoughts and/or actions to either explain away or cope with the perceived threat.
- Information-seeking behavior geared to personal survival. The public would seek information allowing people to (a) assess probabilities of the threat, (b) assess personal vulnerability, and (c) determine appropriate personal responses.
- Selection of information sources, based on judgments about (a) the perceived quality and usefulness of information available, (b) familiarity with and confidence in the various information channels available, (c) personal, peer group, kin, and small group experience, (d) the individual's own knowledge, (e) the accessibility of information which appears to address the individual's specific circumstances, (f) the

general image and perceived authority of the source, and still other factors relevant to a particular individual's intellectual and emotional condition.

- Coping behavior to relieve stress, including the information-seeking activity itself, rationalizing the threat away, a decision to "wait and see," or activity which the individual believes will (a) remove the threat, (b) provide personal protection, (c) allow escape from the threat, or (d) stimulate a good, collective response with others sharing in the activity.

In a crisis-expectancy period this sequence will or could recur several times, involving successively larger percentages of the population in "threat-reactive" action.

When the public begins reacting to threat perceptions and seeking information, the CD organization will--for really the first time--be "tested" by the public for its capacity to provide satisfactory information and solutions. To fail that test, at a time when significant percentages of the population are avidly seeking information, would be to sacrifice a portion of CD's capability to orchestrate a public response.

Any CD program will require that specific groups of people behave in specific ways--for example, certain neighborhoods must use particular evacuation routes or shelters. If public behavior is responsive to conflicting sources of information, or if it is irrational or random, then CD will have lost its capacity to distribute the population as it must be distributed to maximize survival under any particular program.

If, on the other hand, the CD organization and CD information programs can respond to successively higher levels of public interest, the result can be:

- Rapidly escalating levels of public knowledge about the desired behavior and the particular actions required in response to an "execute" or warning message.
- A systematic buildup of CD's organizational outreach--as interested officials and citizens are drawn into the CD educational, information, and training programs.
- A systematic buildup of CD's organizational capacity and effectiveness--as interested officials and citizens are fitted into operating or management systems which had previously existed largely on paper.

From studies of disaster behavior, it is clear that the population would, in overwhelming numbers, seek to behave adaptively and responsively to a prospective attack. The challenge for CD programs, then, is to ensure that the desired patterns of behavior are charted in advance--in great detail--and that CD becomes and remains the authoritative source of such information through any preattack period.

C. STRATEGIES FOR INCREASING PUBLIC RESPONSE

The desired public response to any CD program takes two forms:

- The orderly and timely movement of the general public to shelter. (For some programs, this would be fallout shelter located at the end of evacuation routes.)
- Participation in CD and related organizations (police or fire departments, etc.) while the program is being implemented.

As described in Section A above, the structural characteristics of a CD program define the specific requirements for public action--the extent of the movement required, the difficulty or complexity of the action, the need for larger or smaller organizations to manage and channel public activity, etc. Any changing levels of public interest or concern, as described in B above, will govern the program's ability to elicit public response at any given time.

Given these limiting factors, the maximally effective approach to public participation is defined by reference to four interrelated factors:

- Plans
- Warning systems
- Organizational development over time
- Educational and information programming over time.

All of these elements are traditional concerns of CD, though recent DCPA research and development efforts now allow a more sophisticated approach to the integration of public information with the other elements. Indeed, the concept of a crisis-expectancy period, with its implications for mobilizing an even greater public response, is a product of that R&D program.

1. Plans

CD plans for a given region or community are the ultimate definition of the specific behavior required of the public at the time of an "execute" or warning message. Under any comprehensive CD program, these area-specific plans describe:

- The physical shelter facilities to be utilized by specific groups of people--e.g., the blast shelter serving a particular city block
- The size and structure of the operating CD (and related) organizations during the various types of periods that might precede or follow an attack
- The procedures, resources, and timetables involved in managing the population--i.e., in implementing the CD program for a given region or community.

Examples of such plans include the numerous Community Shelter Plans (CSPs) produced for many communities during the 1960s and 1970s, and selected Crisis Relocation Plans (CRPs) produced for a few communities in the course of developing the embryonic CRP program. The better of the CRPs provide detailed instructions for the reception and care of evacuees in host areas, dividing host counties into successively smaller neighborhoods and providing a management structure for each such unit. Transportation, food distribution, and other CD functions also receive reasonably detailed treatment. These plans illustrate the level of detail which can be achieved from even a low-budget planning effort.

For any of the CD programs contemplated here, planning would be focused on the specific public actions envisioned; the detailed plans would define the appropriate organizational structure, staffing needs, and procedures to fill staff positions from other organizations or the general public during a preattack period. At any point before a crisis, it must be noted, the perceived adequacy of these plans could seriously affect the credibility of the overall CD effort among the general public.

2. Warning Systems

Aside from the technical features of warning systems (discussed elsewhere in this report), the subject deserves special attention in relation to CD training, education, and public information efforts under any of the four programs being considered.

After ensuring that the warning technique allows CD programs to reach the vast majority of a region, the socialization of the system must be planned. Training and education efforts must instill in the public mind (1) the meaning of the signal, (2) a capability to interpret the warning, and (3) an understanding of the required action and time constraints on its performance.

As with plans and other elements of CD programs, the specificity of the warning must be defined in relation to specific populations. Over-reliance on a very generalized warning message can produce negative effects, including loss of credibility. For example, people listening to radio stations outside their locality may receive a message not appropriate to their circumstances. Such problems require especially careful study where "mixed" CD programs are adopted. People who have built expedient blast shelters must be differentiated from audiences asked to evacuate, for example, and a crisis relocation program must distinguish between the "evacuate" signal (when time allows) and the take-shelter signal for an immediate, incoming attack.

For any of the programs considered here, the warning system would be defined in local, detailed plans and explained in the educational and public information messages associated with the program. For the more complex or mixed programs, the expense would be higher or the predictable response somewhat lower.

3. Organizational Development Over Time

The CD plans for a given program type and specific region provide the desired structure and staffing pattern for an operating CD effort. Those structures, staffing arrangements, and resulting needs for skill or

training vary among the programs. Thus, the blast shelter program emphasizes in-shelter management and shelter living. Crisis relocation calls for more complex communications tasks, control of traffic, reception and allocation to host area facilities, management of people in a congregate lodging mode (before moving to shelter), and more elaborate efforts to provide goods and services before an attack (during a post-evacuation "waiting" period).

Given the end-point staffing and training requirements under any CD approach, it must be recognized that many of the positions may be filled only as the public, including public officials, becomes increasingly concerned about the threat. The maximum potential of any program--and especially the longer-response evacuation program--may be achieved only insofar as CD can recruit and train personnel during a crisis expectancy period, while people are moving. or after people are in shelter.

Recognizing this staffing and leadership problem, the approach to any of the CD programs would necessarily include:

- A phased approach to staffing--a sequence for filling more critical positions first
- Prepackaged instructions for performing in each staff position
- Packaged materials which can be used by a few existing staff members--or groups thrown together by the crisis--to train themselves and others in each position.

Such staffing and training materials have been created for a few CD elements. The existing guidance for organizing evacuees in host areas includes, for example, organizational charts down to the neighborhood level, job descriptions for each position, and recommended approaches to training for each position under normal or "crash" conditions. The guidance also charts a host-county staffing structure which could include several hundred jobs, but begins the organizational development process with a staff of three people.

4. Education and Public Information Over Time

Plans, warning systems, and needs for organization define the critical objectives of CD educational, training, and public information efforts. The public's concern and interest, increasing over time, define the limits on the effectiveness of communications at any given point in time. A strategy of education and information dissemination represents a plan to take maximum advantage of public interest at any given point in the evolution of a preparedness program.

The fundamental purpose of such a strategy is to achieve and maintain a maximum cumulative effect. Given a certain proportion of interested people, CD seeks (1) to reach them with the maximum acceptable amount of information and (2) to ensure that the people thus reached are "retained" in the system so that their knowledge can be used at a later stage.

Central to such a strategy are the following concepts:

- Information is packaged in successively more detailed presentations. An official or interested citizen can go into a topic to whatever depth he or she may desire--then return to the subject later to explore the next module of information.
- Training and education efforts are directed through organizational channels--the Red Cross or Boy Scouts, for example--in an effort to take advantage of these organizations' "outreach," and to increase the probability that whole organizations of people could eventually (in a crisis) be incorporated in CD efforts.
- Research and development and planning efforts are sensitized to the various target audiences which may require special approaches--for example, non-English-speaking, handicapped, or minority populations that might be excluded from particular channels by which communications are "legitimized" or disseminated.

All educational and information efforts, finally, must seek the objective of furthering the state of public knowledge about a region's particular CD program--the knowledge that would support effective communications at the "next" levels of detail and public interest. At the same time, CD education, training, and information programs must seek to recruit

potential members of an operating CD effort. Again, information is packaged to allow a stage-by-stage progression of the interested official or citizen toward a working role in a CD operation. Thus, only by degrees can CD programs seek to take advantage of low-level, peacetime interest to prepare for a crisis period in which the public's demand for information would be enormous.

VII. TRAINING, EDUCATION, AND EMERGENCY PUBLIC INFORMATION[1]

The principal or first objective of any CD program is to enlist the public in a massive, organized, and coordinated life-saving endeavor prior to the time of attack. Given any configuration of physical protective facilities, the population should be moved into the maximally protected posture which those facilities make possible. This redistribution would involve coordinated activity by a public which only gradually and perhaps recently had become aware of their need to take such action.

The achievement of a successful and timely mobilization of the public is the fundamental objective of CD communicative efforts: the training, education, and public information programs. These programs, in turn, have the dual objectives of:

- Preparing the public to receive, accept, interpret, and act appropriately on CD instructions defining necessary public activity at the time of an "execute" or warning message.
- Enlisting officials and citizens who would serve in the greatly enhanced CD operating organization, and providing for their training, as growing public interest and concern allow.

Achievement of these objectives requires, first, an integrated approach to the detailed plans and warning systems, and their implied organizational and staffing structures. These elements, collectively, define the requirements for public action or movement and the requirements for CD organizational development.

Achievement requires, secondly, the deployment of communicative programs and the dissemination of information at a pace which takes maximum advantage of public interest at any given time.

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[1]For additional discussion, see References 19-21.

This chapter addresses the following topics:

- Elements of a CD communications strategy
- Training, education, and information requirements of the alternative CD programs analyzed in this study
- Cost estimates.

A. ELEMENTS OF A STRATEGY FOR CIVIL DEFENSE COMMUNICATIONS TO THE GENERAL PUBLIC

The CD strategy for program development, introduced in Chapter VI, is designed to provide suitable and timely public information, closely coordinated with the operating requirements implicit in CD plans, at every stage in the preattack evolution of public concern. The following sections elaborate that strategy in greater detail, focusing on training, education, and public information programs. Emphasis is placed on the concepts governing development of communications programs, rather than the tailoring of these programs to a particular CD approach, with its attendant plans, warning mechanisms, and organizational ramifications. The following sections discuss:

- Knowledge requirements for all CD systems
- Sensitivity tradeoffs
- Warning times and the public response to a war threat
- The current status of civil preparedness training, education, and public information programs
- Emergency public information
- Currently available general public information materials
- Training as a means of organizational outreach and increased organizational effectiveness
- Private sector augmentation of local and state governments
- Strategies for improving training, education, and information programs.

1. Knowledge Requirements for All Civil Defense Systems

There exists a body of knowledge and information that applies to everyone at risk in a nuclear war situation. This might best be described as an understanding of the situation and of the actions required to improve the chances of personal and societal survival. It includes a general understanding of the effects of nuclear detonations, including the blast, initial heat, and radioactive fallout effects; ways and means of protection from these effects; and the general civil defense preparations for protection from these effects. These include the warning signal and how to respond to it; the use of public fallout shelters, including how to identify them; what they are and do to protect people, and how to live in them for limited periods of time. It also includes knowledge of how to use private home basement shelters, including instructions on how to improve their fallout shelter protection; how to improvise new fallout shelters, and the need to share shelters with others. It also includes instructions for building home shelters during an emergency.

Knowledge is also needed relative to the use of relocation to provide protection from weapons effects, including what should be taken along in terms of survival supplies and how best to relate and share the resources of the host area community. Lastly, it includes a set of survival skills such as firefighting, emergency sanitation, care of the sick and injured, care of the people, etc.

As one reads over the above knowledge requirements, it is obvious that this is the kind of information most people hope they will never need to use. Also, it is somewhat technical in nature and quite different from what one might call common knowledge or understanding. It is uniquely the kind of knowledge that could best be transmitted to audiences through public education channels, preferably as a part of a broader program of teaching response to all disaster hazards. It can best be used in a setting where the audience can interact with the content. Experience indicates that it can be integrated into programs of instruction dealing with health and safety, science, and government in the public school system.

2. Sensitivity Tradeoffs

The previous chapters discussed differences in public response requirements of the four programs analyzed. Blast shelters have high installation costs, but moderate training, education, and emergency information costs. This is best exemplified by a discussion of shelter use and the public education program with civil defense staff in Europe where blast shelter systems provide protection for most of the population in some countries. It was pointed out that the shelters were in the living environment of the people who must use them. The people understood the existence and use of the shelters, and public education dealt largely with knowledge about warning and shelter use. When this is compared with the sources of understanding and response requirements of people using crisis relocation, it is clear that the demands of the program are much greater. In crisis relocation, people must understand (1) the warning signal, and where to go, (2) relating effectively to host-area reception and care plans, (3) how to live in mass care facilities or share private resident resources, and (4) how to undertake the upgrading of shelters or build improvised shelters.

3. Warning Times and the Public Response to a War Threat

A limiting factor in past assessments of the feasibility of public education programs as a means of increasing effectiveness deals with the general concept of warning time. It is recognized that public demand for survival information increases during a period of perceived threat of war. Conversely, public interest in civil defense information and actions is relatively passive in peacetime. In the past, when CD public education programs tried to increase public perceptions of the threat of war in non-threatening periods, they tended to generate denial behavior and resistance to learning. A mass-media Emergency Public Information program became the last resort. The real opportunity to educate the public is somewhere in between the peacetime low-response period and the short warning period just prior to an attack.

A recent study on the "Concept and Feasibility of a Citizens Civil Preparedness Education Program" [Ref. 19] identifies a more likely pre-war environment of the program. It is difficult or impossible to assess the likely pre-war environment. However, war out-of-the-blue appears to be an unlikely scenario. Different potential types of pre-war environment have been defined as follows:

- A peacetime environment, in which many accept the likelihood of war in their lifetime, but these views are passive and carry low motivation to action
- A crisis-expectant environment, where more and more people see the world as less stable, and inquiries about survival requirements increase slowly and at times rapidly. This might be viewed as a Berlin-type crisis lasting over a number of years, involving peaks and valleys in terms of the extent of perceived threat.
- A crisis surge environment, more like the 1-2 week and 24-hour crisis-buildup times discussed in this study, might be defined as the period during which the government and the people come to a consensus that the risk of war is real and begin taking survival actions.

The education and emergency information phases of these three time periods are: during peacetime--orientation and education; during a crisis-expectant period--training to meet public demand for information; during a crisis surge period--instructions to the public.

4. Current Status of Civil Preparedness Training, Education, and Emergency Information Programs

The identification and development of new programs usually goes through the following phases: (1) research and policy formulation, (2) development of prototype plans and field testing, (3) diffusion of the plans through staff interactions and training, and (4) informing the users of the plans of their existence and the circumstances of their use. The training, education, and information phases come last. Because of past austere budgets, the major focus of civil preparedness has been on the planning process. While it was recognized that paper plans do not achieve effectiveness, in a low-budget program they were perceived as the first and most essential step to achieving an operational capability. Such plans

are obviously needed before widespread community involvement is possible. Training is essential to complement planning and increase the ability of the government to provide information to the public on demand, in a form that can best be used by the public.

In general, DCPA has experienced difficulty in educating the general public to understand attack hazards and practical countermeasures. Relating the survival measure to natural disaster hazards has increased public response.

5. Emergency Public Information (EPI)

The purpose of EPI is to provide information on detailed survival knowledge. Because such information is salient to the general public (and to the news media) only during a period of severe international tension, EPI, by its nature, can be effectively received by the general public only when war is perceived as a distinct possibility. However, civil defense planning and preparations to disseminate emergency public information should be an important part of the regular peacetime activities.

When such a danger is perceived by the public, time would be the most critical factor. By its nature, EPI must be disseminated in short periods of time by the fastest available means, which are the mass media. In a crisis period of a week or less, EPI and training tend to converge into a single "crash" effort for survival instruction of the general public via the mass media.

Survival information would be applicable to specific, local situations. This information and training program would emphasize:

- The location of public fallout shelters, how to get there, and who should go where
- Routes for relocating from a high-risk area, if this is directed by responsible authorities
- Where the safer areas within driving distance of a risk area would be, and who should go where to assure optimum use of host facilities

- Specific instructions on what to do after arrival in the host area
- How host area residents should prepare for incoming relocatees.

Local information would vary greatly, depending on whether the area is considered to be "risk," "host," or "neither"; and whether it is an urban or rural area.

6. Currently Available General Public Information Materials

- "In Time of Emergency" is a citizens' handbook on protective measures during nuclear attack and natural disasters. The pamphlet contains information on protection against the hazards of nuclear attack: improvising fallout protection, shelter living, relocation, and emergency care of the sick and injured. The pamphlet also includes information on protective procedures in case of floods, tornadoes, winter storms, hurricanes, and so forth. The pamphlet is printed in Spanish as well as English. About 30 million copies of this handbook have been distributed to the general public. A nuclear-only variation of this handbook is called "Protection in the Nuclear Age."
- The "Your Chance to Live" book was published and distributed in 1974 to the 50 States and Territories as part of an emergency curriculum for students in grades 7 through 9. The book includes an explanation of nuclear and natural disasters, and of the appropriate responses when an emergency occurs. Films accompanying the unit are available at school district offices.
- A home study course entitled "Civil Defense USA" is available upon request for all interested citizens. The course outlines the basic hazards and procedures for nuclear attack (e.g., warning signals, hazards, fallout protection, and so on).
- A motion picture, "Protection in the Nuclear Age," provides basic survival information for the general public. This film runs just over 23 minutes, and is intended for both film showings and television use.
- Taped survival guidance materials for the general public can be used over the Emergency Broadcast System as supplemental programming to official announcements.
- Survival instructions, both general and locally oriented, in the EPI packages, are part of local Community Shelter Plans and Crisis Relocation Plans. These EPI packages are in formats for both printed and electronic media.

7. Training as a Means of Organizational Outreach and Increased Governmental Effectiveness

The management of survival programs in a nuclear emergency requires a massive expansion of local and state governmental capability and the channeling of activities in new functional areas. Government must train its staffs concerning the unique problems of nuclear attack, help them understand the measures and strategies of reducing the effects of nuclear attack, and train them in the specific roles they must perform in such an emergency. Training programs must be used to help officials at all levels to understand these new roles and prepare for the influx of the public and private sector manpower and resources, to meet the large-scale need of protecting and caring for the nation's population.

A CD program should include at least three types of training: training associated with normal peacetime activities, training in preparation for a possible crisis-expectant period, and training in preparation for a possible crisis-surge period. All three types would be conducted during normal peacetime.

Training associated with peacetime activities would provide orientation about the likely situation resulting from an attack, the civil preparedness measures designed to reduce the effects of an attack, and the special role each operating unit would perform during a period of emergency operations. Training in preparation for a crisis-expectant period would produce the training content needed to facilitate a widespread capability of expansion of governmental functions. Training in preparation for a crisis-surge period would prepare to provide the essential knowledge needed to operate the various activities of government, and prepare to use mass media to transmit the information needed by operating units.

In addition to key governmental departments such as police, fire, engineering, public health, welfare staff and volunteer auxiliaries, special training must be provided in such areas as Nuclear Civil Protection, Radiological Defense, Reception and Care, Emergency Lodgings, Shelter Management, and General Civil Defense Management.

a. Nuclear Civil Protection (NCP)

NCP planning is done by CD planners from the state, county, and involved jurisdictions, including risk and host communities. The CD staffs must have a thorough knowledge of the community's organizational structure, plans, and operations, in addition to the operations and procedures needed for civil defense. With the concurrences and coordination of other departments, the CD staff writes detailed plans for the two attack contingencies: in-place shelters and crisis relocation. Training for this staff is provided through workshops, seminars, and conferences in the field or at DCPA Staff College.

b. Radiological Defense (RADEF)

A RADEF capability is required to measure and manage radiation exposure in and out of shelters; to identify selective decontamination of, and/or remedial movement from, areas of high radiation levels; and to control exposure in recovery activities. The Radiological Defense Officers (RDOs) are the keystone of the RADEF system. They develop operational plans and procedures, train radiological monitors during crisis periods, and provide RADEF input for decisionmakers. RADEF capabilities also provide dual-use benefits for peacetime incidents involving radioactive materials (e.g., reactor or transportation accidents or possible nuclear terrorism).

c. Reception/Care

The care of the population in a relocation mode requires a massive expansion of total community social services. This includes expansion of mass feeding programs, registration and information programs, care of the sick and injured, and the total utilization of the community resources. This is a completely new activity for all communities. Training is required to acquaint community social services with these roles, and to expand resources to meet the large volume of needs [see Ref. 20].

d. Emergency Lodging/Shelter Management

It is necessary to develop emergency lodgings/shelter management capability in consonance with the large-scale expansion of the community resources. A viable and effective state/local management structure is essential for building CD systems and for implementing CD procedures.

e. Emergency Operations Simulation Exercise

These simulation exercises have proven to be a practical and economic tool to provide training in a variety of settings. The Emergency Operations Simulation Exercise (EOSE) has been used to familiarize emergency operating staff with (1) the Emergency Operating Center (EOC) facility, (2) the communications systems, (3) other department duties, (4) the procedures needed for rapid decisionmaking, and (5) the use of limited resources. Simulation exercises provide dual-use benefit for peacetime disasters requiring coordinated emergency operations, and also serve to motivate local and state officials to improve preparedness. Because of the immediate demand for better emergency management in natural and peacetime disasters, and the complex functions required for nuclear attack operations, a jurisdiction begins the exercise program with simple scenarios. After three to five EOSEs, the emergency management staff is then ready for in-place and relocation scenarios based on a postulated nuclear attack. The EOSE training is preceded by planning and operations workshops and/or conferences for public officials. The planning and operations workshops review the basic plan annexes, responsibilities, and procedures with the emergency management staff. Conferences for public officials include discussions of the general organizational structure of emergency management.

f. Training of Local Coordinators

The major focus of current training is to develop the capability of local and state civil defense staffs. The program provides training on the general civil defense mission and programs, and national defense strategy as it relates to civil defense, emergency management, and orientation to special functional areas.

8. Private Sector Augmentation of Local and State Governments

The emergency management staff of a local area, city, or county usually consists of elected officials and department chiefs. However, a major disaster increases the need to use private resources and augment the government staff with representatives from business, industry, labor, and welfare organizations. Major disaster data show that emergency management staffs trained to work as a cohesive and coordinated system, using the expertise and resources of each group, respond effectively and efficiently in saving lives and property.

9. Strategies for Improving Training, Education, and Information Programs

Civil preparedness training, education, and information programs, although conducted during peacetime, should be designed to encompass preparation for peacetime, crisis-expectant, and crisis-surge environments. Preparation for a crisis-expectant period will be the central substantive part of the training. Training and information in preparation for peacetime and crisis-surge periods are modifications of the program that prepares for a crisis-expectant period resulting from constraints in terms of audience motivation or training time available.

The peacetime-oriented public education program should have as its primary goals (1) general orientation to the problem and response requirements and (2) preparation for stress and uncertainty of the public, by teaching strategies of response which will maximize survival and recovery. This program should focus on responses to the nuclear hazard, and assume a favorable attitude by the majority of the public.

Training programs described should be broadened to include a public education component for a full-time staff of civil defense, part-time auxiliary service, and augmentation staff. Each training audience should be exposed to (1) public education content and (2) training materials designed to provide technical knowledge about performance of specified tasks. The crisis-expectant period-oriented training content should assume high levels of motivation to learn, and be designed to (1) achieve

expansion of capabilities by incorporation of volunteers into operating units and (2) increase operational effectiveness by the use of simulation, case studies, operational exercises, etc. The training should focus on increasing performance of designated tasks. Crisis-surge period-oriented training should be packaged for rapid use, and should be action-oriented.

Training programs should be designed to achieve rapid expansion of training capability for use in crisis-expectant environments. This expansion might be facilitated by the development of many optional training channels. Also, the training content and delivery strategy should depend on techniques of self-paced instruction, team training, or group interaction training, which minimize start-up times for training deployment. This will allow rapid delivery of training on public demand, or at the direction of the government.

Further study is needed to apply the study methods used in References 19 and 21 to a range of training and emergency information program requirements of civil preparedness.

Research, development, and testing should be used to prepare training programs for peacetime, crisis-expectant, and crisis-surge periods, in such areas as reception and care, emergency lodgings/shelter management, and public education, where massive expansion of governmental capability is a characteristic of the systems.

Recent public attitude studies indicate that about 40 percent of the adult population would respond to a specific public education request. An adult public education program could be designed and the audience tested.

B. TRAINING, EDUCATION, AND INFORMATION REQUIREMENTS OF THE ALTERNATIVE CIVIL DEFENSE PROGRAMS

The following sections provide an overview of the principal factors governing public communications efforts under the current, Crisis Relocation, Expedient Blast Shelter, and Dedicated Blast Shelter options. Each of these discussions revolves around the strategy components previously

discussed--plans, warning, organizational development over time, and education and public information over time.

1. Current Civil Defense Program

The current program essentially consists of a warning system, a partially completed set of fallout shelters, elements of training and other programs, and the beginning of a crisis relocation program. In high-risk areas, best available shelter from blast effects is to be used. In other areas of the country, fallout shelter is to be used. A shelter period of about two weeks is planned, though very few shelters are stocked with supplies.

a. Plans

Community Shelter Plans have been developed which rely on public fallout shelter as the means of protection. The distribution of people in relation to available shelter results in shelter deficiencies in some areas of most communities. The voluntary sharing of private home basements might occur and help to meet this deficiency. Information has been developed which could be distributed in a crisis period, outlining measures to be undertaken to improvise and/or improve existing fallout shelter during an emergency.

b. Warning

Both risk and host areas would receive attack warning messages, which are intended to trigger "take shelter" actions. Spontaneous evacuation during a severe crisis is likely, thus adding a new sheltering burden on the low risk areas. Sharing of home basement fallout shelter space would be necessary in most areas, but is not formally a part of CD plans.

c. Organizational Development

Over time, the program presents population-management and service-delivery problems. The population would be sheltered near survival resources but would require extensive attention to their distribution during the "pin-down" period in shelters. A large-scale shelter management structure and radioactive fallout monitoring capability would be the major requirement for organizational development during a crisis period. Peacetime training is geared to role performance and the rapid expansion of the management system.

d. Training, Education, and Public Information

Over time, emergency public information would provide survival guidance during a crisis-expectant period. Even at the local level, however, such messages would be confusing due to the conflicting "signals" built into the program--for example, formal reliance on public fallout shelters, which are now often inadequate, and clear requirements for large-scale management systems to respond to population movements and information demands in a systematic way. Much of the communication to the public would be in response to public actions already under way.

2. Crisis Relocation Program

The essential elements of a relocation program include an "execute" message; large-scale population movement to preselected "host" counties; the allocation of incoming evacuees to lodging and shelter facilities (in volunteered homes, buildings, and nearby fallout shelters or basements, some of which the residents and evacuees would have to upgrade before an attack); and the organization of the evacuee-plus-resident population to facilitate delivery of food, water, and essential services during a "waiting" period of several days or longer--until an attack came or the crisis subsided.

a. Plans

Risk-area Crisis Relocation Plans (CRPs) would specify in detail the evacuation routes and destinations of the people, according to carefully defined risk-area neighborhoods. "Key workers" and their families--in some cases, whole organizations of workers and their families--would potentially be given still more specific host area destinations. Selected risk-area officials, or whole organizations, might be preassigned to host area CD management or operating functions in these plans.

Host area plans would divide host counties into small Lodging Sections (2,500 evacuees plus residents), Reception and Care Districts (3-5 Lodging Sections) and, if necessary, Reception and Care Divisions containing several Districts each. Plans would designate headquarters locations for each of these geographical units, as well as the County's Reception Centers, where incoming evacuees would be assigned to specific facilities in the Lodging Sections.

Under current guidance, these host-county plans would designate management positions, from the County Coordinator down to the Facility and Shelter Manager, as well as all positions concerned with the distribution of food, special services for dependent or handicapped populations, and other emergency period services. Still other components would describe procedures for managing and operating police, fire, and health services: reconfiguring the distribution of food and other materials in both risk and host areas; and possibly the continued operation of selected risk-area facilities by commuting workers. The plans would contain detailed staffing arrangements and brief job descriptions, but assume that most positions would be staffed only as growing public concern produced increasing numbers of people to fill these jobs.

b. Warning

Risk and host areas would receive an "execute" message to implement the evacuation, reception, and hosting operations. Both regions would also receive an attack warning message. Spontaneous evacuees (anticipating an "execute" message) could sometimes be channeled to host

area facilities opened "early," but would be difficult to reach with a meaningful attack warning instruction while on the road. For situations involving sudden attacks, or situations in which an "execute" message is not authorized, the warning message would direct all residents to nearby fallout shelter, basements, or other best available protection.

c. Organizational Development Over Time

The program involves by far the most complex public activity and the most extensive population-management and service-delivery problems. Beginning with only very modest staffing in peacetime, the staff would be augmented through any crisis-expectancy period and only reach its desired level as personnel were recruited from the incoming evacuees. In the lodging and shelter operations, while most tasks would involve simple skills, extensive interaction would be required with evacuees and the local population. Specialized skills would, of course, be required in police, fire, food distribution, and other areas, and such organizations would be operating in an unusual community environment calling for CD-specific skills over and above those required for normal emergency operations.

d. Training, Education, and Public Information Over Time

During peacetime planning, public communications would utilize community-specific plans to stimulate interest, while seeking to identify and train the relatively small portion of the public that could be reached through non-CD organizations or other channels. Training materials for operating system jobs, associated with locality-specific plans, would be usable at this and all subsequent stages. Additional training would be provided for radiological defense, shelter management, warning, and other specialized functions, as interest allowed. All training would be geared to preparing the trainee both to perform a job and to instruct later recruits.

Crisis-expectancy public education and information would continue to elicit individual and group participation in the future management system. Materials designed for multi-media presentation would link

general discussions of attack effects to (1) specific "execute" and warning messages and the proper response, (2) community-specific evacuation routes, (3) detailed descriptions of hosting arrangements and organization, (4) CD needs for personnel willing to be trained and assigned. Special arrangements in CD offices would allow the monitoring of information requests, followed by a "collective" response to common concerns via mass media.

The "execute" message would usher in an intense period during which population management would be handled both by the operating organization and media instructions. Recruiting and training would become highly localized extensions of the operating system itself. As defined in the current Reception and Care guidance, the plan for each Lodging Section and District would also constitute an operational guide and a training package, complete with job descriptions, for use by local residents and evacuees. Using modules of information already prepared for shelter management and shelter living, training in these functions would continue even as the population assumed an in-shelter posture.

3. Expedient Shelter Program

This program would result in expedient shelters providing modest blast protection (at least 15 psi), constructed by families or small groups in high-risk areas (but sufficiently far from counterforce targets or other probable aiming points to provide adequate protection from detonations at those points). The government would stockpile lumber and other materials--in the form of "kits"--which would be used by citizens to construct their own shelters.

Possible variants of this program could include shelter construction by contractors or units of local government; special arrangements to construct shelters for dependent, handicapped, or other groups unable to do the job themselves; or a planned, cooperative effort by clusters or groups of people in particular organizations or neighborhoods.

This approach could become appealing to a portion of the population under a variety of circumstances--for example, a prolonged crisis-expectancy period, or a post-evacuation period in which people could be

especially sensitive to the possibility of recurring crises. (This is essentially what happened in London in 1939-1940.)

a. Plans

Community-specific plans would: map the areas in which expedient shelters would offer sufficient protection; describe regulations governing the distribution and use of materials under both normal and crisis conditions; and describe any publicly-controlled areas which would be made available as shelter locations for use by citizens without suitable property. As shelters were constructed, their locations would be mapped and made available to officials providing supportive services through an attack.

b. Warning

Special "execute" messages would describe available supplies, instructions, and any sources of assistance; define requirements governing the location of shelters, methods of construction, and any inspection procedures; and describe this action in relation to any other alternatives available to citizens in various parts of the high-risk areas. Attack warning would be the same as for other cases.

c. Organizational Development Over Time

Peacetime requirements would include an inventory system, maintenance and security of stockpiles, and possibly some provisions for distributing supplies and regulating their use (for those citizens who decide to build a shelter prior to a crisis). Crisis-expectancy demands could require a greatly increased distribution and technical assistance effort, possibly supplemented by extensive arrangements for contractors and local government to build shelters. As shelters were built, local CD plans would be modified to map their locations and plan for providing essential services for the population. Other CD or governmental elements would be directing, or helping implement, shelter construction for populations unable to provide shelter for themselves. CD staffing

requirements would increase substantially during crisis expectancy, but much of this staff activity would revolve around a few relatively straightforward tasks involving the location or construction of expedient shelters.

d. Training, Education, and Public Information Over Time

Information materials and announcements describing the program in peacetime would constitute low-key messages, saying that the construction materials are available to the public, and outlining the procedures and regulations concerning their use in peacetime by citizens who desire them. (This assumes that peacetime distribution of construction materials to the public is permitted under the program--an issue requiring further study.) Intra-CD training materials would prepare local staff to manage this program at a very modest level of demand, but would be designed to allow a rapid expansion of staff and operations concerned with the distribution of supplies and related administrative procedures.

Construction materials distributed to people would be accompanied by instructional packages which (1) briefly describe program procedures and regulations, (2) address the problem of where to locate a shelter, considering nearby targets of weapons, terrain and soil features, weather climate, drainage, etc., and (3) detail the step-by-step construction procedures. Also incorporated in these packages would be information relating blast and fallout effects to structural characteristics of the shelters--the amount of earth shielding, for example. These information packages would be suitable for distribution at any time a shelter might be constructed.

Crisis-expectancy-period training would utilize a set of task-specific modules, also prepared and distributed to local CD offices in advance, describing requirements of each administrative and technical assistance function envisioned in a community's plan. CD staff would be augmented by local governments, contractors, and other organizations, as well as citizen volunteers, all of whom could be assigned in accordance with pre-crisis plans and trained by use of the prepackaged information

modules. Other specialized training functions--radiological monitoring, service delivery, etc.--would be similar to training under other CD programs.

Public information in a crisis-expectancy period would recommend expedient shelters as the best available approach to an extended crisis because of the possibility of a short-warning attack. Community-specific maps, taken from CD plans, would describe eligible locations, given targeting and other factors, and would describe local outlets where information and materials could be obtained. As with the other CD programs, the public's demands for information would be monitored to determine (1) trends in demands for materials and (2) needs for emergency public information materials and programs that respond to common questions and concerns.

4. Dedicated Blast Shelter Program

Blast shelters would be constructed within a few minutes' travel time of the population. (The program analyzed and costed in this study assumed a residential distribution of shelters and an attack while most people are at home.)

a. Plans

Local plans would resemble the Community Shelter Plans (CSPs) originally designed for in-place fallout shelters. The plans would essentially map the distribution of shelters and the allocation of the population to shelter spaces. The plans would also make provision for helping institutionalized, disabled, or other dependent populations to reach shelter.

b. Warning

These systems would refer almost exclusively to the central "take shelter" message and action.

c. Organizational Development Over Time

Peacetime activities would revolve around the maintenance, inspection, and readiness of shelters and supporting systems, such as warning.

Crisis-expectancy periods would see a substantial augmentation of staff to handle information requests and assist dependent populations to prepare for a "take shelter" or warning message. Shelter-stocking and the further distribution of radiological monitoring instruments would be other concerns of this enhanced organization (which would itself be operating in expectation of an attack warning message).

d. Training, Education, and Public Information Over Time

Modules of information on shelter management, shelter living, and specific technical functions such as radiological monitoring could be utilized both as in-shelter training materials or crisis-period instructions for trainees. Except for dependent populations, the problems associated with this program are readily defined and can be covered in modularized presentations of information prepared in advance of a crisis.

Public information materials would concentrate, from the time of shelter construction up to a warning message, on securing the proper allocation of people to particular shelters. Very detailed maps, taken from local plans, would specify "who goes where." Such materials would be disseminated via all media channels and, in prepackaged form, from local CD offices responding to information requests.

The second focal message in crisis-period communications to the public would instruct the public in how to interpret and respond to the warning message. Basically, this program approaches the ideal communications situation for at least the able-bodied citizen, who must attend to one message and remember one or a few shelter locations. This simplicity would be reflected in the organization of educational and informational materials and systems for disseminating them.

C. COST ESTIMATES

Estimates of CD training, education, and information costs over a five-year period for the four programs are given in Table 16. These estimates are extracted from the program cost estimates given in Table 4.

The following points are made in regard to the training, education, and information estimates.

- Effective and successful communicative programs are based upon prior research, development, and full testing.
- Operational, staff, and system-building training are embedded in several elements of Table 4. The cost of training has been extracted and is given in Table 16, indicating an operational training subtotal.
- Costs of programs for the general public are included under Emergency Public Information, Training, and Education.
- For each program, basic capabilities and resources would be established during peacetime. As events fluctuate among peacetime, crisis-expectant, and crisis-surge periods, resources could be shifted to produce more instructional material for the public, more training in a given specialized area, or more public information as circumstances require.
- Cost estimates are greatest in regard to the Dedicated Blast Shelter Program. Not only is it a program of prime magnitude, but it must also encompass a large part of the Crisis Relocation Program for citizens who might spontaneously relocate.

The United States is rich in communicative delivery systems. In peacetime, daily and weekly newspapers and broadcast media are available for CD public information. State educational systems are channels to many people of different ages and interests.

In times of tension, when people are seeking information, not only can training peacetime systems be intensified, but channels leading to adults in the private sector also become increasingly available. Under this heading would come industrial associations, unions, technical and civic groups.

If an attack appears probable and time is limited, emergency public information through the broadcast media becomes the prime resource.

TABLE 16

ESTIMATED COSTS TO ESTABLISH CIVIL DEFENSE
TRAINING, EDUCATION, AND INFORMATION PROGRAMS
(Over 5-Year Period; 1979 $ Millions)

	Current CD	Crisis Relocation 140M at Risk	Expedient Shelters 7M at Risk	Dedicated Blast Shelters 140M at Risk
Shelter				
Survey	0.15	6.00	0.10	0
Planning	0	5.00	0.50	0
Peacetime Construction	0	0	0	4.00
Shelter Management	0	50.00	5.00	100.00
Nuclear Protection Planning	0.15	10.00	2.50	2.50
Direction and Control	0.25	65.00	10.00	83.00
Radiological Defense	1.50	30.00	10.00	30.00
Emergency Public Information, Training, and Education	2.95	150.00	10.00	150.00
Research and Development	0.50	1.60	0.60	10.00
Total	5.50	317.60	38.70	379.50

Appendix A

PRESENT STATUS OF CRISIS RELOCATION PLANNING (CRP)
FOR U.S. MISSILE COMPLEXES

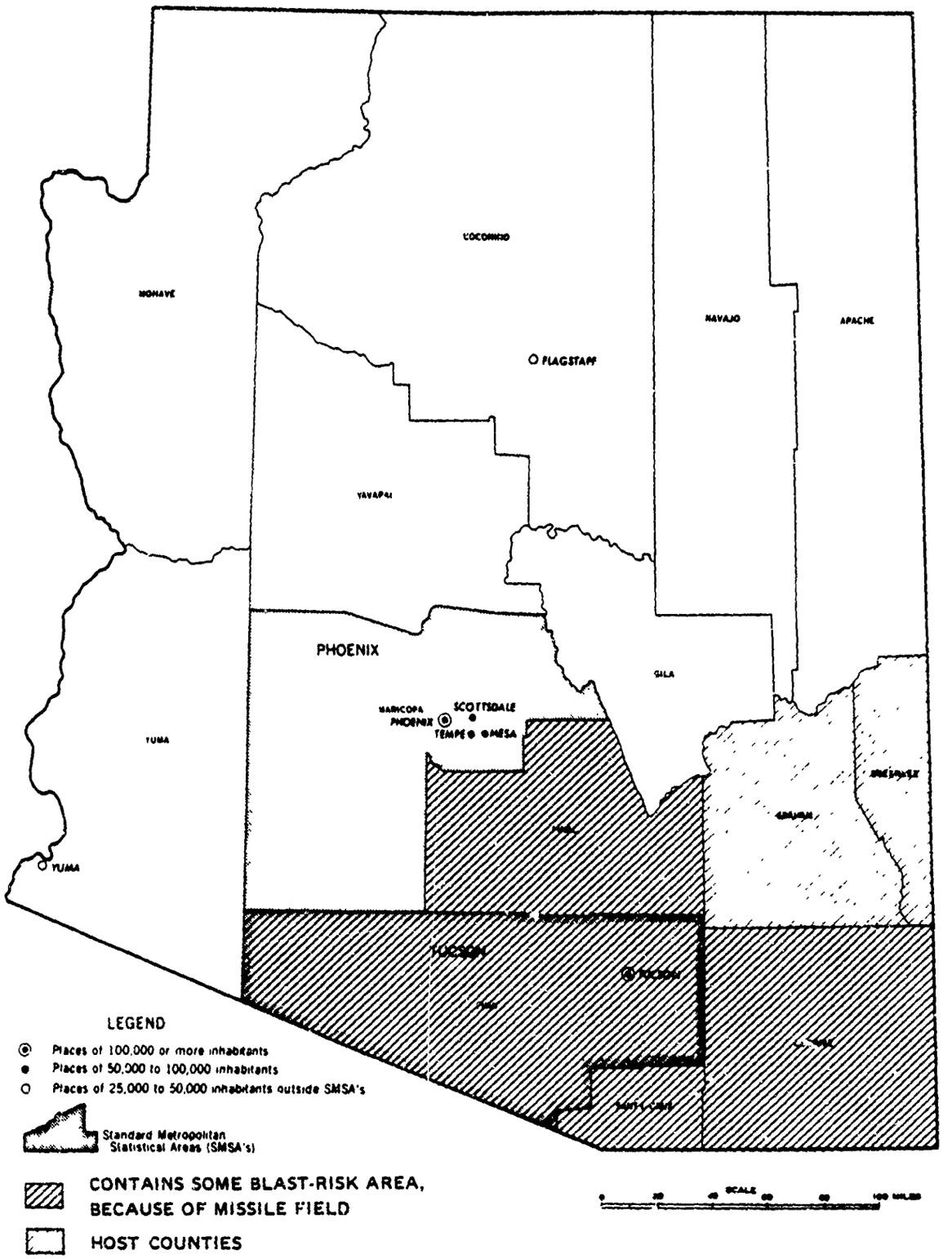


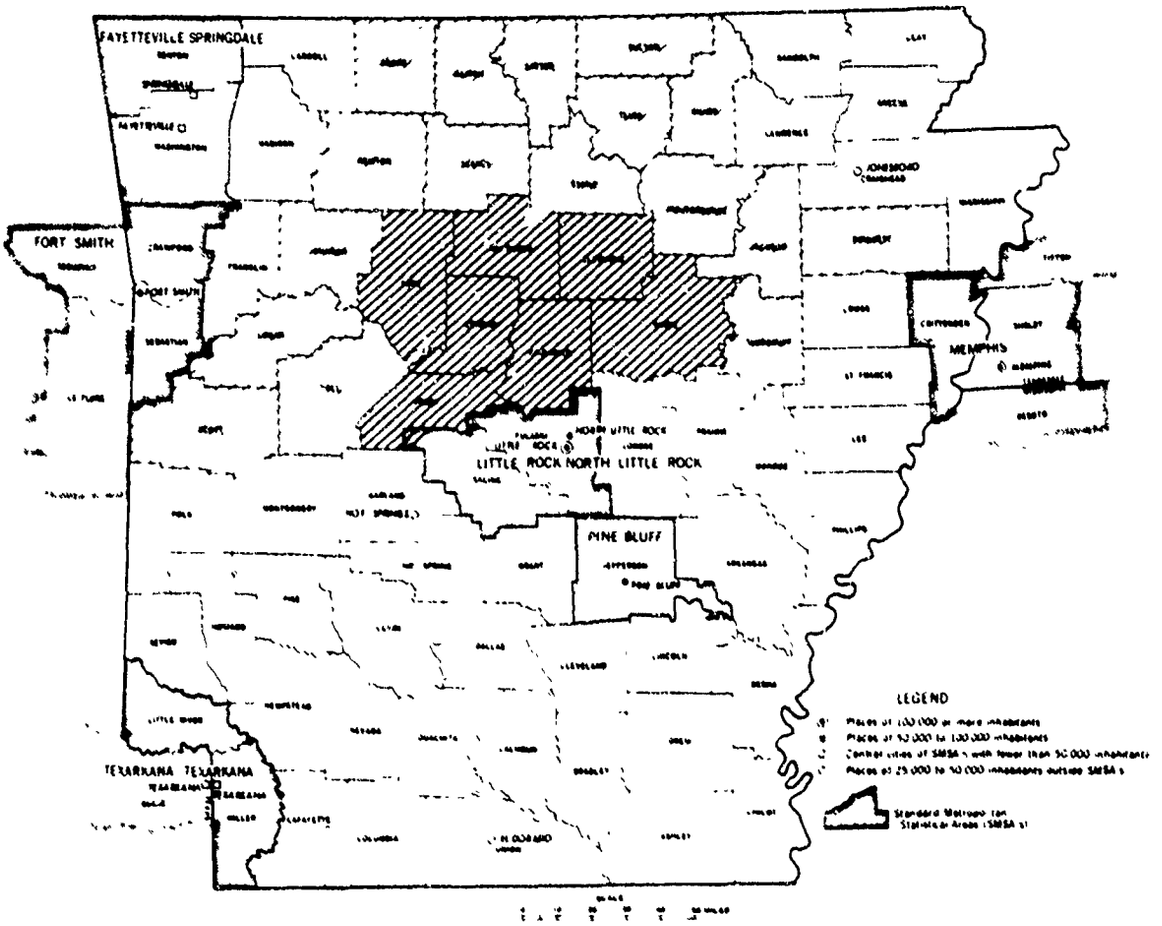
FIGURE A-1. PRESENT RELOCATION ALLOCATION FOR ARIZONA
(Davis-Monthan Missile Field Only)

TABLE A-1

ARIZONA:
PRESENT CRP FOR RISK AND HOST COUNTIES OF MISSILE FIELD

	Estimated Current Population	High-Risk Population	In-Place Option: Allocation & EPI Complete	In-Place Option: Detailed Planning Complete	Relocation Option: Allocation & EPI Complete	Relocation Option: Local Procedure Complete	Outdoor Warning Est. % Pop. Covered	D&C: Exist. EOCs/ Req. EOCs
PISY COUNTIES								
Pima[a]	476,200	476,200	No	No	Yes	Yes	35	1/3
Pinal[a]	105,700	92,100	No	No	Yes	Yes	52	0/3
NON-PISY COUNTIES		Relocatees from Other Counties to be Hosted						
Cochise[a]	90,300	197,500	No	No	Yes	Yes	62	3/4
Graham	22,500	56,300	No	No	Yes	Yes	59	1/1
Greenlee	11,500	37,000	Yes	No	Yes	Yes	48	0/1
Santa Cruz[a]	18,100	57,100	No	No	Yes	Yes	0	0/1

[a]Contains some blast risk area, because of missile field [Ref. 2]. Some people at risk relocate within same county.



RISK COUNTIES
(MISSILE FIELDS ONLY)

HOST COUNTIES,
FOR RESIDENTS OF
RISK COUNTIES SHOWN

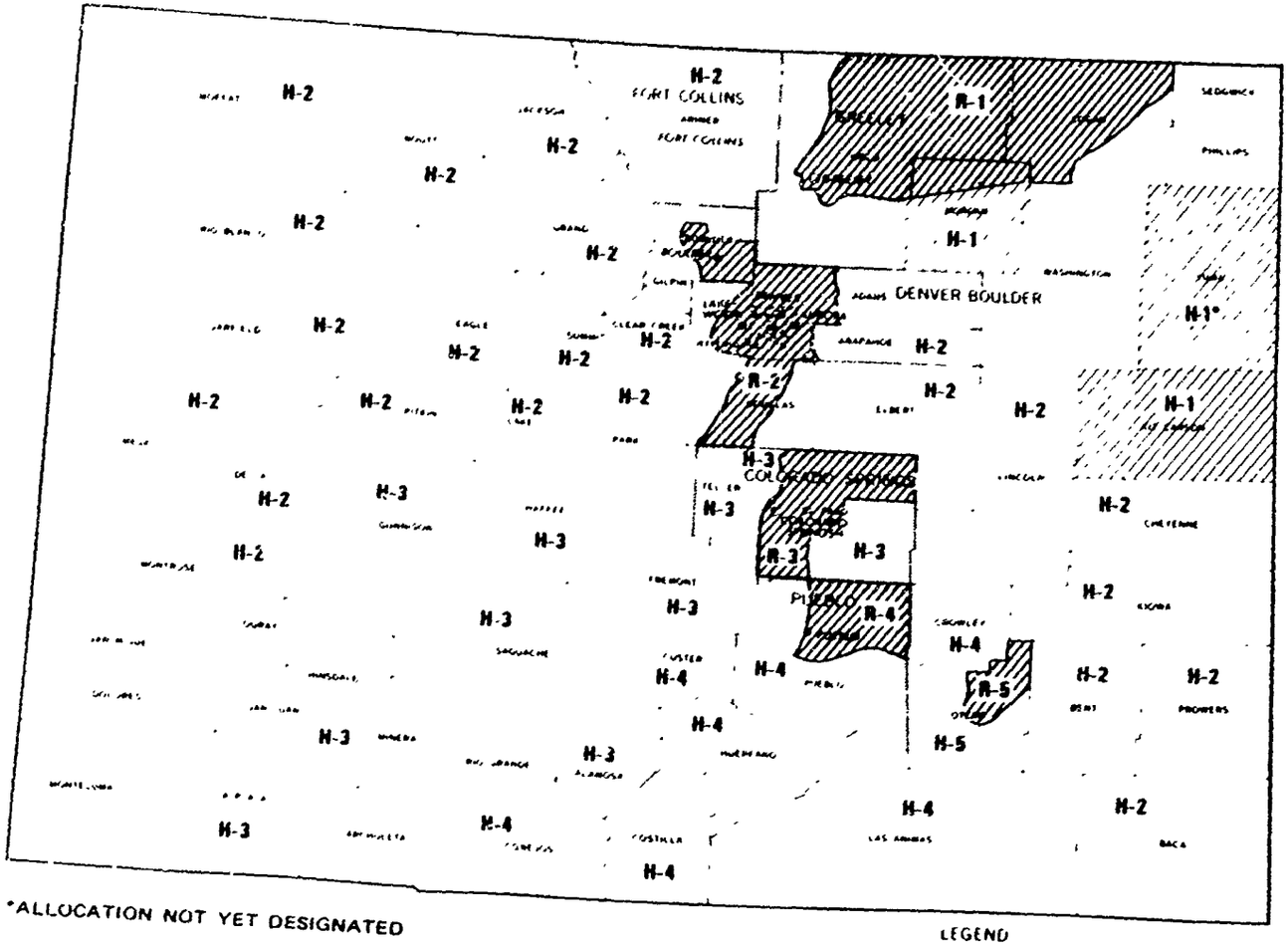
FIGURE A-2. PRESENT RELOCATION ALLOCATION FOR ARKANSAS (Little Rock Missile Field Only)

TABLE A-2

ARKANSAS:
PRESENT CRP FOR RISK AND HOST COUNTIES OF MISSILE FIELD

	Estimated Current Population	High Risk Population	Final-to-Initial Population Ratio	In-Place Option: Allocation & EPI Complete	In-Place Option: Detailed Planning Complete	Relocation Option: Allocation & EPI Complete	Relocation Option: Local Procedure Complete	Outdoor Warning Est. % Pop. Covered	O&C. Exist. EOCs/ Req. EOCs
RISK COUNTIES									
Cleburne	14,600	14,600		No	No	Yes	No	22	1/1
Conway	17,900	17,900	-	No	No	Yes	No	24	1/1
Faulkner	37,800	37,800	-	No	No	Yes	No	27	1/1
Perry	6,900	6,500	-	Yes	No	Yes	No	13	1/1
Pope	33,800	5,400	-	Yes	No	Yes	Yes	19	1/1
Vanburen	10,100	10,100	-	Yes	No	Yes	No	16	1/1
White	46,600	46,000	-	No	No	Yes	No	24	1/1
	167,100	138,300							
HOST COUNTIES		Relocatees from Other Counties to be Hosted							
Baxter	21,600	3,000	1.1	Yes	No	Yes	Yes	23	1/1
Boone	22,900	4,000	1.2	Yes	No	Yes	Yes	10	1/1
Fulton	8,900	3,800	1.4	Yes	No	Yes	Yes	10	1/1
Independence	24,200	19,200[a]	1.8	Yes	No	No	No	17	1/1
Izard	9,500	5,000	1.5	Yes	No	Yes	Yes	23	1/1
Jackson	21,200	16,800[a]	1.8	Yes	No	No	No	25	1/1
Johnson	15,400	15,000	2.0	Yes	No	Yes	Yes	27	1/1
Logan	18,400	24,000	2.3	Yes	No	Yes	Yes	46	1/1
Marion	9,300	1,800	1.2	Yes	No	Yes	Yes	22	1/1
Newton	6,800	1,000	1.1	Yes	No	Yes	Yes	16	1/1
Poinsett	27,800	22,100[a]	1.8	Yes	No	No	No	27	1/1
Scott	9,500	5,900	1.6	Yes	No	Yes	Yes	23	1/1
Searcy	8,300	1,000	1.1	Yes	No	Yes	Yes	19	1/1
Sharp	16,600	3,800	1.4	Yes	No	Yes	Yes	15	1/1
Stone	8,900	1,400	1.2	Yes	No	Yes	Yes	24	1/1
Woodruff	10,500	8,300[a]	1.8	Yes	No	No	No	10	1/1
Yell	16,400	2,200	1.1	Yes	No	Yes	Yes	25	1/1
	249,300	138,300							

[a]Local procedure is not complete. This number is an estimate made, using a final-to-initial ratio of 1.8, to obtain a total number of relocatees of 138,300, which is the high-risk population.



*ALLOCATION NOT YET DESIGNATED

LEGEND

- Places of 100,000 or more inhabitants
- Places of 50,000 to 100,000 inhabitants
- Central cities of SMSA's with fewer than 50,000 inhabitants

Standard Metropolitan Statistical Areas (SMSA's)

RISK COUNTIES

HOST AREA FOR RISK COUNTIES CONTAINING WARREN MISSILE FIELD (R-1)

FIGURE A-3. PRESENT RELOCATION ALLOCATION FOR COLORADO
(Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-3

COLORADO:
PRESENT CRP FOR WARREN MISSILE FIELD RISK AND HOST COUNTIES ONLY

	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCP[c] Prepared	Est. Comp. Date for NCP[c]	Warning: Est. % of Pop. Covered
RISK COUNTIES						
Logan	18,852	1,500	Kit Carson 18,852	NO	1982	60
Morgan	1,938	160	Morgan 1,938	NO	1981	75
Weld	1,354	100	Kit Carson 1,354	NO	1982	50
	22,144					
			Population Ratio Final/Initial			
HOST COUNTIES						
Kit Carson	7,800	28,006	3.6	NO	1981	0
Morgan[d]	21,300	23,238	1.1	NO	1981	75
Yuma[e]	-	-	-	NO	1981	0
	29,100	51,244				

[a] "At-risk" portion only.

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options.

[d] "Non-risk" portion only.

[e] Allocation not yet designated.

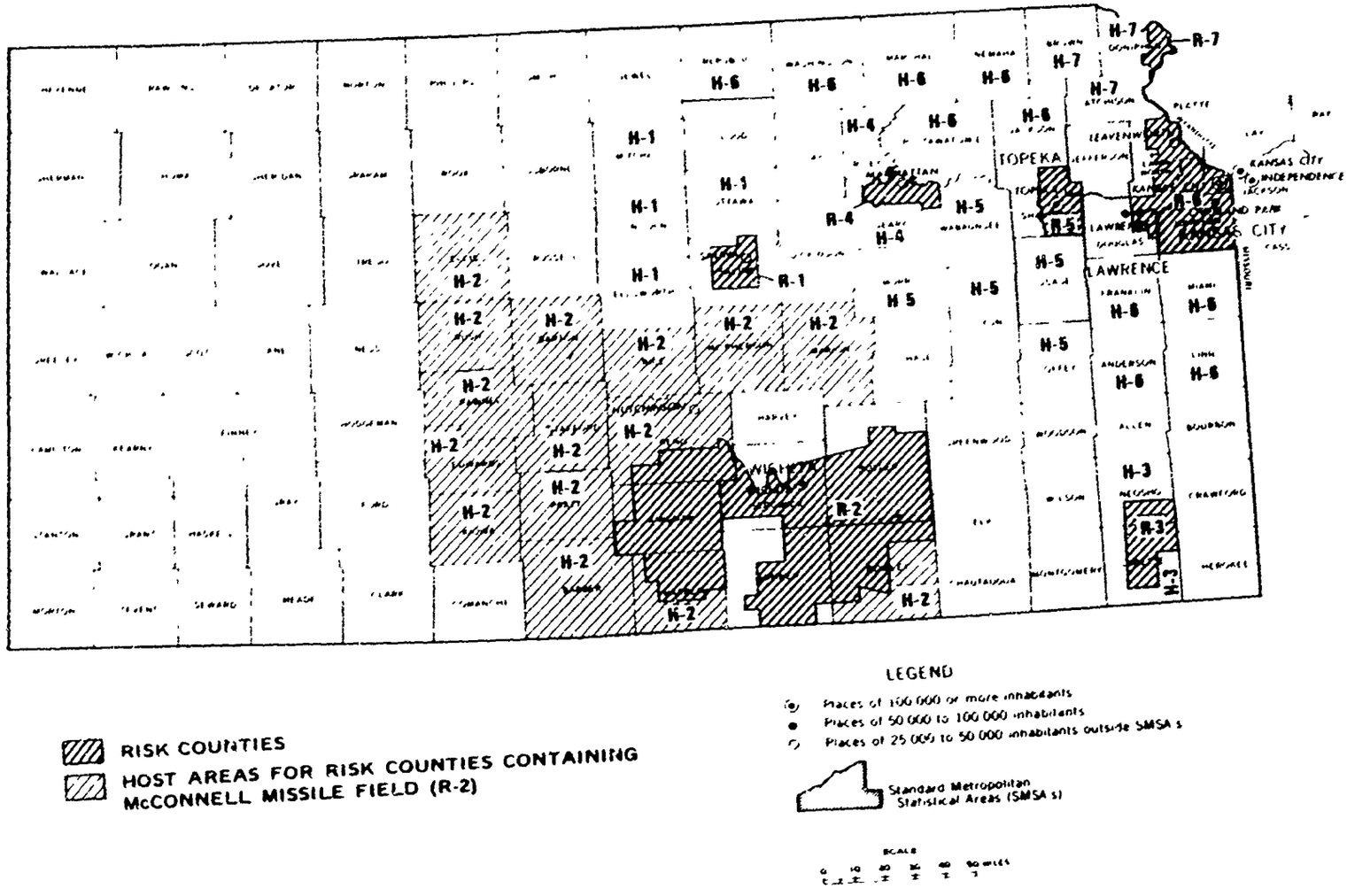


FIGURE A-4. PRESENT RELOCATION ALLOCATION FOR KANSAS
(Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-4

KANSAS:
PRESENT CRP FOR WICHITA/McCONNELL
MISSILE FIELD RISK AND HOST COUNTIES ONLY

	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCPC Prepared	Est. Comp. Date for NCP[c]	Warning: Est. % of Pop. Covered
RISK COUNTIES						
Butler	38,658	3,090	Cowley 23,140 Marion 15,518	NO	1979	65
Harper[d]	2,656	210	Harper 2,656	NO	1980	60
Kingman[d]	7,663	610	Kingman 2,446 Pratt 5,217	NO	1979	44
Reno[d]	3,579	179	Reno 3,579	YES	-	95
Sedgwick	350,694	28,000	Barton 61,326 Edwards 9,162 Ellis 47,942 Kiowa 8,176 McPherson 34,672 Pawnee 16,968 Pratt 14,595 Reno 110,793 Rice 24,640 Rush 10,234 Stafford 11,886	NO	1980	81
Sumner	23,553 478,803	1,890	Barber 13,123 Harper 10,430	NO	1979	80
			Population Ratio Final/Initial			
HOST COUNTIES						
Barber	6,700	19,823	3.0	NO	1979	70
Barton	31,500	92,826	2.9	YES	-	85
Cowley[d]	33,900	57,040	1.7	NO	1979	90
Edwards	4,600	13,762	3.0	YES	-	20
Ellis	25,830	73,742	2.9	YES	-	0
Harper[e]	8,100	21,386	2.6	NO	1979	60
Kingman[e]	9,000	11,446	1.3	NO	1979	44
Kiowa	4,500	12,676	2.8	YES	-	0
Marion	13,400	28,918	2.2	NO	1979	0
McPherson	25,900	60,572	2.3	YES	-	75
Pawnee	8,300	25,268	3.0	YES	-	63
Pratt	9,800	29,912	3.1	YES	-	100
Reno[e]	63,300	177,672	2.8	YES	-	95
Rice	12,500	37,140	3.0	YES	-	60
Rush	5,000	15,234	3.0	YES	-	90
Stafford	6,200 268,700	18,086 695,533	2.9	YES	-	0

[a] "At-risk" portion only.

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options.

[d] At-risk residents of Cowley County relocate within county.

[e] "Non-risk" portion only.

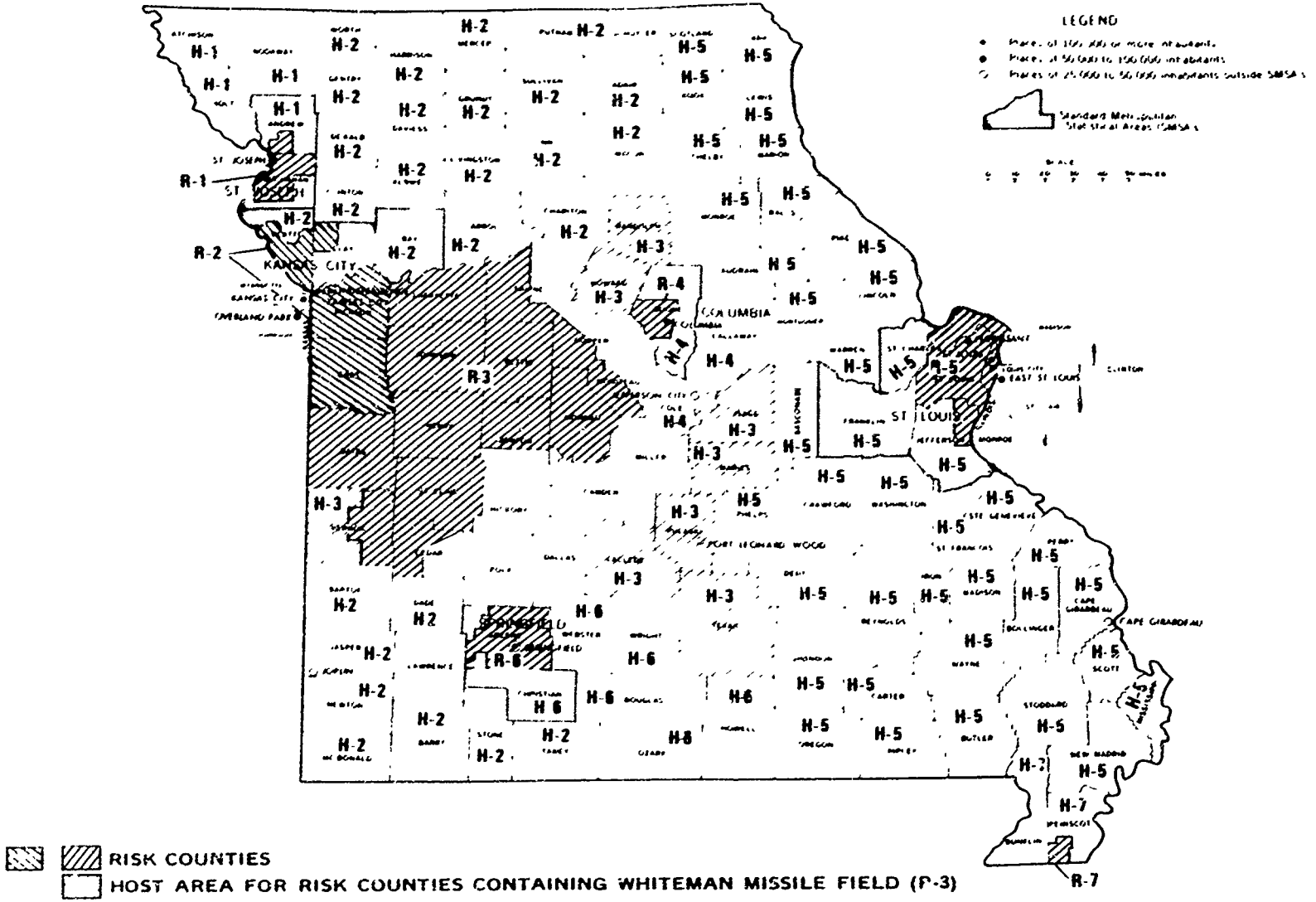


FIGURE A-5. PRESENT RELOCATION ALLOCATION FOR MISSOURI
(Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-5

MISSOURI:
PRESENT CRP FOR WHITEMAN
MISSILE FIELD RISK AND HOST COUNTIES ONLY

	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCP[c] Prepared	Est. Comp. Date for NCP[c]	Warning: Est. % of Pop. Covered
RISK COUNTIES[d]						
Bates	15,468	1,500	Laclede 15,468	NO	1980	0
Benton	9,695	300	Laclede 9,695	NO	1981	63
Cedar	9,424	500	Texas 9,424	NO	1980	37
Cooper	14,732	995	Randolph 14,732	NO	1979	47
Henry	18,451	2,700	Laclede 14,627 Pulaski 3,824	NO	1980	36
Johnson	34,172	1,617	Pulaski 34,172	NO	1979	64
Lafayette	26,626	3,000	Howard 21,066 Randolph 5,560	YES	-	3
Moniteau	10,742	664	Osage 10,742	NO	1980	0
Morgan	10,068	800	Osage 10,068	NO	1980	0
Pettis	34,137	3,000	Maries 11,302 Texas 22,835	YES	-	70
Saline	24,633	1,295	Randolph 24,633	YES	-	42
St. Clair	7,667	1,000	Texas 7,667	YES	-	0
	219,815					
			Population Ratio Final/Initial			
HOST COUNTIES						
Howard	10,561	31,627	3.0	YES	-	30
Laclede	19,944	59,734	3.0	YES	-	0
Maries	6,851	18,153	2.6	YES	-	20
Osage	10,994	31,804	2.9	NO	1979	3
Pulaski	20,168	58,164	2.9	YES	-	0
Randolph	22,434	67,359	3.0	YES	-	14
Texas	18,320	58,246	3.2	YES	-	21
	109,272	325,087				

[a] "At-risk" portion only

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options.

[d] In the case where relocatees move only within county, the county is not listed (viz. Vernon County)

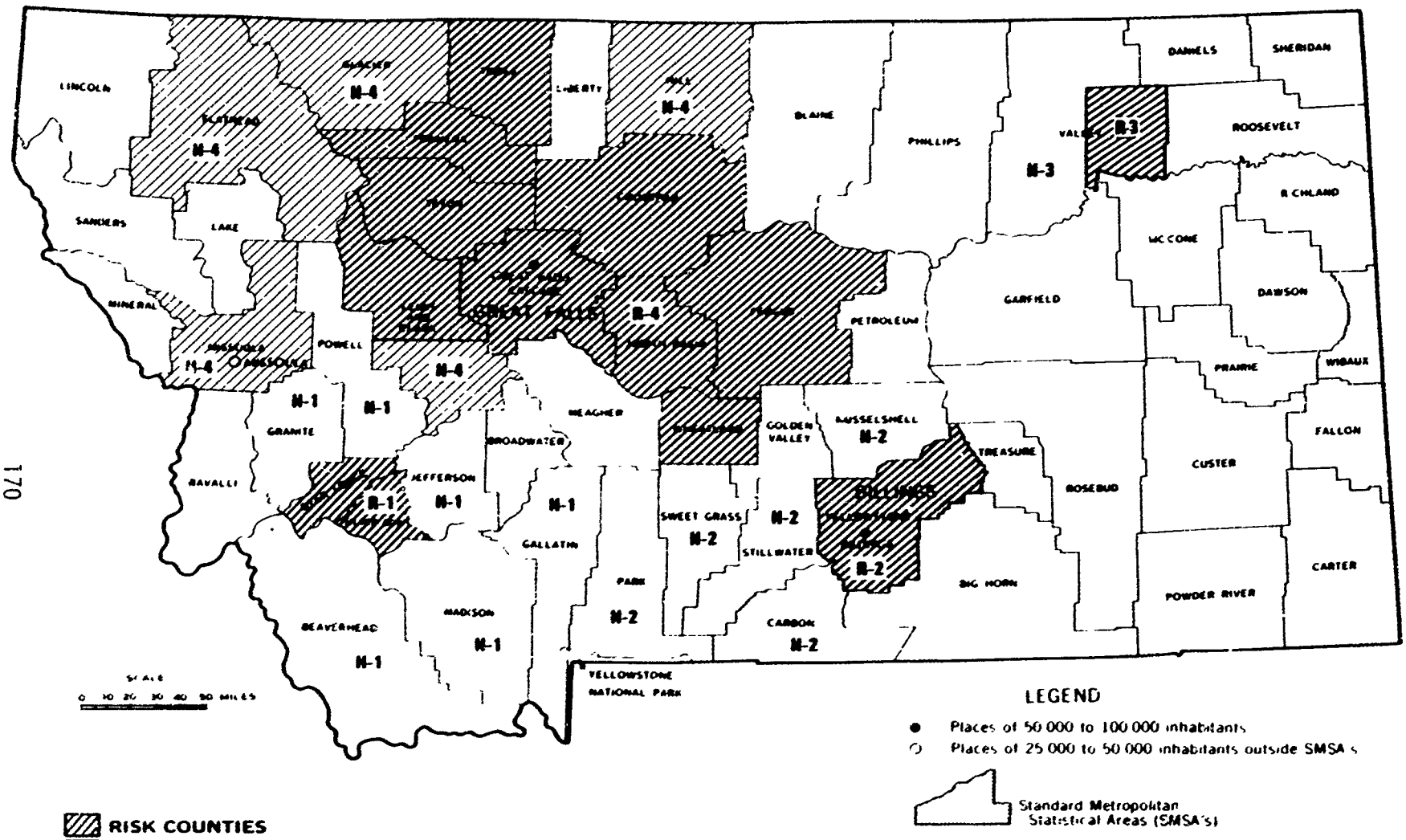


FIGURE A-6. PRESENT RELOCATION ALLOCATION FOR MONTANA
(Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-6

MONTANA:
PRESENT CRP FOR MALMSTROM MISSILE FIELD RISK AND HOST COUNTIES ONLY

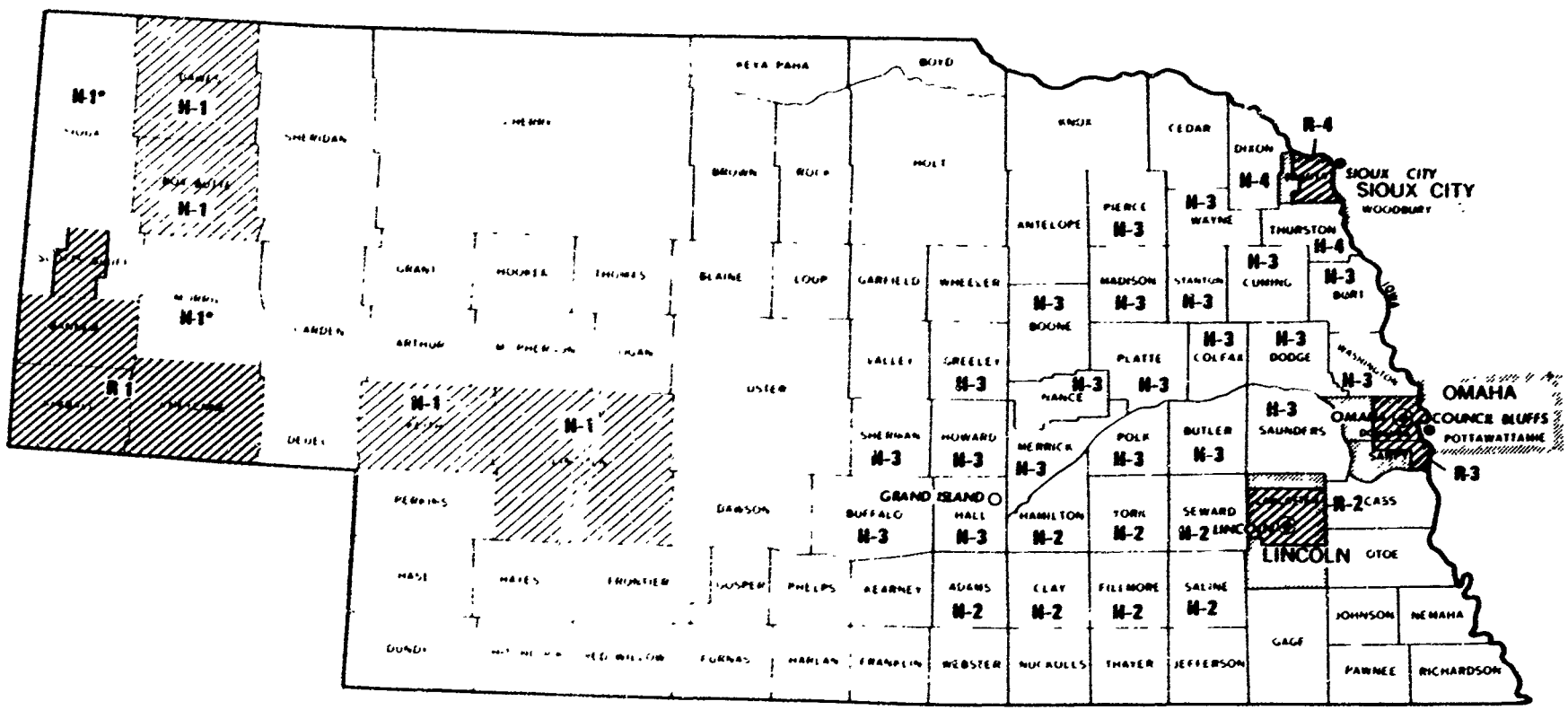
	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCP[c] Prepared	Est. Comp. Date for NCP[c]	Warning: Est. % of Pop. Covered
RISK COUNTIES						
Cascade	68,720	6,560	Flathead 19,994 Missoula 32,893 Lewis & Clark 15,833	NO	1981	80
Chouteau	1,180	520	Hill 1,180	NO	1981	75
Fergus	11,927	1,010	Hill 11,927	NO	1981	60
Judith Basin	2,597	210	Hill 2,597	NO	1982	25
Lewis & Clark	858	2,660	Lewis & Clark 858	NO	1982	-
Pondera	6,488	560	Flathead 6,488	NO	1981	50
Teton	6,018	490	Flathead 6,018	NO	1982	50
Toole	3,418	470	Glacier 3,418	NO	1982	30
Wheatland	2,105	240	Lewis & Clark 2,105	NO	1981	60
	103,311					
			Population Ratio Final/Initial			
HOST COUNTIES						
Flathead	45,400	77,900	1.7	YES	-	60
Glacier	10,783	14,201	1.3	NO	1980	70
Hill	17,358	33,062	1.9	NO	1979	30
Lewis & Clark[d]	32,423	51,219	1.6	NO	1981	75
Missoula	66,500	98,393	1.5	YES	-	60
	171,464	274,775				

[a] "At-risk" portion only.

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options.

[d] "Non-risk" portion only.



LEGEND

- Places of 100 000 or more inhabitants
- Places of 50 000 to 100 000 inhabitants
- Places of 25 000 to 50 000 inhabitants outside SMSA

Standard Metropolitan Statistical Areas (SMSA s)

SCALE
0 10 20 30 40 50 MILES

*SMALL NUMBERS OF KEY WORKERS ONLY

RISK COUNTIES
HOST AREA FOR RISK COUNTIES CONTAINING WARREN MISSILE FIELD (R-1)

FIGURE A-7. PRESENT RELOCATION ALLOCATION FOR NEBRASKA (Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-7

NEBRASKA:
PRESENT CRP FOR WARREN MISSILE FIELD RISK AND HOST COUNTIES ONLY

	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCP[c] Prepared	Est. Comp. Date for NCP[c]	Warning: Est. % of Pop. Covered
RISK COUNTIES						
Banner	943	80	Box Butte 184 Lincoln 759	NO	1980	14
Cheyenne	10,788	860	Keith 3,486 Lincoln 7,302	NO	1981	80
Kimball	5,588	450	Keith 2,125 Lincoln 3,463	NO	1980	59
Scotts Bluff	33,845[a] 51,164	3,630	Box Butte 16,453 Dawes 14,284 Lincoln 3,108	NO	1981	77
			Population Ratio Final/Initial			
HOST COUNTIES						
Box Butte	10,185	26,822	2.6	NO	1980	70
Dawes	9,190	23,474	2.6	NO	1980	76
Keitn	9,259	14,870	1.6	NO	1980	61
Lincoln	33,903 62,537	48,535 113,701	1.4	NO	1979	89

[a] "At-risk" portion only.

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options.

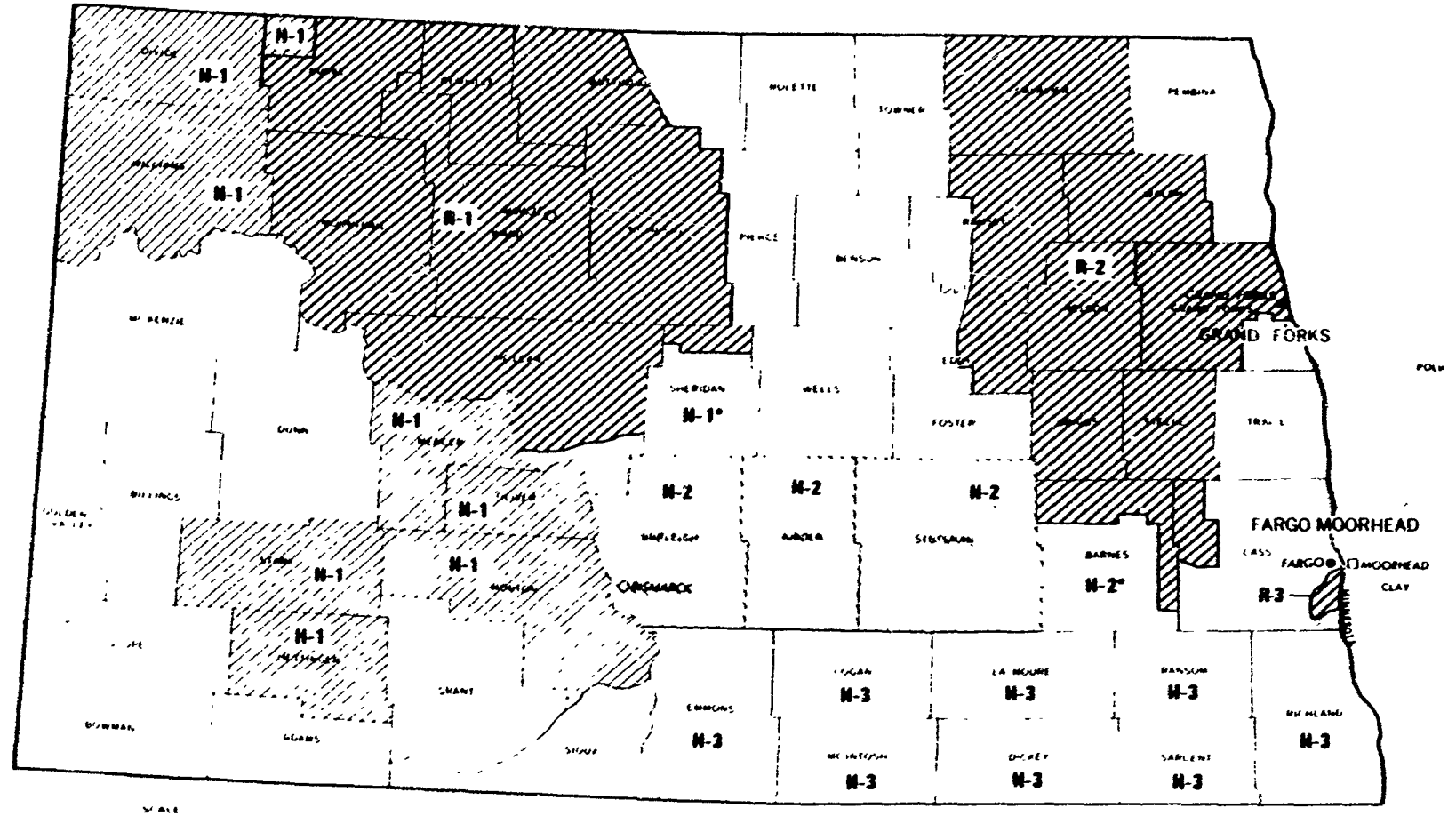


FIGURE A-8. PRESENT RELOCATION ALLOCATION FOR NORTH DAKOTA
(Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-8

NORTH DAKOTA: PRESENT CRP FOR GRAND FORKS AND MINOT MISSILE FIELDS ONLY

	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCPC Prepared	Est. Comp. Date for NCPC	Warning: Est. % of Pop. covered
RISK COUNTIES						
Grand Forks Missile Complex						
Barnes	12,543	1,000	Stutsman 12,543	NO	1980	61
Benson	2,277	180	Stutsman 2,277	NO	1982	30
Cass	1,777	140	Stutsman 1,777	NO	1983	85
Cavalier	8,213	660	Burleigh 8,213	NO	1982	42
Eddy	821	70	Stutsman 821	NO	1984	75
Grand Forks	61,102	4,890	Stutsman 15,969 Kidder 4,362 Burleigh 40,771	NO	1982	81
Griggs	4,184	330	Stutsman 4,184	NO	1981	48
Nelson	5,776	460	Stutsman 5,776	NO	1984	60
Ramsey	12,915	1,000	Burleigh 12,915	NO	1983	68
Steele	3,749	300	Stutsman 3,749	NO	1981	39
Walsh	16,251 129,608	1,300	Burleigh 16,251	NO	1982	78
Minot Missile Complex						
Bottineau	3,236	250	Williams 3,236	NO	1983	56
Burke	4,739	380	Divide 1,000 Williams 3,739	NO	1983	100
McHenry	4,849	350	Mettinger 4,849	NO	1984	50
McLean	9,258	740	Mercer 6,175 Oliver 2,322 Morton 761	NO	1983	39
Mountrail	8,437	670	Williams 8,437	NO	1984	60
Renville	3,828	300	Williams 3,828	NO	1983	50
Sheridan	828	70	Morton 828	NO	1984	46
Ward	58,560	4,700	Morton 27,721 Stark 30,839	NO	1982	50
	93,735					
			Population Ratio Final/Initial			
HOST COUNTIES						
Grand Forks						
Burleigh	48,000	126,150	2.6	YES	--	90
Kidder	47,200	51,562	1.1	NO	1980	32
Stutsman	23,200	70,296	3.0	NO	1979	72
	118,400	248,008				
Minot						
Divide	4,000	5,000	1.3	NO	1981	25
Mettinger	4,700	9,549	2.0	NO	1981	68
Mercer	6,700	12,875	1.9	NO	1981	70
Morton	22,500	51,810	2.3	NO	1980	30
Oliver	2,400	4,722	2.0	NO	1981	34
Stark	19,500	50,339	2.6	NO	1980	76
Williams	19,100 98,900	38,340 172,635	2.0	NO	1980	75

[a] "At-risk" portion only

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options

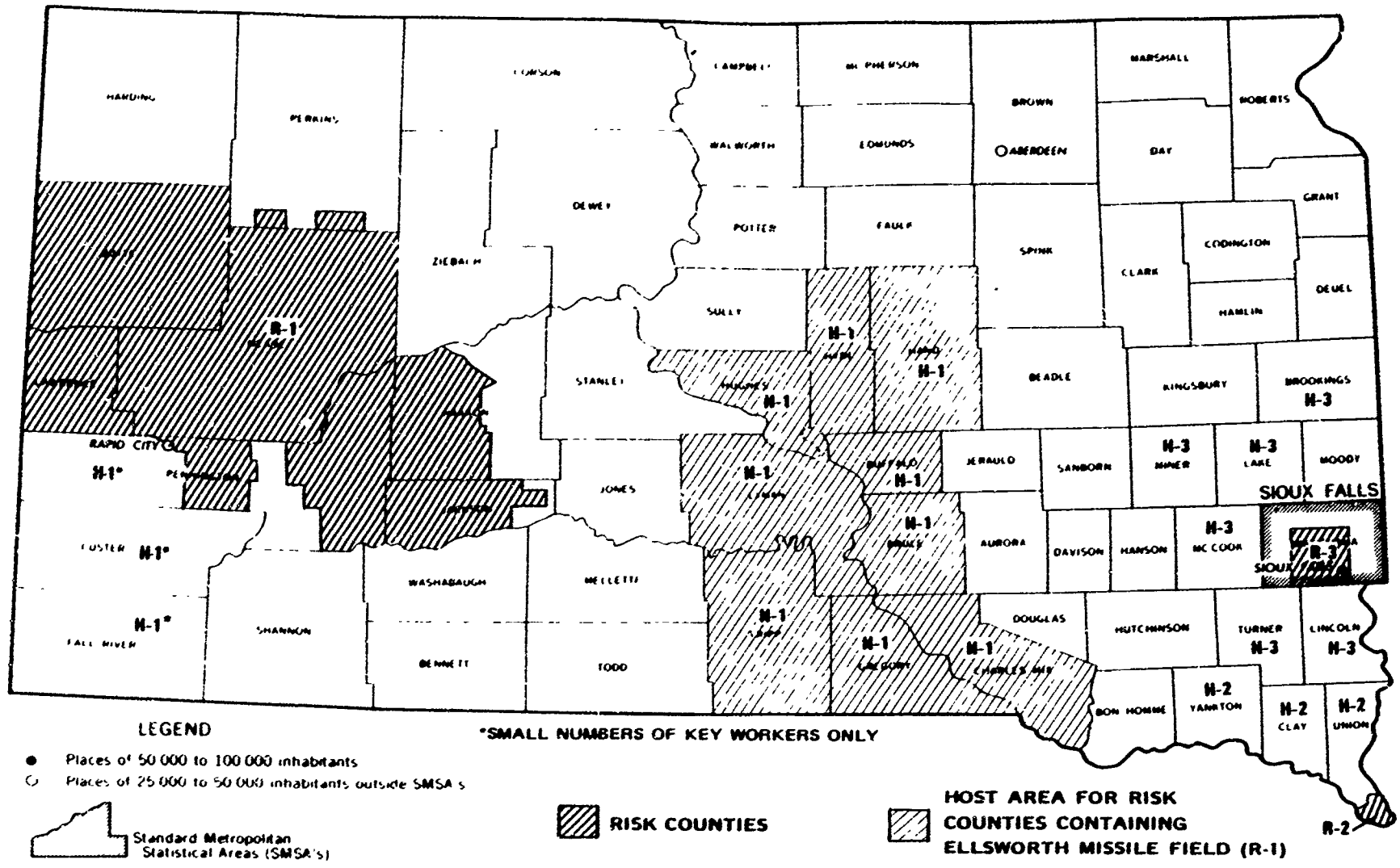


FIGURE A-9. PRESENT RELOCATION ALLOCATION FOR SOUTH DAKOTA (Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-9

SOUTH DAKOTA:
PRESENT CRP FOR ELLSWORTH MISSILE FIELD RISK AND HOST COUNTIES ONLY

	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCP[c] Prepared	Est. Comp. Date For NCP[c]	Warning: Est. % of Pop. Covered
RISK COUNTIES						
Butte	8,151	650	No Risk	NO	1980	0
Haakon	2,793	220	County Specif-	NO	1981	0
Jackson	1,623	130	ically Assigned	NO	1982	32
Lawrence	16,644	1,330	to Host County	NO	1982	75
Meade	18,188	1,450		NO	1982	90
Pennington	64,532	5,160		NO	1980	75
Perkins[a]	14	-		NO	1981	55
	111,945					
			Population Ratio Final/Initial			
HOST COUNTIES						
Brule-Buffalo	7,400	24,200	3.3	NO	1979	52
Charles Mix	10,300	28,700	2.8	NO	1981	80
Gregory	6,600	14,800	2.2	NO	1981	0
Hand	5,400	10,600	2.0	NO	1980	0
Hughes	13,400	56,945	4.2	NO	1980	90
Hyde	2,300	6,700	2.9	NO	1981	50
Lyman	4,000	10,700	2.7	NO	1981	0
Tripp	8,000	16,700	2.1	NO	1980	6
	57,400	169,345				

[a] "At-risk" portion only.

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options.

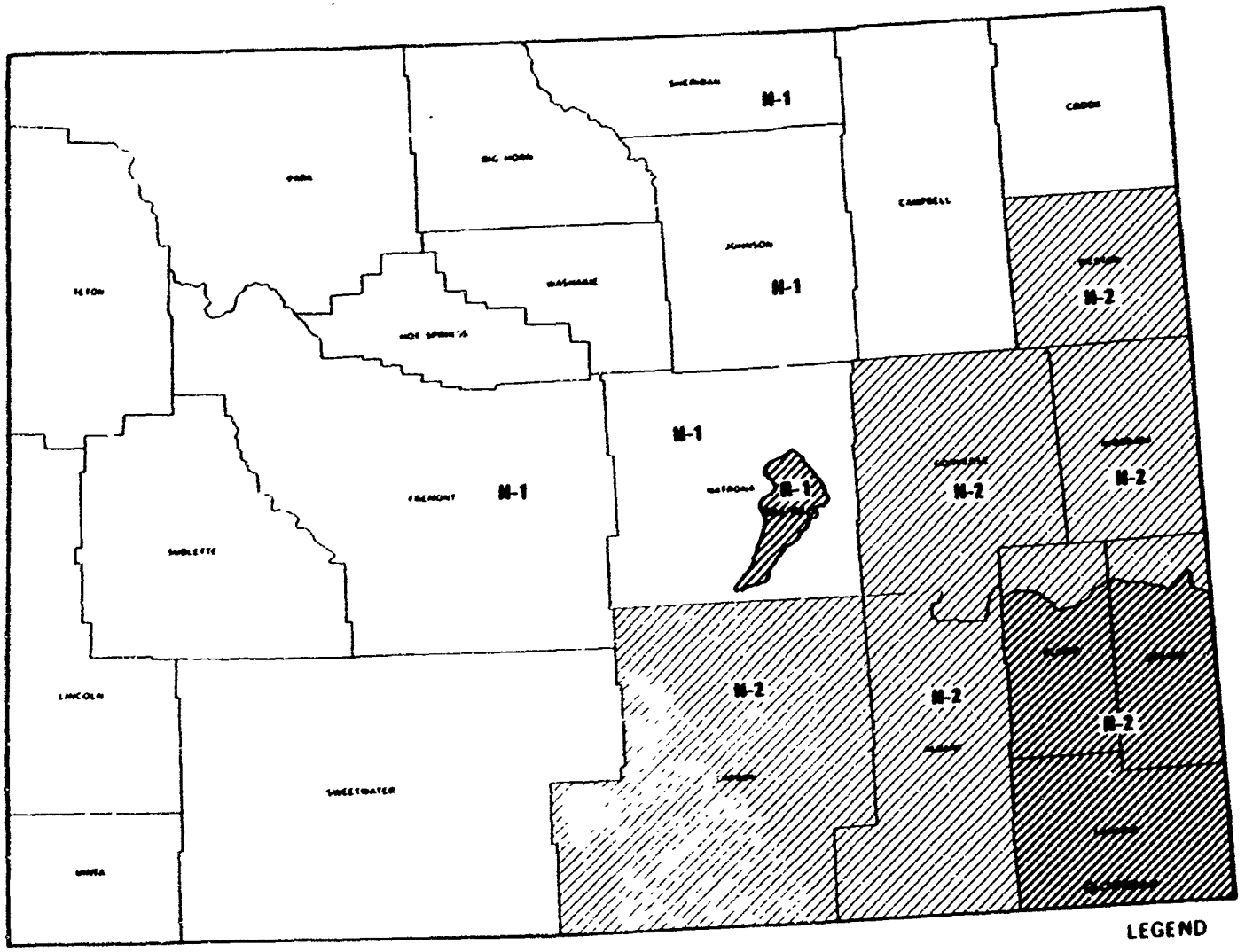


FIGURE A-10. PRESENT RELOCATION ALLOCATION FOR WYOMING
(Host Area H-1 Corresponds to Risk Area R-1, etc.)

TABLE A-10

WYOMING:
PRESENT CRP FOR WARREN MISSILE FIELD RISK AND HOST COUNTIES ONLY

	Initial Population[a]	Final Population[b]	Host County Allocation	Book-Length NCP[c] Prepared	Est. Comp. Date For NCP[c]	Warning: Est. % of Pop. Covered
RISK COUNTIES						
Goshen	10,522	840	Niobrara 3,333 Weston 7,189	NO	1981	60
Laramie	56,494	4,510	Albany 37,532 Carbon 18,962	NO	1981	60
Platte	4,512	360	Converse 4,512	NO	1981	58
	71,528					
			Population Ratio Final/Initial			
HOST COUNTIES						
Albany	27,900	65,432	2.3	NO	1980	10
Carbon	17,200	36,162	2.1	NO	1981	50
Converse	9,400	13,912	1.5	NO	1979	50
Niobrara	2,800	6,133	2.2	NO	1980	55
Weston	6,600	13,789	2.1	NO	1980	65
	63,900	135,428				

[a] "At-risk" portion only.

[b] Final population for risk counties is estimated assuming less than 100% relocation. However, final population for host counties is estimated assuming full 100% relocation.

[c] Nuclear Civil Protection plan, including detailed plans for relocation (CRP) and in-place (CSP) options.

Appendix B

CURRENT CIVIL DEFENSE IN NEW MEXICO AREAS STUDIED

Appendix B

CURRENT CIVIL DEFENSE IN NEW MEXICO AREAS STUDIED

A. LOS ALAMOS CITY/COUNTY, NEW MEXICO

1. Description of Existing and Proposed Civil Defense Plans and Supporting Systems

a. Plans

(1) Community Shelter Plan (CSP). Los Alamos County has a current in-place plan for fallout sheltering the estimated population of 18,000. This Plan provides PF40 or better shelter protection, with approximately 80 percent of the shelter spaces being located in below-ground (basement) areas. Ninety percent of the shelter spaces are located in buildings belonging to the Los Alamos Scientific Laboratory, with the remaining 10 percent being in privately owned buildings in the city/county.

(2) Crisis Relocation Plan (CRP). The current State of New Mexico Plan for Crisis Relocation designates Los Alamos City/County as a Host Area for the Albuquerque Risk Area, with approximately 21,300 persons from Albuquerque to be relocated to Los Alamos. Detailed plans governing operations in Los Alamos under such crisis relocation conditions have not yet been developed, but are scheduled to be completed during calendar year 1979. Surveys for hosting facilities have been completed.

(3) Other Emergency Operations Plans. Los Alamos City/County has developed and tested plans for operations under nuclear emergency conditions, including operating procedures for key emergency services.

b. Supporting Systems

(1) Warning. There are two NAWAS warning terminals in Los Alamos, the primary warning point at the Protective Force Communications

Center that is manned on a 24-hour basis, and the backup warning point located in the EOC. There are nine air horns/steam whistles within the Laboratory Complex for outdoor warning dissemination, and one siren in a residential area. It is estimated that this system will provide 57 percent coverage of the population during normal working hours and 60 percent during other hours. All outdoor devices are controlled by the Primary Warning Point. Other planned warning means are through local Radio Station KRSN (6:00 AM to 11:00 PM) and radio/telephone systems within the laboratory area.

(2) Direction and Control. A 3,400 square foot Emergency Operating Center has been established in the basement of the Occupational Health Laboratory (Building SM184). This facility will provide PF500 fallout protection, and is equipped with: a 90KW emergency generator and 5,000 gallon diesel fuel supply (14-day operation); necessary maps and operating spaces; stored emergency water; adequate toilet facilities; sleeping accommodations for 12; ventilation system; and adequate radio and telephone communications, including ties with local emergency services, state agencies, and selected Federal sites. The psi rating of the EOC is not known, but a cursory examination indicated good possibilities for upgrading to the 10- to 15-psi level. This EOC will be staffed with Department of Energy and Los Alamos Laboratory personnel under nuclear conditions, but will include liaison personnel from the Los Alamos City/County government. Los Alamos City/County has established an EOC in the City/County Government Building, but it does not provide adequate fallout protection and, generally, does not meet DCPA-recommended criteria.

(3) Radiological Defense. Los Alamos City/County has an adequate RADEF System with necessary monitoring instruments on hand and trained personnel available.

(4) Emergency Public Information (EPI). Los Alamos City/County has a current operating procedure covering EPI activities to be followed under nuclear conditions, together with necessary EPI materials

on hand for issuance to the public. Agreements have been completed with area media outlets on procedures to be followed. Capability for remote broadcasting over local Radio Station KRSN from the Laboratory EOC is planned for installation by 1 April 1979.

2. Estimated Effectiveness of Existing Civil Defense Plans and Supporting Systems

a. Crisis Warning (1 to 2 Weeks)

It is believed that CD operations in Los Alamos City/County would be carried out very effectively during this time frame of warning. Due to the unique character of Los Alamos, with approximately 15,000 of the total population of 18,000 being either employees of the laboratory or dependents of such employees, there is a high level of individual involvement in all community endeavors, including civil preparedness. There is also a keen awareness of the threat that a nuclear war would pose to the U.S., as evidenced by the fact that Los Alamos developed its Community Shelter Plan several years before most other communities. The local CD Director has served in that position for many years, is highly respected, and has developed emergency operating plans that are understood and concurred in by both local government and laboratory officials. Over 80 percent of the population has already been assigned to a specific shelter, and the balance, no doubt, would be during a crisis period. Given the international tensions likely to be prevalent during such a crisis period, it is believed the public would readily respond to such crisis training (Shelter Management, Radiological Monitoring, etc.) as might be offered, and generally take such preparatory actions as would likely be recommended. It is the belief of local officials that spontaneous evacuation of Los Alamos under these conditions would be less than 10 percent, an indication of the confidence most citizens have in existing plans for their protection. A possible problem could arise in use of the laboratory EOC by non-security-cleared city/county government personnel, since the Department of Energy's current thinking is that only personnel with security clearances will be admitted.

b. 24-Hour Warning

For the reasons given above under "Crisis Warning," it is felt that nuclear emergency plans would be carried out effectively in this warning time frame. First order of business would likely be checking the readiness of designated shelters, selection of persons for training as shelter managers, and issuance of instructions to the public concerning shelter occupancy. It is believed that adequate warning could be provided to 98 percent of the population and that upwards of 95 percent will go to designated public shelters. Spontaneous evacuation should not exceed 5 percent.

c. Tactical Warning (15 to 30 Minutes)

Since approximately 14,500 persons have been apprised of their shelter assignments, it is believed that orderly and timely movement to shelter under short warning notice would be limited only by the degree of warning provided and capacities of travel routes. It is estimated that warning would be received by about 67 percent of the population during working hours and by 60 percent during non-working times. On that basis, and with the traffic restrictions imposed by the two-lane bridge leading to the laboratory area, it is estimated that about 55 percent would reach shelter if the attack came during working hours and about 45 percent if during non-working hours. The population balances of 45 percent and 55 percent, respectively, could thus be assumed to be unprotected at the time of attack.

B. ALBUQUERQUE, NEW MEXICO

1. Description of Existing and Proposed Civil Defense Plans and Supporting Systems

a. Plans

(1) Community Shelter Plan (CSP). Albuquerque has an in-place plan for providing fallout protection that was developed in 1974. While this plan is considered valid in some respects, it needs to be updated to reflect the significant increase in population since 1974 and to meet current planning criteria, such as movement time. Additionally, an "all-effects" survey has not been made; thus, there is no information available concerning the relative blast resistance of National Shelter Survey (NSS) buildings in the existing plan. The plan includes personnel of the military/defense installations (Kirtland AFB and Sandia Laboratory) who live off base.

Kirtland AFB has developed a plan for sheltering approximately 10,500 on-base personnel in buildings that have been surveyed and identified as NSS shelters. Sandia Base and Laboratory does not have such a plan, since current procedures call for all personnel to be released in the event warning is received.

(2) Crisis Relocation Plan (CRP). The plan for relocating 378,000 persons from the Albuquerque Risk Area to areas of lower risk has been completed, together with supporting public information materials. Due to the high percentage of Spanish-speaking persons in the area, a Spanish version of the relocation plan has been developed and, along with the English version, would be printed for public distribution in the event of an international crisis. The State Plan for Crisis Relocation shows that 12 surrounding counties are designated to serve as host areas for the relocatees from Albuquerque and Bernalillo County. Detailed plans will be developed for each of these host counties beginning in mid-calendar year 1979. All necessary surveys for the host plans have been completed.

(3) Other Emergency Operations Plans. The Albuquerque CD organization has coordinated the development and continuing update of very adequate plans for all likely emergency contingencies, including operating procedures for the EOC and key emergency services (roles of police, firefighters, etc.). Exercises of plans have been held on an annual basis.

b. Supporting Systems

(1) Warning. There are four NAWAS Warning Points in the city of Albuquerque: at the Department of Energy, Albuquerque Operations Office at Kirtland AFB; the National Weather Service Office; the Albuquerque Police Department; and in the EOC, which is utilized as a daily office for the Albuquerque Civil Defense Director and staff. The Primary Warning Point for the city is at the Police Department, which is manned 24 hours a day. The EOC warning terminal serves as a backup warning point. There are 17 outdoor warning sirens in the city which are estimated to provide coverage for 30 percent of the population. The city EOC also has the capability for relaying warning information to seven local AM, FM, and TV stations, four of which operate 24 hours daily. There is also preempt capability from the EOC over the local MUZAK System, with an estimated maximum potential for reaching 70,000 persons. The city has adopted, subject to annual availability of funds, a five-year program for increasing siren coverage to 90 percent by the end of 1983.

The Albuquerque operations office, DOE, has plans covering dissemination of warning to DOE employees and contractor personnel at Kirtland AFB-East by use of existing radio and telephone systems. This procedure can presently be accomplished in about five minutes, but without a high level of confidence as to receipt by all concerned due to antiquated equipment. It has been proposed that this system be replaced by the end of 1981.

(2) Direction and Control. Albuquerque has a 15,000 square foot Emergency Operating Center located in the basement of the Police and Courts Building at 401 Marquette Street. This EOC, which was built in 1970 with Federal matching funds, provides PF1000 fallout protection and

has all necessary emergency backup systems. It has been used on a number of occasions as the City Command Post during emergency situations and is kept in a ready state at all times. All day-to-day city communications systems are available in the EOC, and necessary ties with broadcast media, Federal agencies, state governments, etc., are also in the EOC.

(3) Radiological Defense. The city of Albuquerque has one of the most complete and effective RADEF systems in the country. This system is built around the Fire Department as a backbone, with all required equipment and trained personnel on hand. Equipment is also on hand for shelter monitoring and Operational Weapons Effects Stations, and, to the extent practicable, personnel have been assigned and trained.

(4) Emergency Public Information. Necessary operating procedures and public guidance materials have been prepared. EOC access to local TV and radio stations is planned as the principal means for disseminating emergency public information.

2. Estimated Effectiveness of Existing Civil Defense Plans and Supporting Systems

a. Crisis Warning (1 to 2 Weeks)

As mentioned previously, the existing CSP is not based on current criteria; the latter emphasize use of below-ground spaces as shelters, restrict movement times to shelter to 30 minutes or less, and are based on the population being at home at time of attack. For this reason, it is believed that the existing plan would not prove very effective unless the decision to put the CSP into effect was made prior to receipt of attack warning, which is not considered likely. It is true that a 1- to 2-week period of crisis tension before receipt of warning could be used to good advantage, such as in preparing public shelters for occupancy; in advising the public on measures to take for expedient shelter in their homes, etc. But it is unlikely that more than 35 percent of the population would be sheltered at the time of attack if the CSP was activated upon receipt of warning that an attack was in progress.

As noted above, planning for host operations in the 12 counties of the Albuquerque conglomerate has not progressed much beyond the preliminary stage. For that reason, it is felt that effectiveness in carrying out crisis relocation plans for the Albuquerque risk population would be impaired, but certainly not totally negated, with the likely result that as high as 30 percent might stay in-place unless forcefully required to evacuate.

b. 24-Hour Warning

The constraints on effective execution of plans enumerated under "Crisis Warning" above would generally be even more applicable to this shorter warning time frame, with the result that the percentages shown above might well be 25 percent and 50 percent, respectively, for this case.

c. Tactical Warning (15 to 30 Minutes)

Under this short time frame, it is believed that not more than 15 to 20 percent of the population would be in NSS shelters, with the balance minimally protected. The relatively low degree of existing warning coverage (30 percent) becomes a key factor in this situation.

C. WHITE SANDS MISSILE RANGE CENTER, NEW MEXICO

1. Description of Existing and Proposed Civil Defense Plans and Supporting Systems

a. Plans

(1) Community Shelter Plan (CSP). The White Sands Missile Range Center has an up-to-date in-place shelter plan that will accommodate up to 18,000 persons in PF40 or better fallout spaces, with 10,000 of these spaces being in basement areas with PF100+ protection. There are 1,800 military personnel at the Center and 2,200 military dependents in an adjacent housing area; additionally, there are approximately 5,000 civilian employees and contractor personnel who work at the Center and commute daily from the nearby cities of Las Cruces, Alamogordo, and El Paso. Thus, the requirements

for sheltering will vary from about 9,000 on weekdays to about 4,000 at night and on non-workdays. From the above, it can be concluded that all personnel can be sheltered in spaces with PF100+ fallout protection. All shelters are marked both interior and exterior with CD fallout signs, and each family moving onto the Center is given a map showing the shelters, together with letters of instruction and other pertinent materials. There are no food stocks for the shelters, but essential medical supplies are maintained for shelter use. Each shelter occupant is expected to bring his own supply of food to his shelter.

(2) Crisis Relocation Plan (CRP). While the CD Coordinator for Dona Ana County considers the Missile Range Center to be a potential host area, the current State of New Mexico Crisis Relocation Plan does not make such a designation, and it can be presumed at this point that no crisis relocation plans will be developed for the Range Center.

b. Supporting Systems

(1) Warning. There are 5 outdoor warning sirens at the Center which provide 100 percent coverage. There is not a NAWAS warning point at the Center, but timely warning is received through military communications means. Additionally, the EOC is equipped with override capabilities on Cable TV, which is available free to each home. The outdoor warning system is also activated from the EOC.

(2) Direction and Control. There is a 1,000 square foot Emergency Operating Center in the basement of the Center Headquarters Building. The EOC is equipped with an emergency generator and fuel supply, and PF100+ fallout protection is provided for the EOC staff. The EOC has operating capabilities on all day-to-day radio frequencies, including fire, transportation, military police, range facilities, and other nearby military installations. An emergency staff is designated for the EOC, and an Emergency Operations Handbook (including an annex on Nuclear Incidents/ Accidents) has been developed to govern operations under emergency conditions. Exercises on EOC procedures are conducted at least on an annual basis.

(3) Radiological Defense. An inventory of radiological instruments adequate for both shelter and operational requirements is maintained at the Center, with storage being at the points or locations of designated use. All military personnel receive Chemical-Biological-Radiological (CBR) training and all designated monitors are trained on base by the Army CBR Team, which includes Radiological-Defense-Officer (RDO) training capability. Refresher training is provided every three years, as a minimum.

(4) Emergency Public Information and Public Education. As mentioned above, all personnel, including dependents, are given survival orientation materials upon reporting to the Center. Additionally, there is a Survival Measures Orientation Plan which is reviewed by all employees, military and civilian, upon coming on duty at the Center. Override capability on local Cable TV is planned as the principal means for disseminating public information during emergency periods.

2. Estimated Effectiveness of Existing Civil Defense Plans and Supporting Systems

a. Crisis Warning (1 to 2 Weeks)

It is believed that CD operations would be accomplished with a high degree of effectiveness during a crisis time frame of from 1 to 2 weeks, and that 100 percent of the population would be in adequate fallout shelter prior to an attack that might follow such a period. Shelter drills that have been conducted in past years revealed little or no reluctance to follow prescribed plans and procedures, and the provisions already made for direction and control by designated authorities are considered very adequate and workable.

b. 24-Hour Warning

Operations should prove equally as effective in this time frame for essentially the same reasons as outlined above under "Crisis Warning." It is believed that spontaneous evacuation would be limited

almost entirely to civilian and contractor personnel, of which it is estimated that more than 90 percent would likely return to their homes in neighboring cities. The remaining population of 4,000 plus would be in PF100 or better fallout shelter.

c. Tactical Warning (15 to 30 Minutes)

In view of the excellent outdoor warning coverage available, and the close proximity of essentially all the population to adequate fallout shelters, it is believed that upward of 98 percent will reach shelter during daylight hours and as high as 90 percent if the warning is received at night. Spontaneous evacuation would likely not exceed 3 percent under these conditions.

Appendix C

RESULTS AND APPLICATION OF ANALYSIS AND SENSITIVITY EVALUATION (National, Missouri, and New Mexico)

Appendix C

RESULTS AND APPLICATION OF ANALYSIS AND SENSITIVITY EVALUATION (National, Missouri, and New Mexico)

This appendix is designed primarily to provide more detailed and/or additional information pertinent to or in support of Chapter V, "Analysis of Effects of Possible Nuclear Attacks." The tables show such things as the numerical values of estimated fatalities, injuries and total casualties in considerable detail. These are the numerical values from which the percentage tables included in Chapter V were derived. The figures provide additional information on such things as population distribution as a function of evacuation scheme. In addition, further detail is provided on methods of approach and constraints associated with analysis methods utilized as well as results of some of the analyses which did not appear to warrant space in the main text.

1. National Background Material

A comparison of the results of the counterforce-only, counterforce-plus-research facilities, and full-scale attacks was carried out. The full-scale attack assumes strikes against counterforce targets, other military targets, leadership, industry, and population. Results are not strictly comparable since the constraints applied in the full-scale attack evaluation were not identical to those associated with the counterforce-only (CF) and counterforce-plus-research facility (CF-plus) cases. Despite the lack of absolute consistency, however, the comparative results are estimated to be valid within a range of plus or minus 10 percent.

Table C-1 presents estimates of the U.S. casualties resulting from the three different attack scenarios against two possible civil defense (CD) programs.[1] The first set of casualties assumes current CD with

[1]Casualty estimates for the all-out Soviet attack on CONUS are taken from SPC Report 342, Candidate U.S. Civil Defense Programs, [Ref. 1].

TABLE C-1

ESTIMATED CASUALTIES, ASSUMING 1-2 WEEKS "WARNING"

Percent of Total Population
(Number in Parentheses)

ASSUMED CIVIL DEFENSE PROGRAM	FULL-SCALE ATTACK % of Total Population (Millions)				COUNTERFORCE + DEFENSE LABS ATTACK % of Total Population (Millions)				COUNTERFORCE ATTACK % of Total Population (Millions)			
	KB	KF	I	U	KB	KF	I	U	KB	KF	I	U
Current Civil Defense	54	8	14	24	2.1	2.4	4.3	91.1	0.12	2.3	1.2	96.3
	(114)	(17)	(30)	(51)	(4.5)	(5.1)	(9)	(193)	(0.3)	(4.9)	(2.6)	(204)
Crisis Relocation	9	4	12	75	0.3	0.2	1.2	98.2	0.02	0.2	0.8	99.2
	(19)	(9)	(25)	(159)	(0.6)	(0.3)	(2.5)	(208)	(0.05)	(0.3)	(1.7)	(210)

LEGEND

KB - Killed by Blast
KF - Killed by Fallout
I - Total Injuries
U - Uninjured

spontaneous evacuation by some of the population. The majority of the population will occupy shelters with a modest amount of fallout protection. This posture represents essentially a marginal civil defense capability. The second set of casualties assumes that a crisis relocation program has been fully implemented. The attacks discussed in this paragraph represent three different Soviet threats to the U.S. Figure 11 (main text) graphically depicts the U.S. fatalities resulting from these three attack scenarios with the two assumed CD programs. Under these current CD programs the fatalities resulting from these attacks increase from roughly five million for the counterforce strike to about 130 million for the full-scale attack. With a fully implemented crisis-relocation program and enough warning time to relocate, the number of survivors from these attacks increases dramatically--a factor of about five for the full-scale attack and 10 or more for the CF-plus and CF-only attacks, respectively.

The advantages of implementing a civil defense program involving crisis relocation are obvious. The life-saving ability of such a program, especially for areas where special civil defense measures are needed, could be decisive, provided there was adequate warning time.

2. Missouri

Estimated casualties and injuries, resulting from a CF attack against the missile sites in west central Missouri are shown in Table C-2. In Missouri, the results of a national CF-plus-research facilities attack are the same. A small percentage of the fallout casualties result from the CF attack against the missile sites in Kansas. Significant features of these results are that fatalities due to fallout outside the blast risk area dominate the scene in all cases as shown in Figure C-1. Dramatic reductions in fatalities are shown for Cases 4 and 10 which involve evacuation and fallout and/or blast shelter programs. Generally, for the attacks and cases considered here however, a reduction in fallout fatalities results in an increase in injuries as warning time decreases. This suggests that higher fallout protection factors (PF) could be of advantage. This is probably true, however, only in the downwind direction from areas where a

TABLE C-2

SUMMARY OF MISSOURI CASUALTIES[a]
(BY NUMBER AND PERCENT OF STATE POPULATION OF 4.76 MILLION)
(DCPA COMPUTER ANALYSIS)

	KILLED		INJURED			
CASE	BLAST	RADIATION	BOTH	BLAST	RADIATION	UNINJURED
1	52,600	1,963,200	8,300	16,600	219,800	2,494,800
	1.1%	41.3%	.17%	.35%	4.6%	52.45%
2	57,100	2,044,100	8,000	15,900	210,900	2,419,200
	1.2%	43%	.17%	.33%	4.4%	50.86%
3	67,900	2,363,100	4,400	7,800	123,900	2,190,000
	1.4%	49.7%	.09%	.16%	2.6%	46.04%
4	8,000	238,900	1,700	3,900	1,109,500	3,393,300
	.17%	5%	.04%	.08%	23.3%	71.33%
5	21,000	1,439,900	2,800	5,200	209,500	3,076,800
	.44%	30.3%	.06%	.11%	4.4%	64.58%
6	64,400	1,527,800	6,300	13,900	251,400	2,893,100
	1.4%	32.1%	.13%	.29%	5.3%	60.82%
8	53,200	1,863,700	8,700	13,300	145,200	2,671,100
	1.1%	39.2%	.18%	.28%	3.1%	56.15%
10	6,400	233,900	0	1,000	1,092,100	3,423,600
	.13%	4.9%	0%	.02%	22.96%	71.97%
12	12,700	1,134,200	0	1,800	450,000	3,158,200
	.27%	23.8%	0%	.04%	9.5%	66.39%

[a]Figures hold for attack vs. counterforce targets only or counterforce plus research facilities.

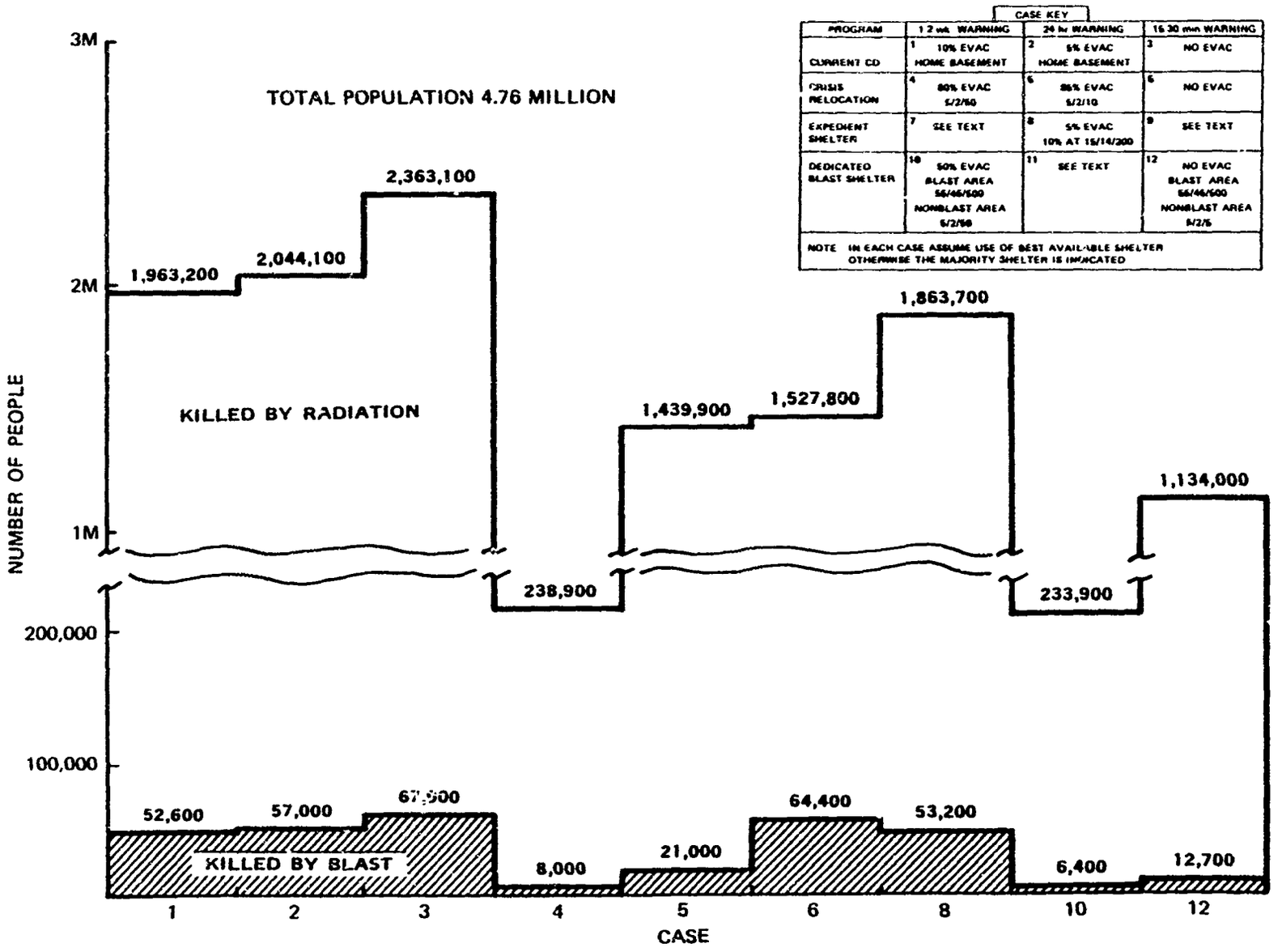


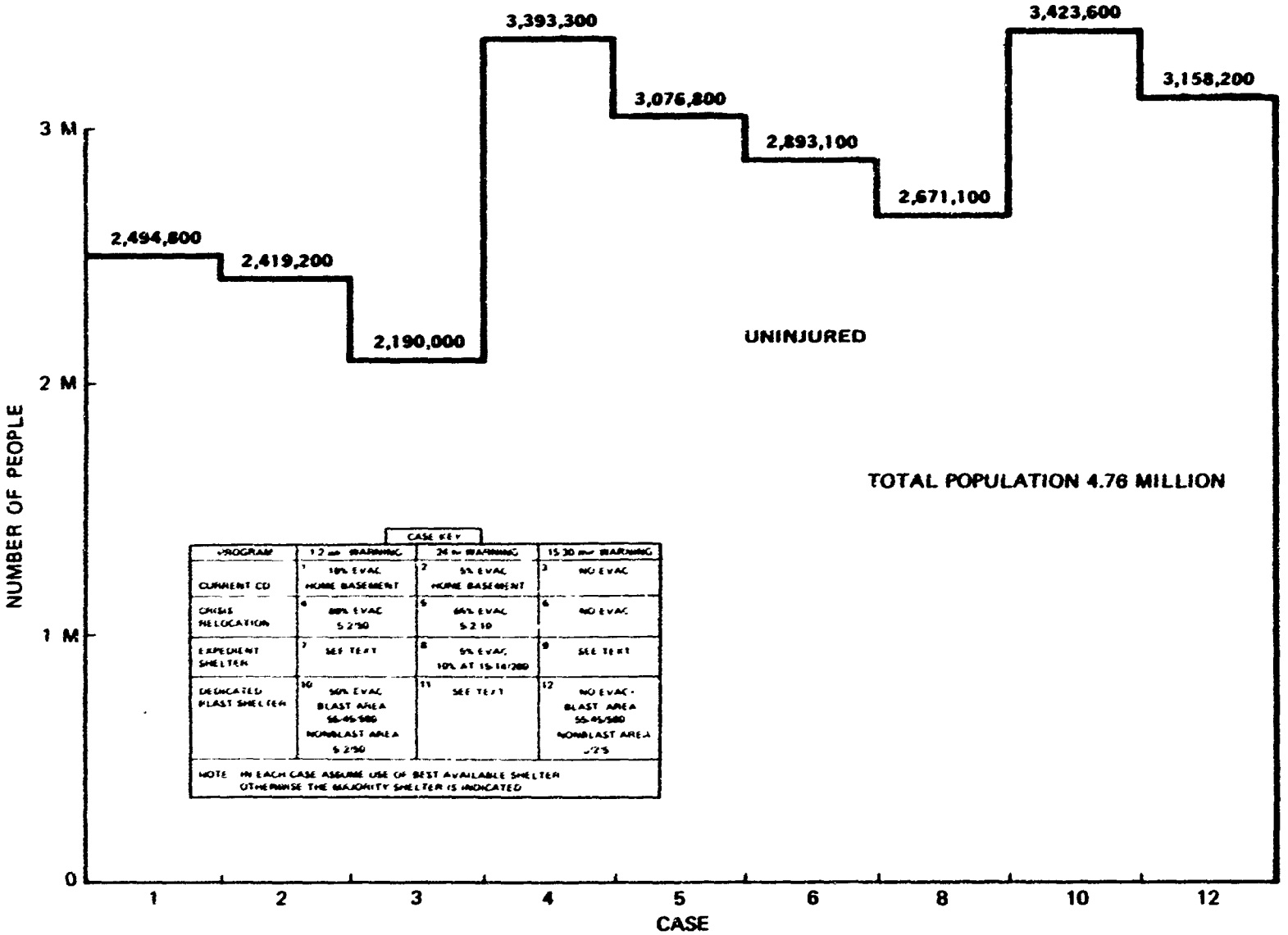
FIGURE C-1. FATALITIES FOR VARIOUS LEVELS OF PREPAREDNESS IN MISSOURI

large number of surface detonations may be anticipated. It is worth noting also that Missouri represents a "worst" case in terms of a CF attack because it is more heavily populated in the likely downwind direction(s) than are other counterforce target areas. Figure C-2 depicts the number of individuals out of the total Missouri population who survive on a case-by-case basis. These were based on the "constant host ratio" evaluation method. The population distribution resulting from this method is shown in Figure 17 of the main text.

Since it is clear that the use of evacuation procedures and/or fallout protection would have the largest potential overall impact in terms of population survival, an evaluation was made of the results of various evacuation schemes. Figure C-3 shows the present population according to 1976 Census Bureau estimates. Figure C-4 shows the population distribution based on current Missouri evacuation plans. It should be noted that this plan calls for 100 percent evacuation of the "risk area" population. This is probably an unrealistic assumption, but the results are worthy of note. Figures C-5, C-6, and C-7 show population distributions based on increasing evacuation of areas subject to downwind fallout (see Figure 15 of main text). Table C-3 provides a description of these plans and shows the estimates of casualties resulting from each of these possibilities. The current Missouri evacuation plan is quite effective, (assuming that full implementation is possible), but could be considerably improved, perhaps, by avoiding evacuation into areas where there is a significant risk of fallout, and evacuating areas where there is a high risk of heavy fallout.

3. New Mexico

Detailed estimates of the DCPA computer run results for casualties (fatalities and injuries) under CF-plus and CF-only conditions are depicted in Tables C-4 and C-5, respectively. The casualties resulting from the CF-only attack are a consequence of fallout from strikes in Arizona. These fatalities and injuries would be uncertain at best, since the variability in wind at the appropriate altitudes is such that the fallout might occur almost anywhere in New Mexico, or miss New Mexico altogether. Note that



CASE KEY

PROGRAM	1-2 hr WARNING	24 hr WARNING	15-30 min WARNING
CURRENT CD	1 10% EVAC HOME BASEMENT	2 5% EVAC HOME BASEMENT	3 NO EVAC
CRISIS RELOCATION	4 80% EVAC 5 2 50	5 60% EVAC 5 2 10	6 NO EVAC
EXPEDIENT SHELTER	7 SEE TEXT	8 5% EVAC 10% AT 15-10/200	9 SEE TEXT
DEDICATED BLAST SHELTER	10 50% EVAC BLAST AREA 55-65/500 NONBLAST AREA 5 2 50	11 SEE TEXT	12 NO EVAC - BLAST AREA 55-65/500 NONBLAST AREA 1/25

NOTE IN EACH CASE ASSUME USE OF BEST AVAILABLE SHELTER OTHERWISE THE MAJORITY SHELTER IS INDICATED

FIGURE C-2. UNINJURED FOR VARIOUS LEVELS OF PREPAREDNESS IN MISSOURI

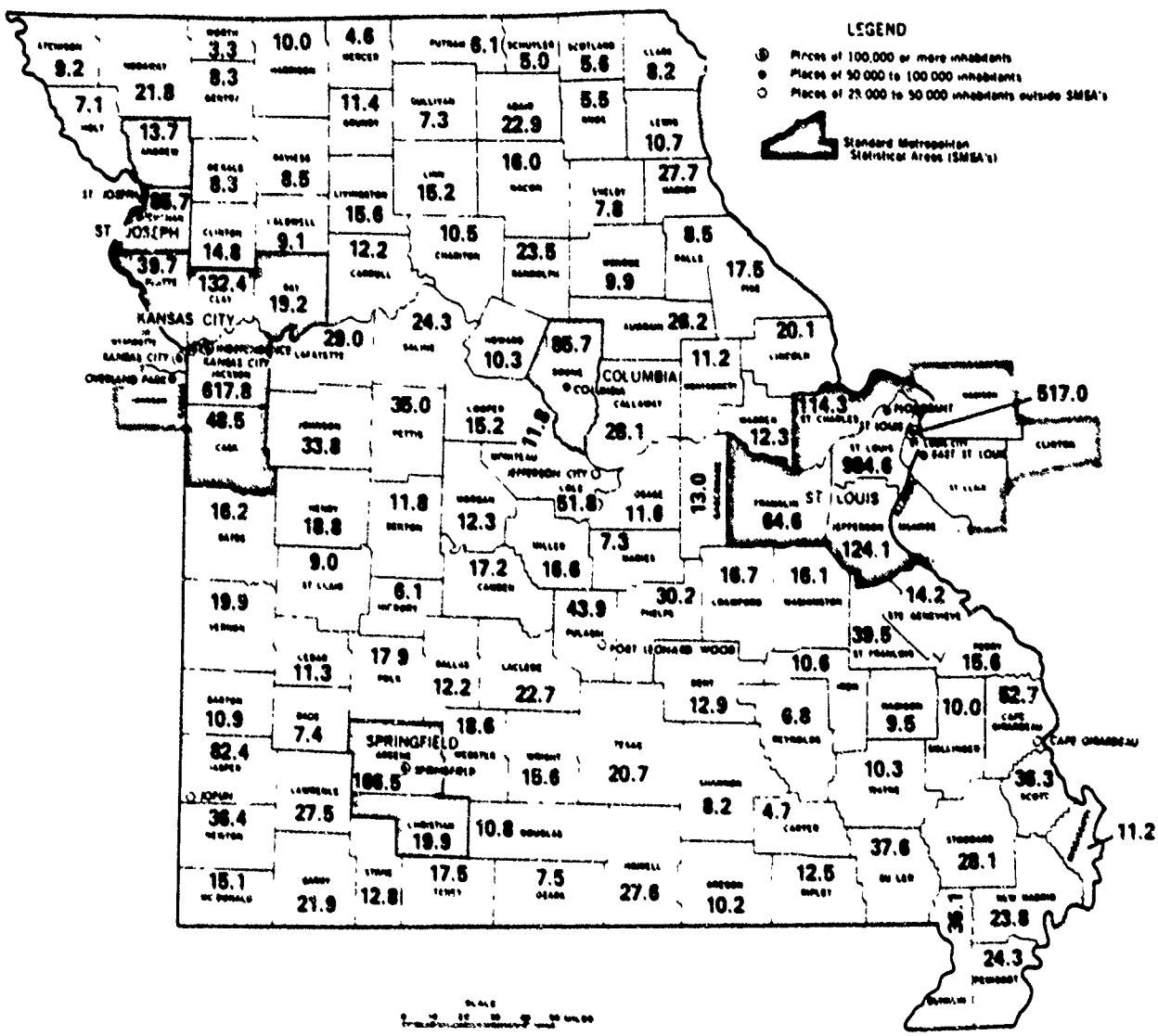


FIGURE C-3. MISSOURI, INITIAL POPULATION IN THOUSANDS (Census Bureau Estimates for 1976)

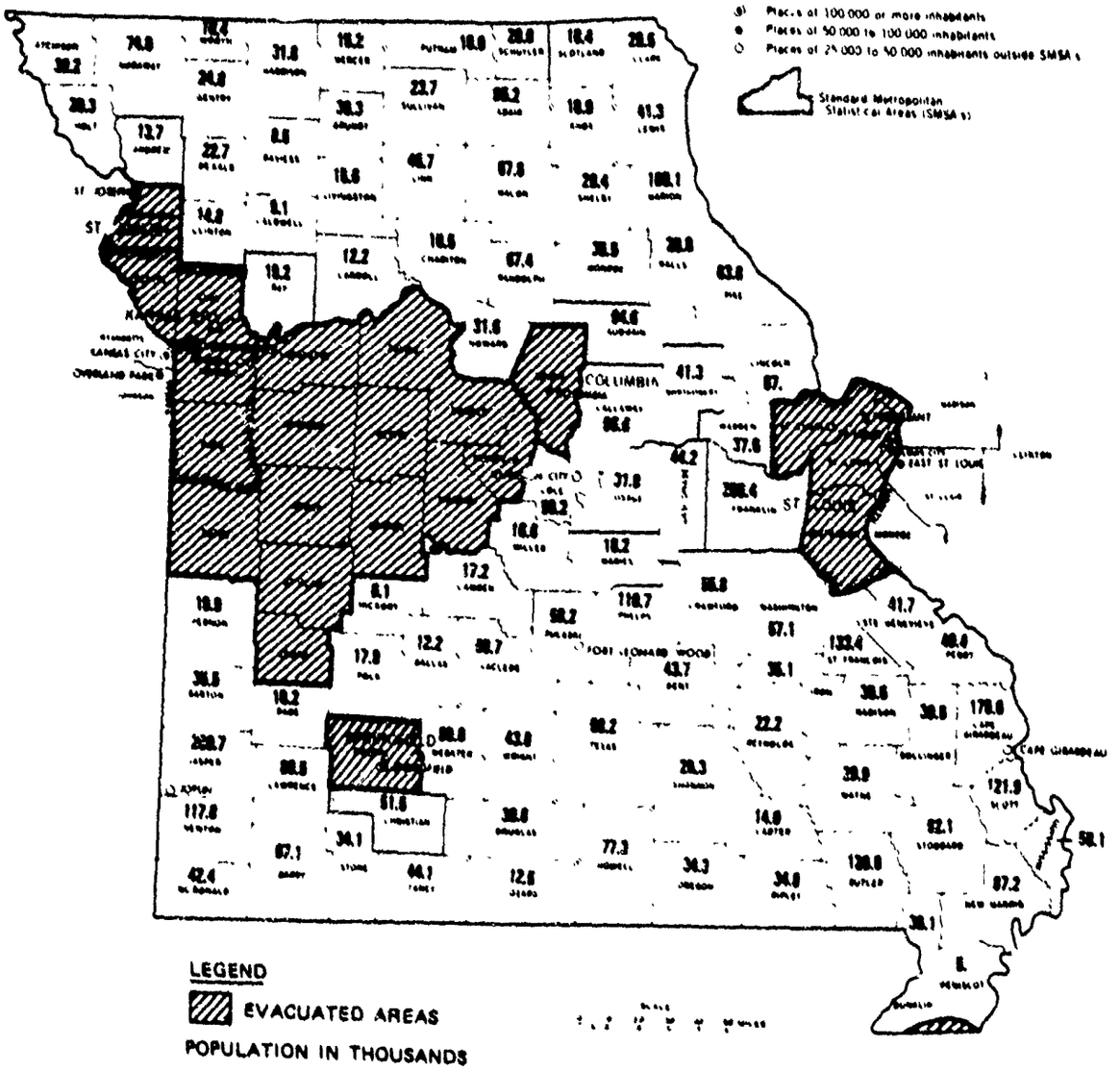
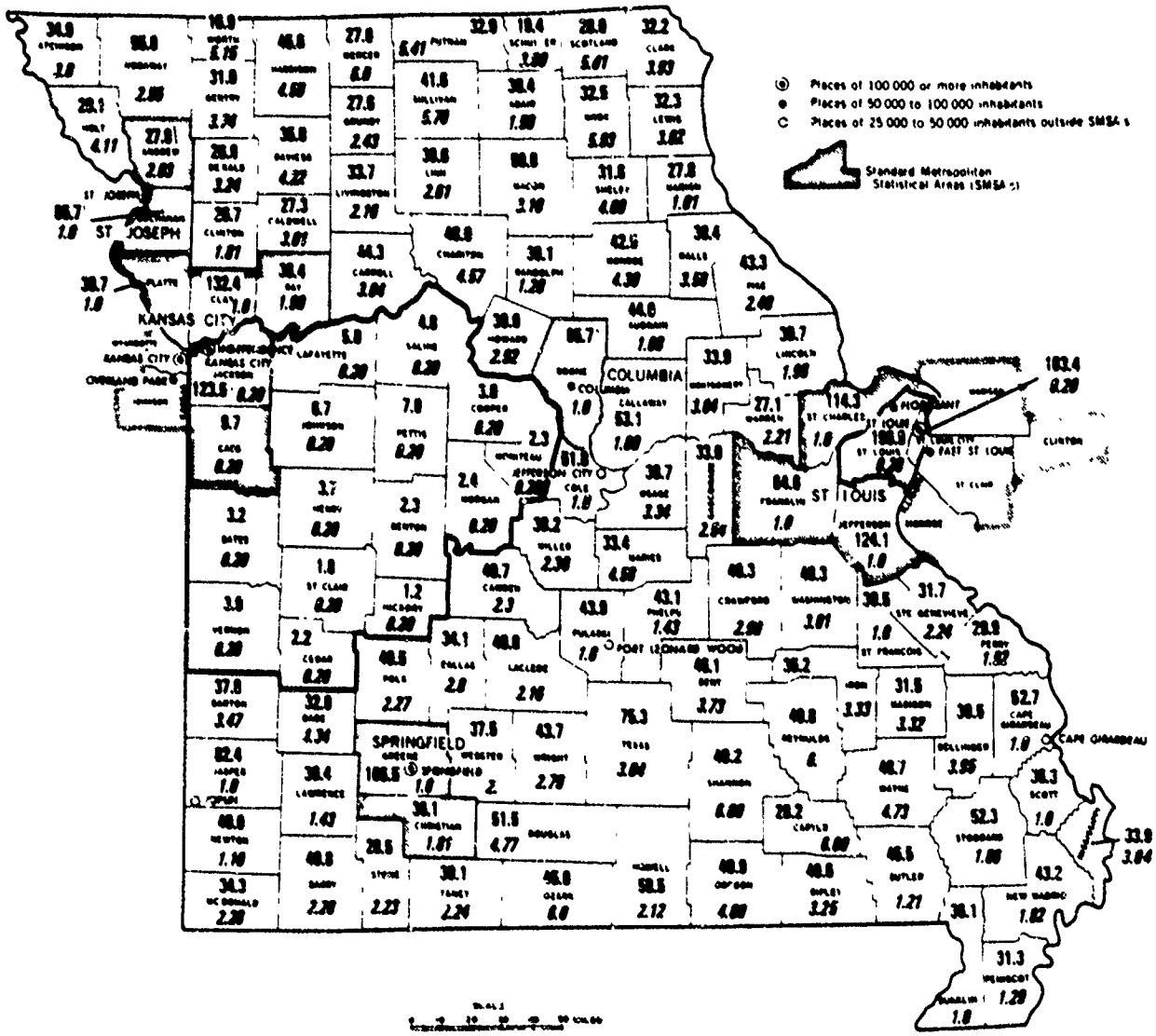


FIGURE C-4. MISSOURI FINAL POPULATION FOR EVACUATION PLAN E (100% EVACUATION FROM INDICATED COUNTIES)



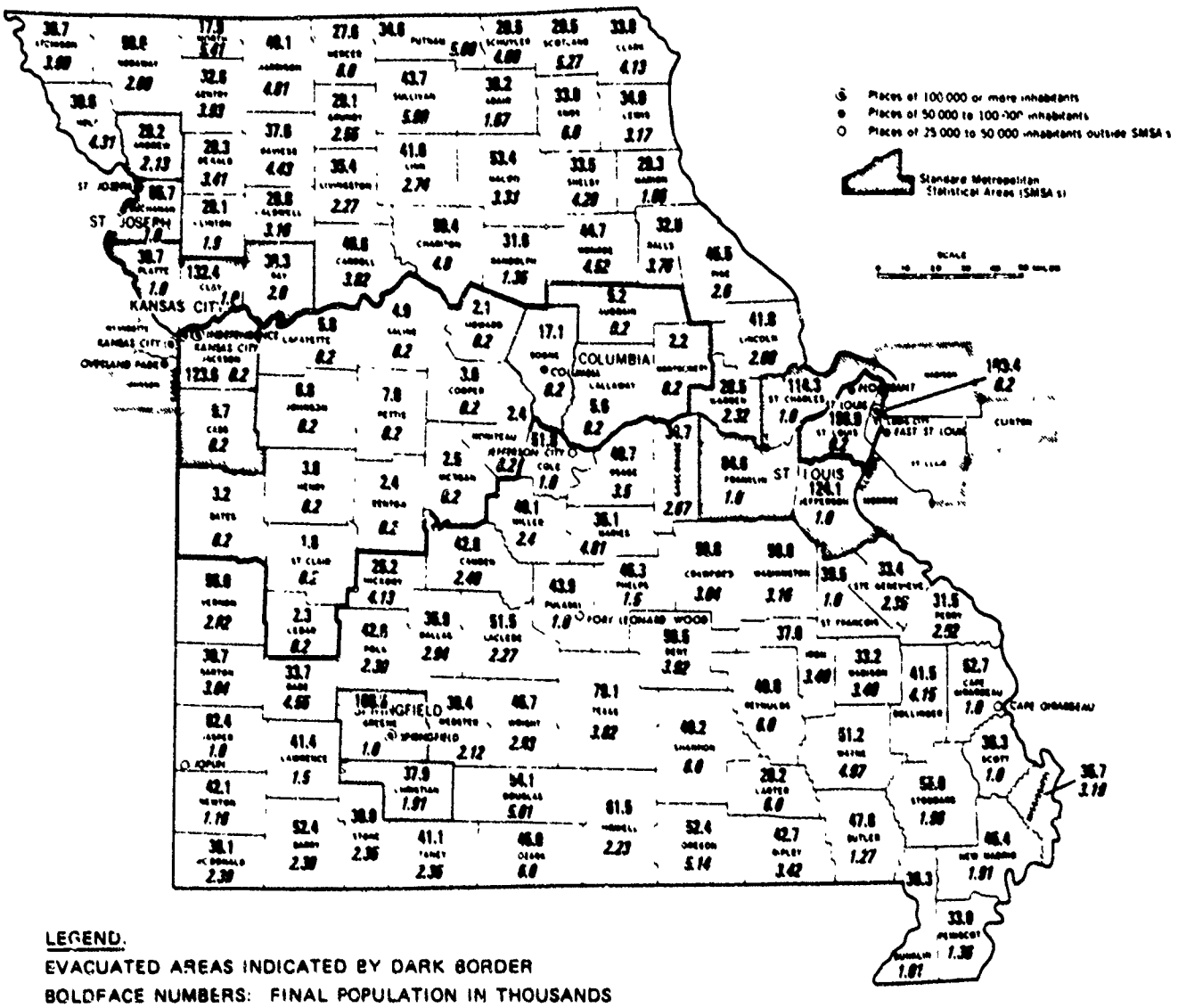
LEGEND.

EVACUATED AREAS INDICATED BY DARK BORDER

BOLDFACE NUMBERS: FINAL POPULATION IN THOUSANDS

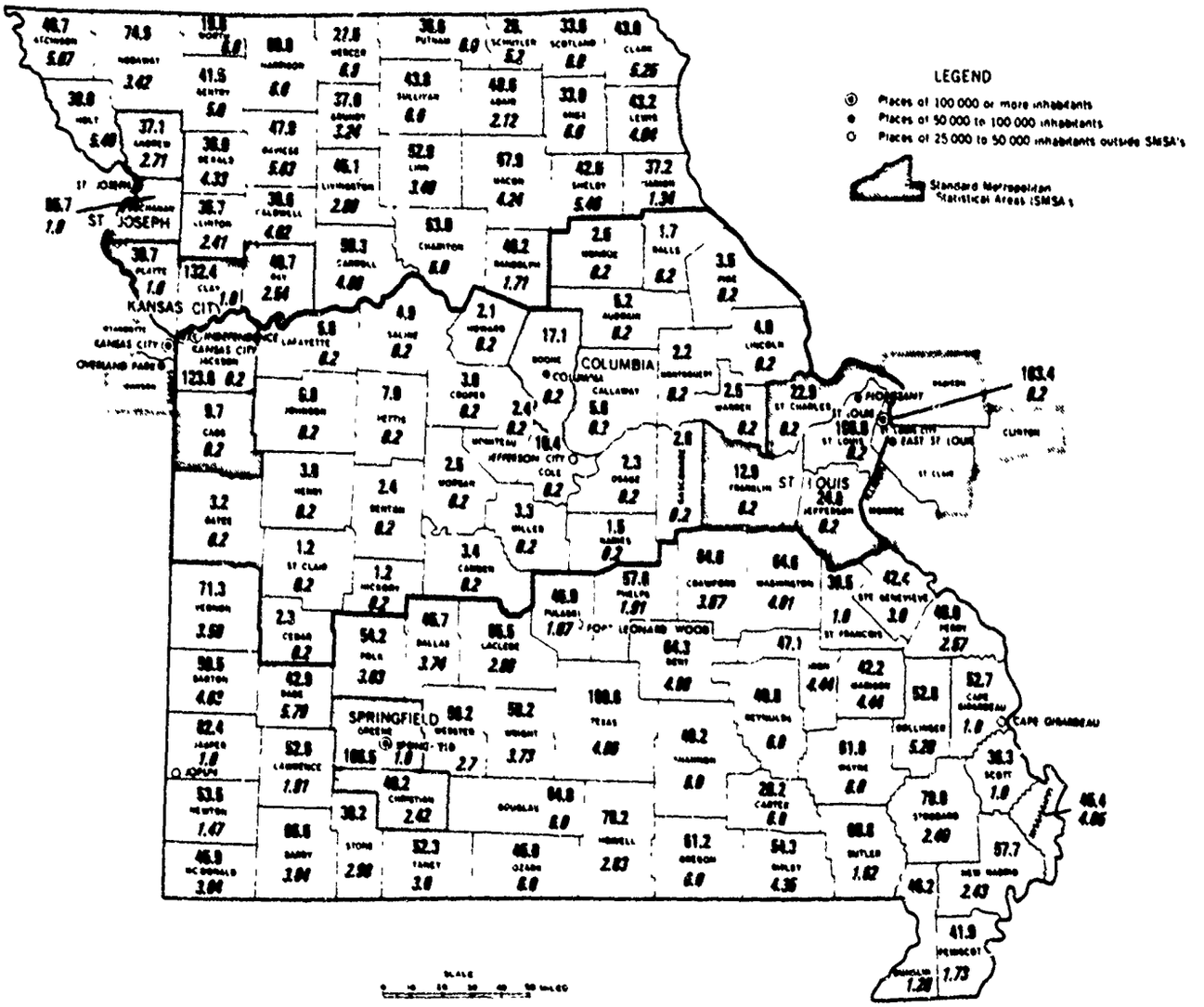
ITALIC NUMBERS: FINAL POPULATION/INITIAL POPULATION

FIGURE C-5. MISSOURI COUNTY FINAL POPULATION AND FINAL/INITIAL RATIO FOR EVACUATION PLAN B (80% Evacuation from Indicated Counties; Uniformly Distributed to Other Counties)



LEGEND.
EVACUATED AREAS INDICATED BY DARK BORDER
BOLDFACE NUMBERS: FINAL POPULATION IN THOUSANDS
ITALIC NUMBERS. FINAL POPULATION/INITIAL POPULATION

FIGURE C-6. MISSOURI COUNTY FINAL POPULATION AND FINAL/INITIAL RATIO FOR EVACUATION PLAN C (80% Evacuation from Indicated Counties; Uniformly Distributed to Other Counties)



LEGEND:
EVACUATED AREAS INDICATED BY DARK BORDER
BOLDFACE NUMBERS: FINAL POPULATION IN THOUSANDS
ITALIC NUMBERS: FINAL POPULATION/INITIAL POPULATION

FIGURE C-7. MISSOURI COUNTY FINAL POPULATION AND FINAL/INITIAL RATIO FOR EVACUATION PLAN D (80% Evacuation from Indicated Counties; Uniformly Distributed to Other Counties)

TABLE C-3

CASUALTIES SUFFERED UNDER
VARIOUS MISSOURI EVACUATION PLANS*

Plan	Killed	Injured
A	247,000	1,109,000
B	180,000	518,000
C	121,000	407,000
D	67,000	242,000
E	119,000	257,000

*Holds for attacks on both counterforce-only and counterforce-plus-research laboratories.

Description of Plans:

A. As outlined in Case 4; analyzed by computer. Eighty-percent evacuation from blast risk counties to host counties requiring a constant final/initial population ratio in host counties. Key workers protected to 55/45/500. All others to best available shelter (min PF = 50) and balance to 5/2/50.

B. Evacuation includes heavily populated areas of Clay, Jackson, and St. Louis counties plus St. Louis city. Requires uniform population density in host counties. Same protection as outlined in Plan A.

C. Evacuation includes B plus Audrain, Boone, Callaway, Howard, Moniteau, and Montgomery counties, which are likely to be covered by heavy fallout.

D. Evacuation includes C plus Camden, Cole, Franklin, Gasconade, Hickory, Jefferson, Lincoln, Maries, Miller, Monroe, Osage, Pike, Ralls, St. Charles, and Warren counties, which are adjacent to areas of heavy fallout and covered by moderate fallout under the March wind conditions assumed here.

E. Current evacuation plan which involves 100-percent evacuation from designated counties to specific host counties (see Appendix A). Same protection as Plan A.

TABLE C-4

SUMMARY OF NEW MEXICO CASUALTIES
(BY NUMBER AND PERCENT OF STATE POPULATION OF 1.14 MILLION)
ATTACK VS. COUNTERFORCE TARGETS ONLY
(DCPA COMPUTER ANALYSIS)

	KILLED		INJURED			
CASE	BLAST	RADIATION	BOTH	BLAST	RADIATION	UNINJURED
1	0	4,200	0	0	11,300	1,129,400
	0%	.37%	0%	0%	.99%	98.65%
2	0	4,700	0	0	12,700	1,127,500
	0%	.41%	0%	0%	1.11%	98.48%
3	0	18,200	0	0	65,700	1,061,000
	0%	1.59%	0%	0%	5,74%	92,67%
4	0	0	0	0	0	1,144,900
	0%	0%	0%	0%	0%	100%
5	0	400	0	0	3,500	1,141,000
	0%	.04%	0%	0%	.31%	99.66%
6	0	8,000	0	0	24,400	1,112,500
	0%	.7%	0%	0%	2.13%	97.17%
8	0	400	0	0	2,900	1,141,600
	0%	.04%	0%	0%	.25%	99.71%
10	0	0	0	0	0	1,144,900
	0%	0%	0%	0%	0%	100%
12	0	4,000	0	0	10,000	1,131,000
	0%	.35%	0%	0%	.87%	98.79%

TABLE C-5

SUMMARY OF NEW MEXICO CASUALTIES
(BY NUMBER AND PERCENT OF STATE POPULATION OF 1.11 MILLION)
ATTACK VS. COUNTERFORCE TARGETS PLUS RESEARCH FACILITIES
(DCPA COMPUTER ANALYSIS)

	KILLED		INJURED			
CASE	BLAST	RADIATION	BOTH	BLAST	RADIATION	UNINJURED
1	152,100	4,400	0	121,400	11,900	854,800
	13.29%	.38%	0%	10,6%	1.04%	74.66%
2	165,300	4,800	0	133,200	13,000	828,200
	14.44%	.42%	0%	11.63%	1.14%	72.34%
3	191,800	18,200	0	133,000	65,500	736,500
	16.75%	1.59%	0%	11.62%	5.72%	64.33%
4	12,900	0	0	17,500	0	1,114,200
	1.13%	0%	0%	1.53%	0%	97.32%
5	38,600	600	0	52,500	4,700	1,048,200
	3.37%	.05%	0%	4.59%	.41%	91.55%
6	147,200	8,000	0	145,300	24,400	820,100
	12.86%	.7%	0%	12.69%	2.13%	71.63%
8	155,000	400	0	124,800	3,000	861,300
	13.54%	.03%	0%	10.9%	.26%	75.23%
10	0	0	0	100	0	1,144,500
	0%	0%	0%	.01%	0%	99.99%
12	0	4,000	0	100	10,000	1,130,800
	0%	.35%	0%	.01%	.87%	98.77%

this applies to practically all of the radiation casualties in both cases since there is little or no fallout from the postulated detonations at defense-related research facilities.

Strikes within New Mexico were at Albuquerque (2 weapons), Los Alamos (1 weapon) and White Sands (2 Weapons). The areas affected are shown in Chapter V. Figure C-8 shows the risk areas for Los Alamos and White Sands in greater detail. Figures C-9 and C-10 show the initial and evacuated populations by county based on the DCPA estimates and computerized evacuation methods.

Figure C-11 shows the redistribution of population based on the present New Mexico Civil Defense evacuation plan which would evacuate a considerable number of individuals from Bernalillo County (Albuquerque area) to Los Alamos. (This was based on TR-82 [Ref. 3] which indicates possible attacks on the cross-hatched areas shown in Figure 11.) Figures C-12 and C-13 show initial and evacuation population distributions based on 1976 Bureau of the Census population estimates and SPC's evacuation model. Note that this provides for 80 percent evacuation of Los Alamos as well as Bernalillo County which considerably reduces casualty figures. A brief description of the evacuation plans and the resultant casualty figures are presented in Table C-6.

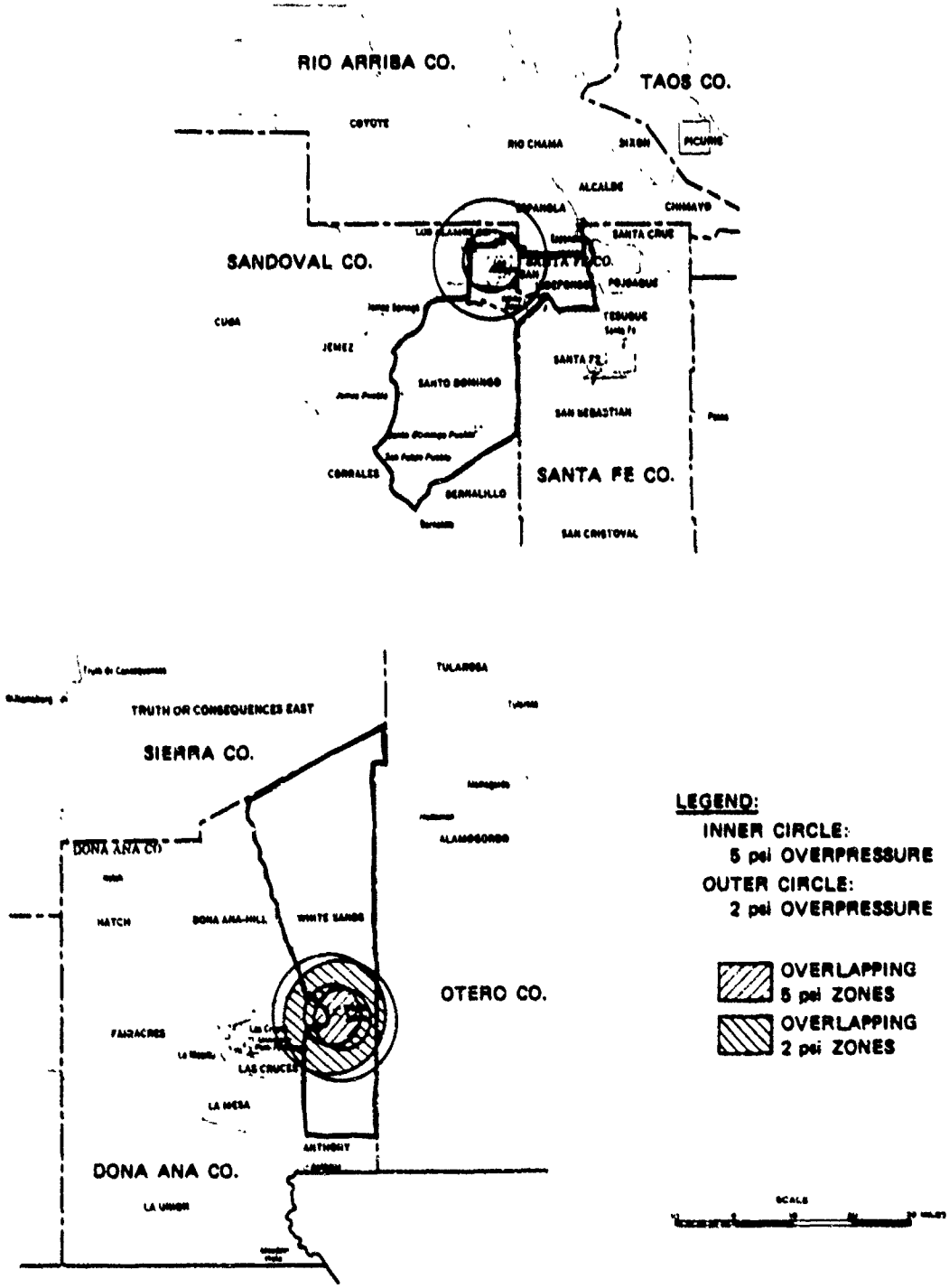


FIGURE 3-8. BLAST ZONES FOR LOS ALAMOS AND WHITE SANDS

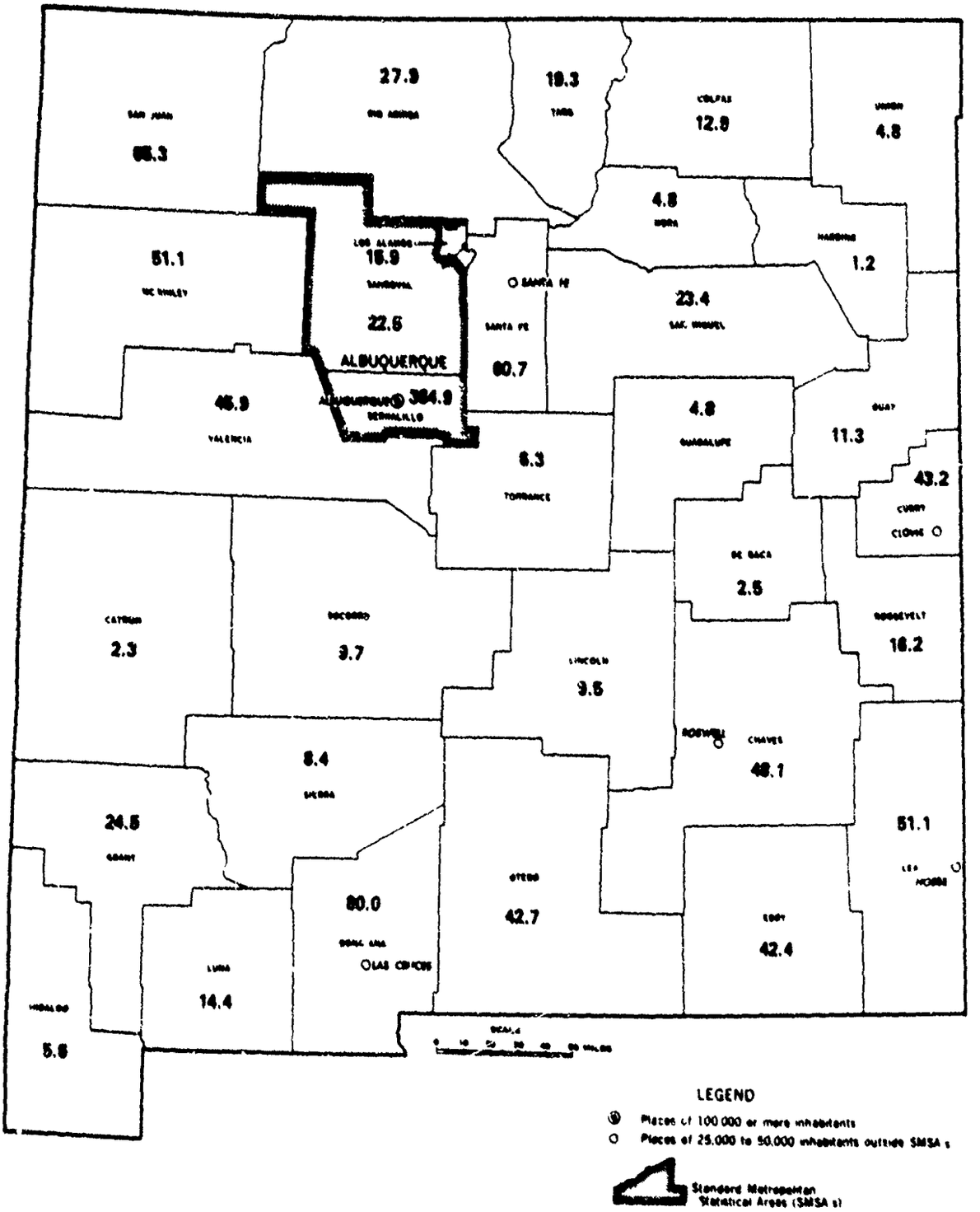


FIGURE C-9. NEW MEXICO, INITIAL POPULATION IN THOUSANDS (DCPA ESTIMATES)

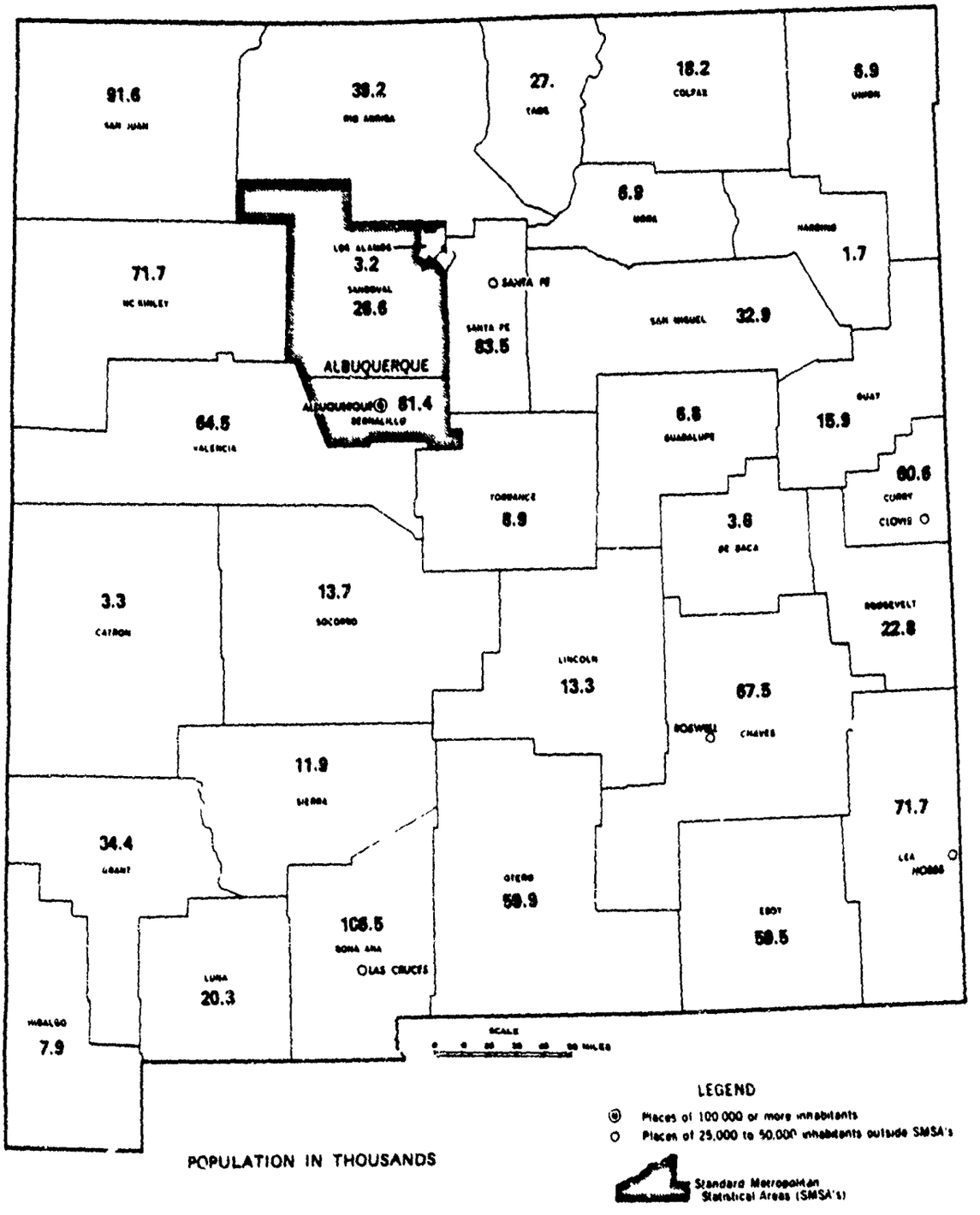


FIGURE C-10. NEW MEXICO, FINAL POPULATION FOR EVACUATION PLAN A (80% Evacuation from Los Alamos, Albuquerque, and White Sands)

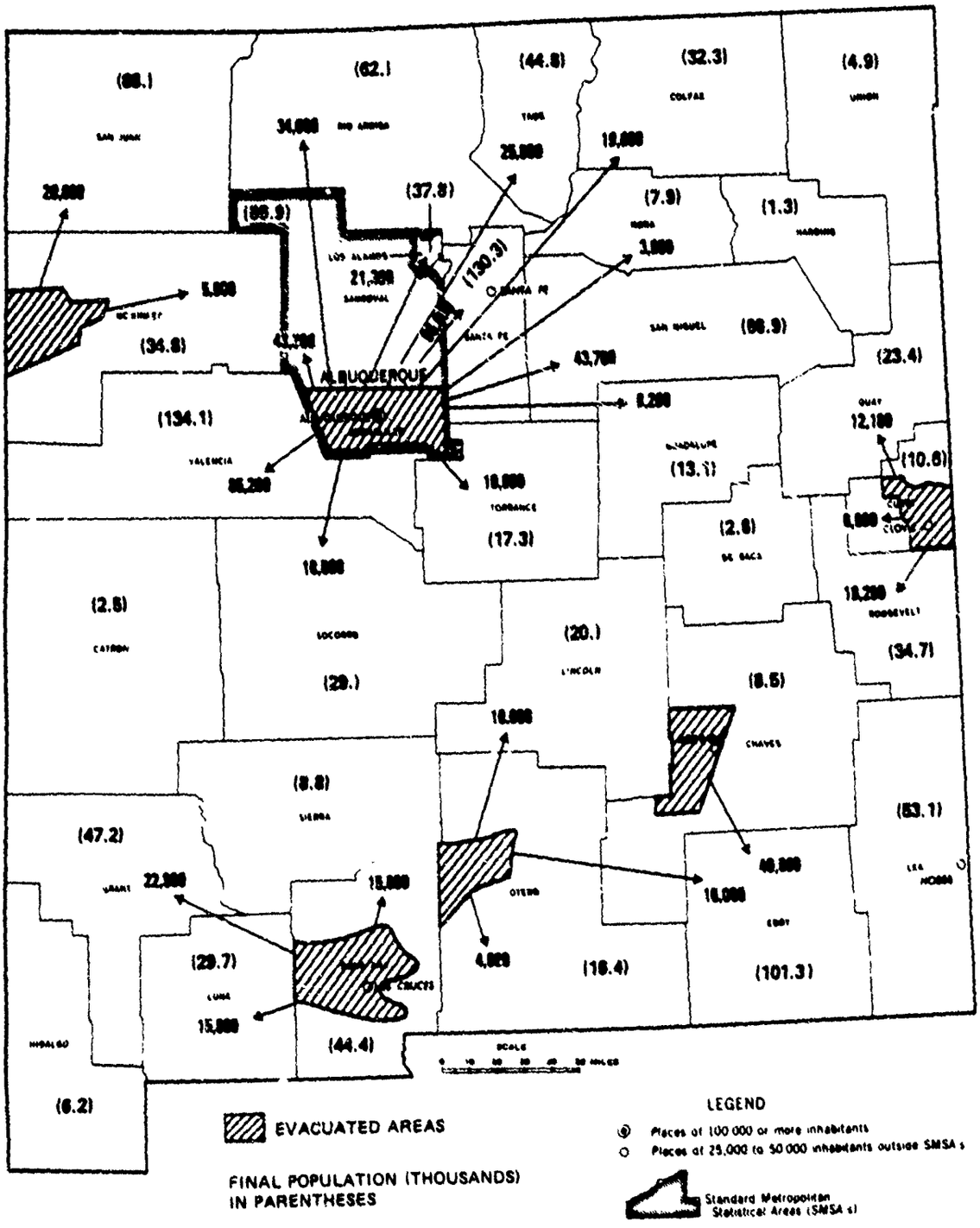


FIGURE C-11. NEW MEXICO. FINAL POPULATION FOR EVACUATION PLAN B (Current Plan)

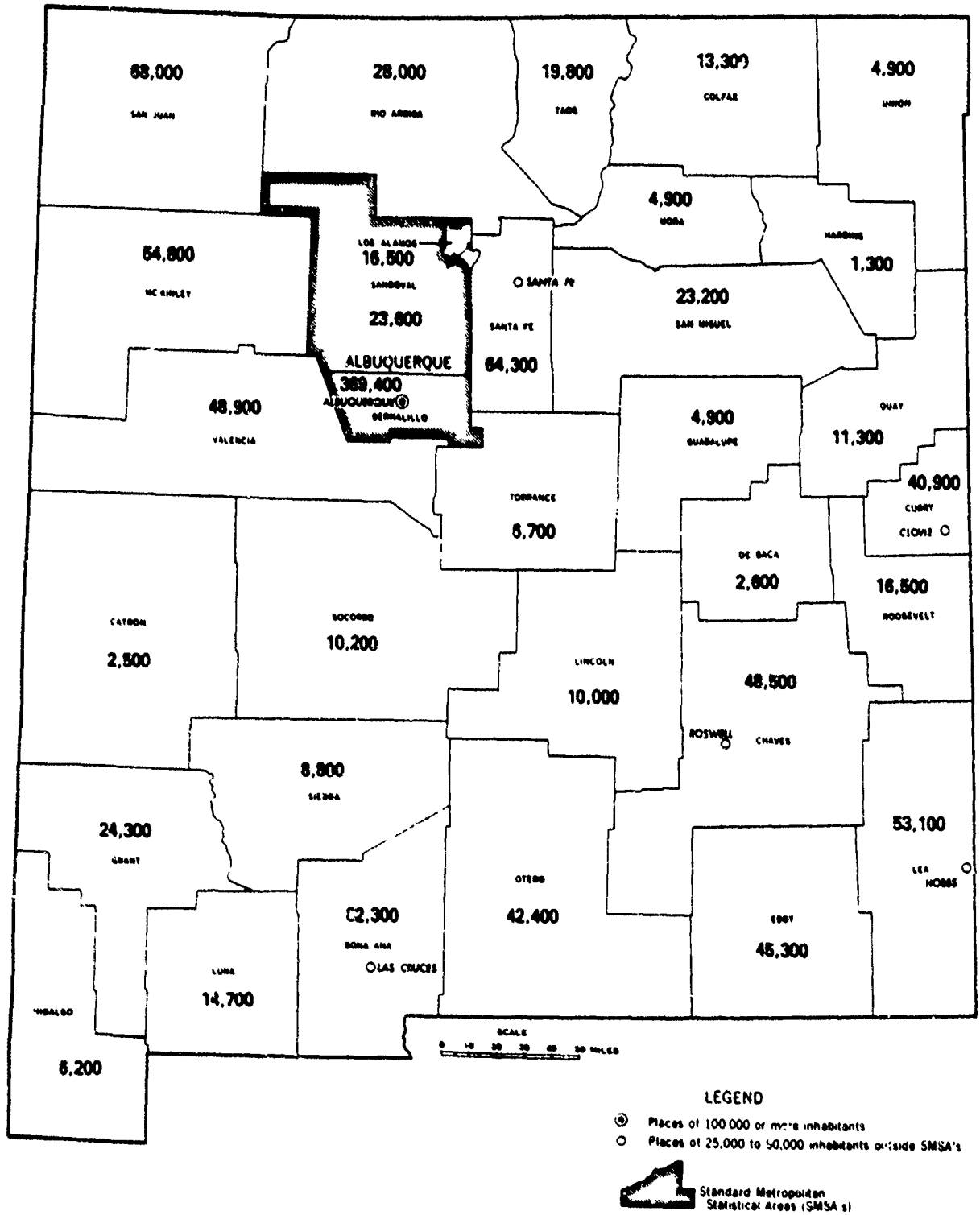


FIGURE C-12. NEW MEXICO, INITIAL POPULATION (Census Bureau Estimates for 1976)

LIST OF TABLES

TABLE C-6

CASUALTIES SUFFERED UNDER
VARIOUS NEW MEXICO EVACUATION PLANS

Counterforce Plus Research Laboratories*

Plan	Killed	Injured
A	12,900 (mostly in Albuquerque)	17,500
B	12,500 (virtually all in Los Alamos)	8,900

*None killed or injured for counterforce alone.

Description of Plans:

A. As outlined in Case 4; analyzed by computer. Eighty-percent evacuation from blast risk areas to host counties requiring a constant final/initial population ratio in host counties. Key workers protected to 55/45/500. All others to best available shelter (min PF = 50) and balance to 5/2/50.

B. Current evacuation plan calling for 100-percent evacuation from White Sands and Bernallilo County to surrounding counties including Los Alamos. Same protection as outlined in Plan A.

Note: Plan C, which employs the SPC algorithm for evacuation, described in Chapter V, results in essentially the same casualties as Plan A.

LIST OF TABLES

LIST OF FIGURES

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