Nuclear Weapons and Their Effects (1.7)

With the advent of the bombing of Hiroshima, the scope of modern warfare changed radically. After World War II, the subsequent development of the hydrogen bomb and the spread of nuclear weapons technology to other superpowers has expanded the modern battlefield to the entire industrial world. Improved missile technology makes it possible to deliver nuclear warheads launched from submarines to targets in a few minutes' time. Table 1.7-1 illustrates the current inventory of strategic nuclear weapons in the arsenals of the Soviet Union and the United States. These arsenals are divided into categories which include Intercontinental Ballistic Missiles (ICBMs), Submarine-Launched Ballistic Missiles (SLBMs), Long-range Bombers, and nuclear, missle-equipped submarines.

Table 1.7-1[71]

U.S. AND SOVIET STRATEGIC NUCLEAR FORCES (1980 TOTALS)

System	U.S.	U.S.S.R.
ICBMs	1054	1398
SLBMs	600	950
Long-range bombers	348	156
Nuclear-powered, ballistic missile-equipped submarines	37	63
Total long-range bombers and missiles	2002	2504
Total warheads on bombers and missiles, official U.S. estimates	9200*	6000*

* 1 January, 1980

For the past several years, the Soviet Union has increased its production of nuclear weapons and is reaching parity with the United States in terms of intercontinental power. In terms of actual megatonnage, the Soviet Union is somewhat ahead of the U.S. As one recent analysis summarized the arms race:

> For several years Russia has outreached the United States in most measures of nuclear strength--megatons of explosure power (1 megaton = 1 million tons of TNT), numbers of missiles and the total weight that can be lifed to the target. Only in numbers of warheads has the United States remained ahead.

> But even this last American advantage is rapidly disappearing as the Russians deploy large numbers of independently targetable reentry vehicles on their big new missiles. The raw warhead totals do not tell the whole tale anyway. A much higher percentage of America's warheads are carried by manner bombers and submarine launched missiles. The bombers have a much smaller chance of getting through than missiles do, and the submarine missiles are not only much less accurate than the land-based ones—not accurate enough to destroy the other side's missile silos—but also less readily usable (only about half the American missile submarine fleet is at sea and ready for action at any given time).[72]

A nuclear attack on one of our highly concentrated industrial, military or population centers would create massive damage, both in the short-run and long-run. The first two effects of a nuclear detonation would occur within seconds (and minutes) following the explosion. These effects are blast and thermal radiation.

Blast is overpressure which crushes buildings and other structures; it follows a scale law, proportional to the cube root of the yield of the nuclear weapon. The blast pressure wave is a function of the size of the bomb, height of the burst, atmospheric conditions, and distance from the center of the burst. Figure 1.7-1 illustrates the effect of a one-megaton nuclear explosion over the city of Detroit at a detonation altitude of 6,000 feet.

A detonation of this magnitude (one megaton explosion at 6-8,000 feet) would create extensive blast damage between ground zero to six miles. The effects are summarized in Table 1.7-2.

Thermal radiation or the heat from the nuclear explosion accounts for approximately one-third of the energy released by the explosion. The heat wave from the explosion precedes the blast wave by a few seconds; a one-magaton explosion would cause flash-blindness up to 53 miles on a clear night. Such an explosion can cause first-degree burns at distances up to seven miles, second-degree burns (serious blisters and permanent scars) up to six miles away, and third-degree burns (which destroy skin tissue) up to five miles away. According to the Congressional Office of Technology Assessment: "Third-degree burns over 24 percent of the body, or second-degree burns over 30 percent of the body, will result in serious shock, and will probably prove fatal unless prompt, specialized medical care if available. The entire United States has facilities to treat 1,000 or 2,000 severe burn cases; a single nuclear weapon could produce more than 10,000."[75]

Thermal radiation, in addition to seriously wounding people in the critical pathway of the explosion, will cause firestorms such as those experienced during World War II in Hamburg, Dresden and Hiroshima with a resulting grave loss of life. Along with thermal radiation, nuclear explosions create electromagnetic pulse (EMP), an electromagnetic wave which results from secondary reactions occurring when gamma radiation is absorbed in the air of ground. EMP creates a substantially

Figure 1.7-1[73]

DETROIT, 1 MT AIR BURST

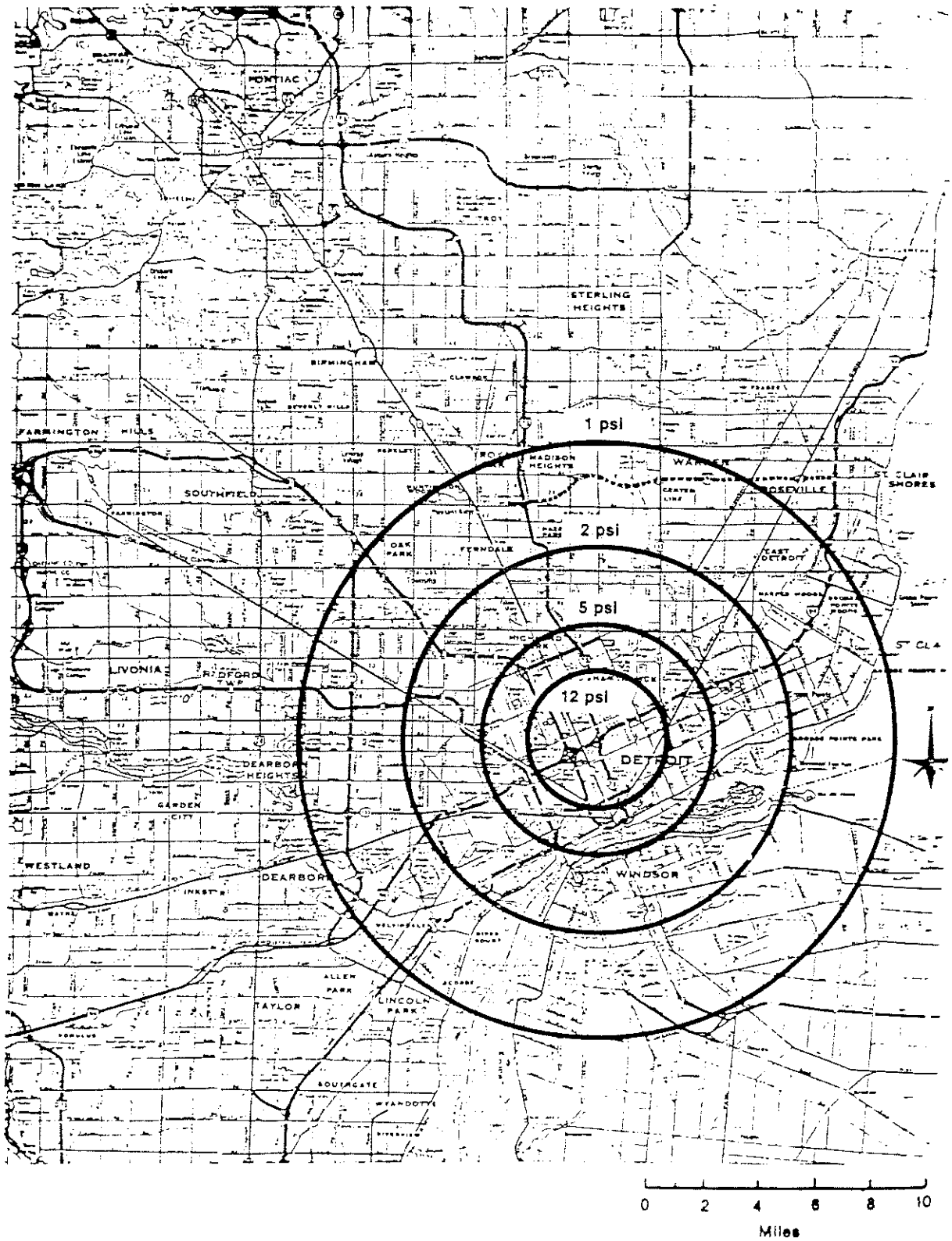


Table I.7-2[74]

BLAST EFFECTS OF A 1 MT EXPLOSION 8,000 FT. ABOVE THE EARTH'S SURFACE

Distance from ground zero (stat. miles)	(kilometers)	Peak over pressure	Peak Wind velocity (mph)	Typical blast effects
.8	1.3	20 psi	470	Reinforced concrete structures are leveled.
3.0	4.8	10 psi	290	Most factories and commercial buildings are collapsed. Small wood-framed and brick residences destroyed and distributed as debris.
4.4	7.0	5 psi	160	Lightly constructed commercial buildings and typical residences are destroyed; heavier construction is severly damaged.
5.9	9.5	3 psi	95	Walls of typical steel-frame buildings are blown away; severe damage to residences. Winds sufficient to kill people in the open.
11.6	18.6	1 psi	35	Damage to structures; people endangered by flying glass and debris.

higher electric field strength than an ordinary radio wave and disappears in a fraction of a second. Although EMP is not necessarily dangerous to human life, it is capable of destroying (or rendering inoperative) sensitive electronic equipment and components of electrical energy systems. EMP can disrupt electrical grids by disrupting enough component parts and circuitry to cause the immediate failure of entire electrical grid systems.

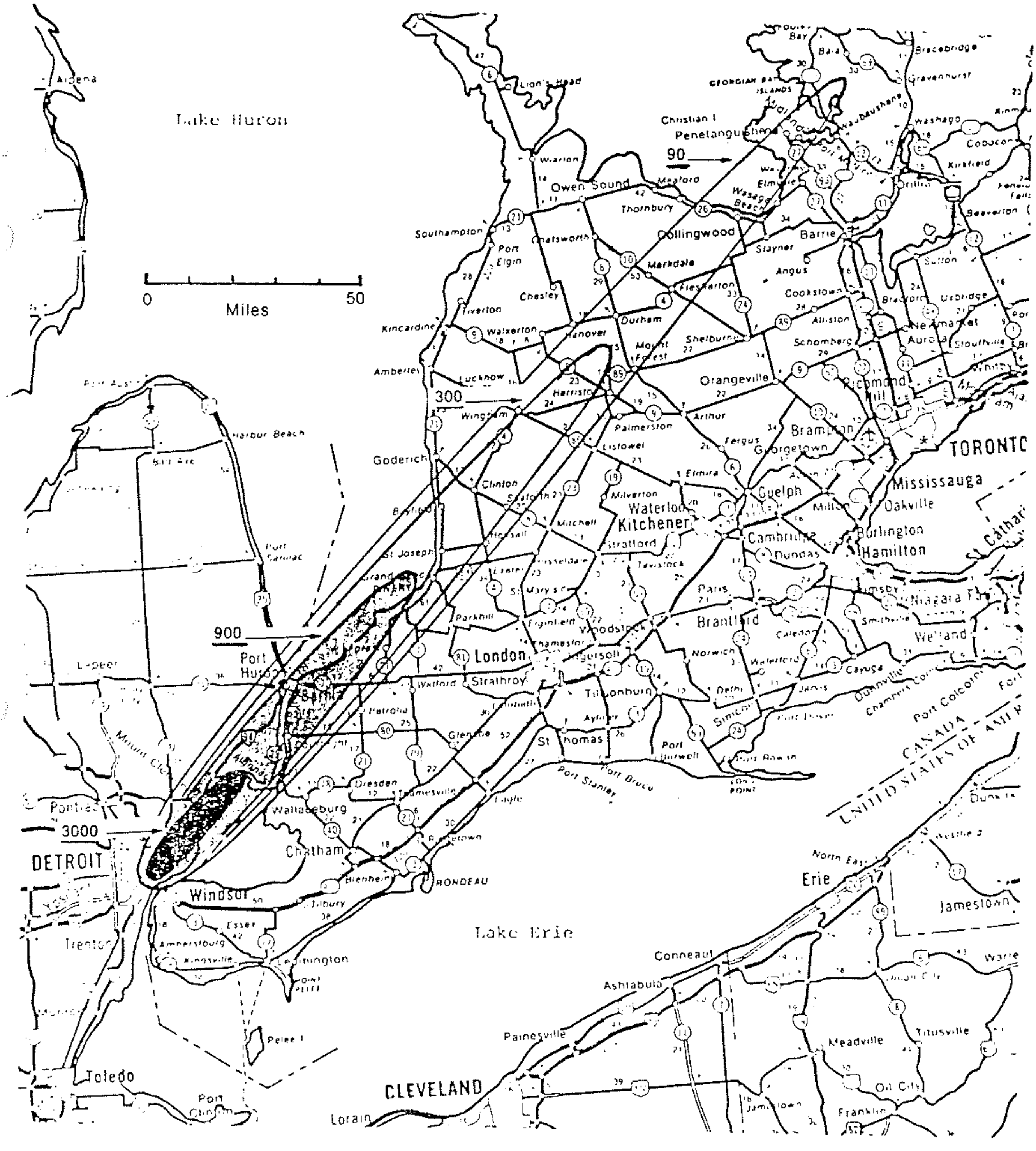
The third, and most long-lasting effect of a nuclear detonation, is radioactive fallout. Fallout, or the radioactive particles caused by irradiation of material swept up into the nuclear cloud, immediately falls near the explosion within a radius of ten miles and is carried into the atmosphere within the mushroom cloud. Figure I.7-2 illustrates the fallout "footprint" from the hypothetical Detroit (one-megaton) explosion. This illustration shows the effects accumulated over a one-week period. High radiation levels, capable of causing death and serious injury, extend up to 200 miles from the blast center. Since radioactive materials have varying "decay" rates, some of the more toxic materials will be somewhat neutralized within a period of days and weeks. However, many of the radioactive materials will remain toxic for lengthy periods, increasing the incidence of cancer for generations.

Substantial work has been performed by predecessor agencies of the Federal Emergency Management Agency (FEMA) (for example, the Office of Civil Defense - OCD, and the Defense Civil Preparedness Agency - DCPA) on the consequences of nuclear attacks on energy facilities.* Recently, the Office of Technology

* Some major reports include: (1) M. Stephens, "Minimizing Damage to Refineries from Nuclear Attack, Natural and Other Disasters," OCD Report, Office of Oil and Gas, U.S. Dept. of the Interior, Feb. 1970; (2) "Critical Industry Repair Analysis: Petroleum Industry," OCD Report, Advance Research, Inc., Wellesley Hills, Mass., 1964; (3) "Protecting Industrial Resources Against Nuclear Attack: Interim Report of an Economic Analysis," OCD Report, Institute for Defense Analysis, Arlington, Va., 1965.

Figure 1.7-2[76]

"FOOTPRINT" OF HYPOTHETICAL NUCLEAR ATTACK ON DETROIT



Main Fallout Pattern—Uniform 15 mph Southwest Wind (1-Mt Surface Burst in Detroit).
(Contours for 7-Day Accumulated Dose (Without Shielding) of 3,000, 900, 300, and 90 Rem.)

Assessment, working with DCPA, presented an analysis of a "limited" bombing attack by the Soviet Union on selected U.S. industrial targets. OTA limited the attacking force to ten Soviet ICBMs (SS-18 missiles carrying multiple independently targetable reentry vehicles (MIRVs) with eight one-megaton warheads on each missile). Petroleum refineries were selected for this reason:

> Given the limitation of ten ICBMs, the most vulnerable element of the U.S. economy was judged to be the energy supply system. The number of components in the U.S. energy system forces the selection of a system subset that is critical, vulnerable to a small attack, and would require a long time to repair or replace. OTA and the contractor jointly determined that petroleum refining facilities most nearly met these criteria. The United States has about 300 major refineries. Moreover, refineries are relatively vulnerable to damage from nuclear blasts. The key production components are the distillation units, cracking units, cooling towers... . Storage tanks can be lifted from their foundations by similar effects, suffering severe damage and loss of contents and raising the probabilities of secondary fires and explosions.[77]

In this attack scenario, the eighty one-megaton weapons carried on the ten SS-18 missiles are used to destroy 77 U.S. refineries having the largest capacity (with the extra three warheads used to destroy the largest refineries within the original attack "footprints"). If all of the weapons are air burst, and given the proximity of refineries to large cities, over five million people are killed immediately. If the weapons are ground burst, just over three million are killed.

In addition to destruction of the refineries, many ports would be heavily damaged, thus crippling U.S. ability to import oil to make up for the loss of domestic capacity. Further, other industries located near refineries would be damaged or destroyed such as the petrochemical industry which is located near refineries and uses oil for feedstock.

The OTA study concludes that even though a third of the nation's refining capacity would survive this attack, "this does not means that everyone would get a third of the petroleum they did before the war." Severe rationing would be imposed, limiting most fuel to military, agricultural, railroad, police, and local government service use. "The demise of the petroleum industry would shatter the American economy," the study emphasizes.[78]

Table 1.7-3 summarizes four potential war scenarios between the U.S. and Russia ranging from an attack on a single city (Detroit) to a full-scale war using much of the available nuclear arsenals.

Table I.7-3[79]

SUMMARY OF POPULATION AND TARGET DAMAGE RESULTING FROM DIFFERENT CLASSES OF NUCLEAR ATTACKS

Description	Main cause of civilian damage	Immediate deaths	Middle-term effects	Long-term effects
Attack on single city Detroit and Leningrad; 1 weapon or 10 small weapons.	Blast, fire, & loss of infrastructure; fallout is elsewhere	200,000 2,000,000	Many deaths from injuries; center of city difficult to rebuild.	Realtively minor.
Attack on oil refineries, limited to 10 [illegible]es.	Blast, fire, secondary fires, fallout. Extensive economic problems from loss of refined petroleum.	1,000,000 - 5,000,000	Many deaths from injuries; great economic hardship for some years. particular problems for Soviet agriculture and for U.S. socio-economic organization.	Cancer deaths in millions only if attack involves surface bursts.
Counterforce attack; includes attack only on ICBM silos as a variant.	Some blast damage if bomber and missle submarine bases attacked.	1,000,000 - 20,000,000	Economic impact of deaths possible large psychological impact.	Cancer deaths and genetic effects in millions: further millions of effects outside attacked countries.
Attack on range of military and economic targets using large fraction of existing arsenal.	Blast and fallout; subsequent economic disruption; possible lack of resources to support surviving population or economic recovery. Possible breakdown of social order. Possible incapacitating psychological trauma.	20,000,000 - 160,000,000	Enormous economic destruction and disruption. If immediate deaths are in low range, more tens of millions may die subsequently because economy is unable to support them. Major question about whether economic viabiilty can be restored--key variables may be those of political and economic organization. Unpredictable psychological effects.	Cancer deaths and genetic damage in the millions: relatively insignificant in attacked areas, but quite significant elsewhere in the world. Possibility of ecological damage.

Defense Preparedness and Vulnerability (1.8)

Most national defense measures subscribe to the idea that the best defense is a good offense. Many countries, including the U.S. and the Soviet Union have also addressed national defense concerns with more passive measures. Civil defense (CD) is one way to prepare for nuclear attack by providing populations with shelter and basic human needs in order to reduce the loss of human life. Civil defense could also contribute to the deterrent posture of a state by convincing its enemy that unacceptable damage would not result from a first strike. On the other hand, CD might also encourage provocation by decreasing vulnerability, the premise on which the Mutually Assured Destruction (MAD) Doctrine is based.

In recent years, the civil defense capabilities of the U.S. and the U.S.S.R. have received considerable attention. Studies show that during the late 1970s, the U.S.S.R. spent about twenty times as much as the U.S. for an ambitious civil defense program of shelter upgrading, evacuation planning and public education. It is estimated that in the event of a large-scale nuclear exchange, with a one-week period for population evacuation, the surviving population of the U.S.S.R. would total 90 percent compared to a 40 percent survival rate for U.S. citizens, based on current levels of civil defense preparedness.[80]

Modern proponents of CD believe that improved CD served the same goal as that set for U.S. strategic offensive forces, which is to "preclude enemy dominiation" and to maximize the "political, economic and military power of the U.S. relative to the enemy in a postwar period."[81] Opponents feel that the value of CD is negligible for both purposes. The difference between these viewpoints is based in differences in assumptions.

The first set of views starts with a conviction that nuclear warheads are weapons of total destruction, the use of which, once initiated, could not possibly be limited or controlled and would make survival of nuclear conflict impossible and the concepts of fighting and winning irrelevant.[82] Those ascribing to this view follow the doctrine of Mutually Assured Destruction, assuming that nuclear warfare able to completely destroy the adversary's society would never take place.

The second view acknowledges a nuclear revolution in warfare but sees the basic laws of warfare as unchanged. Civil defense, therefore, rather than being hopeless and irrelevant, may help the nation to survive and recover. This viewpoint perceives the U.S. need for a national policy that reinforces deterrence. One such defense strategy would be the implementation of an extensive CD program.

The divergence in assumptions regarding deterrence and civil defense kindles the debate over several germane issues:

1. CD and Strategic Equation. Whether CD contributes to strategic equation depends on the perceptions of the actors with respect to the "winability" of war. If CD is perceived to provide long-run protection of populations after an attack, CD, and especially asymmetrical CD protection between adversaries, may encourage one

state to launch a first strike. This view presumes that economic, social and political recovery after a nuclear exchange is likely, and that unacceptable damage would not result from attack. If nuclear war is always perceived as futile for both sides, CD is a wasted effort toward strategic equation.

2. CD and the Credibility of Deterrence. CD may increase deterrent credibility if one state is convinced that the population of another is relatively invulnerable to harm. Hence, asymmetrical CD gives an advantage to the state better prepared to protect populations by providing an added deterrent to enemy attack under the threat of counterattack. On the other hand, opponents argue that CD does not play a significant role toward deterrent credibility due to the minimal contribution CD makes toward actually protecting nations from the dramatic effects of nuclear way.

3. CD and Crisis Coercion. CD advocates posit that states are in better bargaining positions during a crisis if populations are able to relocate. Hence, without relocation capabilities, one state may be "held hostage" by enemy weapons. Opponents believe CD capabilities would not enter into the negotiating process since unacceptable damage to both sides would occur should war break out.

4. CD and Crisis Stability. If one state begins an extensive evacuation of its population from risk areas, another may perceive such action as preparation for an attack and respond with its own preemptive strike. Conversely, evacuation may allow time for negotiation and become a "side issue" under crisis conditions.

5. American Risk-Taking. Some CD opponents point out that a false sense of security provided by high levels of CD could lead to American adverturism, and resulting disaster. Opponents counter that CD is inefficacious and therefore cannot provide a real, let alone false, sense of security. The role civil defense could, or should, play is clearly beset with controversy as well as a plethora of uncertainties.

"In assessing the debate over CD vis-a-vis the strategic balance, it is essential to keep in mind tht judgements cannot be made with certainty or even at a high level of confidence, as to the factors or preceptions tht could enter into the calculus of decision-makers during a future crisis, and might tend either to deter or encourage escalation."[83]

Civil Defense: The Soviet Example (1.8-1)

According to the Central Intelligence Agency's (CIA) 1978 report, the goals of Soviet civil defense are to: "protect the leadership, essential workers, and others in priority order; to protect productivity; and to sustain people and prepare for economic recovery following an attack." The prime motivations for developing the U.S.S.R. civil defense program stem from "the traditional Soviet emphasis on homeland defense, (the desire) to convince potential adversaries they cannot defeat the Soviet Union, (the desire) to increase Soviet strength should war occur, (the

desire) to help maintain the logistics base for continuing a war effort following the nuclear attack, (the desire) to save people and resources, and (the desire) to promote postattack recovery."[84]

According to a Civil Defense Preparedness Agency study, the Soviet CD capability is characterized by the following factors:

1. Soviet CD is a nationwide program under military control. The CD organization consists of over 100,000 full-time personnel at all levels of the Soviet government and economy.

2. The Soviets have made a sustained effort to provide blast shelters for their leadership and essential personnel. Blast protection is available for virtually all of the leadership at all levels, and for at least ten to twenty percent of the urban population including essential workers.

3. Evacuation during a crisis would be the predominant means for reducing urban casualties. It would take a week or more to evacuate urban areas and to develop fallout shelters in rural areas which would then provide a high level of protection for the evacuees.

4. Performance of Soviet CD would depend primarily on the time available for evacuation and other preparations:

   a. With several hours to make final preparations, a large percentage of leaders and communications facilities would probably survive.

   b. A large percent (75 to 90 percent) of the essential work force in blast shelters would survive an attach designed to maximize damage to economic facilities.

   c. Given a week or more to complete urban evacuation, nuclear effects and fallout could be reduced to the low tens of millions, about half of which would be fatalities. (This suggests fatalities of five, ten, or perhaps fifteen million, or around five percent of the Soviet population.)

5. Soviet measures to protect the economy could not prevent massive industrial damage. Some improvements are expected in ability to protect the economy, but a substantial decrease in vulnerability is unlikely.

6. The Soviets believe their present civil defenses would improve their ability to conduct military operations and would enhance the U.S.S.R.'s chances for survival following a nuclear exchange. The U.S. intelligence community does not believe that the Soviets' present civil defenses would embolden them deliberately to expose the U.S.S.R. to a higher risk of nuclear attack.[85]

Civil Defense: The U.S. Example (1.8-2)

During the pre-detente period of the 1950s, U.S. civil defense policy was characterized by evacuation plans based on tactical warning and bomber flight times. These plans were abandoned, however, as the fear of nuclear warfare diminished. "The United States had an overwhelming strategic superiority over the Soviet Union so that any attack could be met with devastating retaliation."[86]

After the Cuban Missile Crisis of 1962, President Kennedy vigorously promoted an expanded CD program under the rationale of "insurance" in an uncertain world in case of an enemy miscalculation. (It had been discovered during the Cuban Crisis that Miami and other cities in Florida could not have been evacuated in any practical manner since no appropriate plans had been made.)

The heightened concern with civil defense enabled Kennedy to push the civil defense budget to its all-time high in 1962 when Congress appropriated $207.6 million for the new office of Civil Defense plans for group fallout shelters. By the late 1960s, however, annual appropriations for all Civil defense operations had dropped to less than half of the 1962 appropriations.

During the 1960s, Soviet military strength grew. The race between the U.S. and U.S.S.R. to develop nuclear arms intensified, resulting in the first Strategic Arms Limitations Talks (SALT) in 1969. A full-scale nuclear war seemed unimaginable during an era of mutually assured destruction and detente, and concern for civil defense dwindled.

With the submission of a report to Congress in 1976, however, Defense Secretary Donald Rumsfield warned that the growing asymmentry of Soviet and American civil defense preparedness was weakening the credibility of U.S. deterrence.[87] Thus, from 1976 to 1978, the Carter Administration conducted several studies on the U.S. civil defense preparedness programs.

The first was an intelligence community assessment of Soviet CD. The second was a Department of Defense study on the feasibility, costs, and preformance of alternative U.S. civil defense programs. The third was an interagency study stemming from the other two studies. The third study also considered the strategic elements of civil defense. These studies were the most exhaustive examinations of civil defense that had ever been done and led to Presidential Decision (PD) 41.

PD 41 of September 1978 directed a new CD policy along the following lines:

1. CD should enhance survivability and improve the basis for recovery from the reduce vulnerability to a Soviet attack.

2. The program should enhance deterrence and reduce Soviet ability to coerce the U.S.

3. The new CD policy should not change our policy relying on strategic forces as the chief factor in maintaining deterrence.

4. The Crisis Relocation Planning program was to be able to function during times of international crisis and also during peacetime emergency.[88]

As a policy statement, PD 41 did not include any program details nor budget requirements. It simply listed civil defense options and suggested associated requirements. One option was crisis relocation planning (CRP).

The federal implementing agency for CD programs, the Federal Emergency Management Agency (FEMA), has determined that between blast shelter systems and crisis relocation planning, the latter is "the only moderate-cost approach which has high potential for survival."[89]

While a blast shelter system would provide residents with more immediate protection, FEMA estimates that developing such a system would cost over $60 billion in an age of "fiscal restraint."[90] While evacuation requires more lead time and better organization, the Agency states that relocation can be effective "given the requisite planning and development of supporting systems and capabilities and given about a week for moving and protecting the bulk of our population at risk."[91]*

Despite the emphasis on CRP, it should be noted that in-place protection of the population is maintained as a fall-back plan in case "time or circumstances don't permit crisis relocation."[93] Perhaps one third of the Unites States' population has available shelters in nearby large buildings. Others have a basement available that would be a suitable shelter. The present plan for in-place protection rests on using buildings and materials already in place rather than on constructing new blast shelters.[94] Essentially, the plan provides for fallout protection since very few blast-resistant structures exist.

Crisis Relocation Planning: Current Status (1.8-3)

The current emphasis of the U.S. civil defense program continues to remain on Crisis Relocation Planning. It "is an effort to develop plans and related systems and capabilities to relocate people from large U.S. cities and other possible risk areas,

*The best-financed civil defense system in the Western World is Switzerland's system, which by 1980 had provided protected fallout shelter spaces for over six million people, 90 percent of the Swiss population. According to the Swiss Office of Civil Defense, mass evacuation approaches were excluded from federal planning at an early point. Reasons given include: "Transportation of the people into the receiving areas and an adequate supply could not be guaranteed under war operations. Furthermore, such evacuation activities could hinder important general defense actions. The uncertainty regarding time and duration of such evacuations would render the operation especially difficult. Consequently, large scale transfers of people in a modern war in this country are ineffective and even dangerous and must be avoided. This is feasible on condition that each inhabitant is provided with a shelter place at or near his domicile."[92]

during a crisis that could escalate to a nuclear attack on this country."[95] Current planning is being done by about 140 professional planners. Most of them are hired under contract between the states and the federal government. The latter provides all of the funding. Initial plans are to be completed in the late 1980s or shortly therafter. Plans must be developed for 400 risk areas and over 1,500 host areas that would receive evacuees if the plans were implemented.[96]

The basic plans assume that two-thirds of the population live in high risk areas in case of a nuclear war due to closeness to key military and economic targets. Most of the population in risk areas is to be moved to host areas far enough away to be safe from nuclear blast.[97] In order to keep the economy going, the most essential activities are to be kept in operation in the risk areas throughout the relocation period. Services such as fire and police protection for evacuated cities, maintenance of food production and distribution, and keeping refineries and certain other critical industries operational will be essential.

The plans will provide for the "key workers" to move with their families to relatively nearby host areas and to commute into the risk areas on a shift basis. For example, the "key workers" in an oil refinery would not be the entire work force, but only enough to keep the facility in operation.

In the host areas, all economic activities would be kept in full operation, insofar as possible.[98] The plans call for most of the evacuated population to be conducted in privately owned vehicles although some of the evacuated population will move by other means. A public opinion sample done by the Defense Civil Preparedness Agency (DCPA) in October and November of 1978 revealed that 88 percent of the people questioned had a vehicle of their own to use. Two-thirds of those lacking a car were certain neighbors, friends, and relatives would give them a ride.[99] People without their own transportation will be bused to host areas. In densely populated areas, rail or air may also be used for transportation.[100] However, most families will be expected to move themselves to the host areas.

Initial reception of the evacuees is to be much like that for other disaster victims such as those fleeing floods or hurricanes. The federal government is conducting "Host Area Shelter Surveys" to identify buildings such as schools and churches which are suitable to use as temporary shelters for evacuees.[101] As yet, no plans exist for involuntary billeting of evacuees in private homes. However, many people have indicated a willingness to accept evacuees in their homes.[102]

Host area residents and evacuees are to improve existing structures for protection from fallout. Relocation plans are to be provided for mobilization of all available earth-moving equipment. However, self-preservation is the great motivating factor in making the shelter building plan work. The average American family is expected to do a lot of its own digging.

Individual initiative and the private sector of the economy are to feed the population. People will be asked to bring several day's worth of non-perishable food

on their own. Several day's more supply of food is expected to be in the stores in the host areas. Food distributors are expected to change delivery patterns to stock host areas.[103]

It should be noted that some areas of the country present special planning problems. In the Northeast, nearly four-fifths of the the people live in possible risk areas, and the percentage is even higher in California. The federal government has conducted special feasibility studies of crisis relocation for the Northeast and California. These studies suggest that crisis relocation would be feasible, but that traffic control, movement, and problems such as food distribution and shelter construction would require a great deal of detailed work by planning professionals.[104]

Present CRP plans rest on three assumptions. One is that a large part of the population will cooperate with evacuation orders and instructions. Another is that key personnel will act in a relatively stable and supportive manner. The last assumption is that sufficient warning time will be available to implement CRP.

Several conditions need to be met in order for the federal plans to be successful. The first is that state and local governments must cooperate before the emergency in preparing the implementation of their planned respective roles. The second is that state and local governments have adequate plans for the emergency. The third is that private business will be responsible for keeping the economy running during the emergency. Any one of these factors could affect CRP's effectiveness.

Crisis Relocation Planning is predicated on the assumption that the affected population will cooperate with evacuation orders and instructions. Based on wartime experience with CD in Britain and Germany and peacetime experience with hurricanes in the United States, 80 percent of the population in risk areas is expected to cooperate with relocation orders. Ten, twenty, or possibly thirty percent are expected to not cooperate. Some people may evacuate on their own initiative. Looting and other forms of antisocial behavior are not expected to be major problems due to the assumption that "in a threat situation, human beings realize almost instinctively that cooperative behavior is much more to their benefit than conflict or struggle."[105] In support of this contention, DCPA cites the case of Hurricane Carla in 1961. Over one-half million people were evacuated from the Gulf Coast with no fatalities or major accidents. Although the New York City blackout was accompanied by considerable looting, DCPA argues that many people helped each other and that the perceived danger was not great enough to make all act in a cooperative manner as would threat of nuclear attack.[106]

For effective enactment of the plans, key personnel will need to accept risks and harsh conditions. These personnel include policemen, firemen, certain workers in essential industries, and deliveries of food and essential provisions. Their cooperation is critical to the success of the evacuation plans.[107]

Sufficient warning time will be necessary to allow evacuation plans to be implemented. Most of the population in high risk areas could be evacuated in three days. New York City, Los Angeles, and San Francisco could take four days to complete evacuation plans.[108]

In order for the federal plans to work, state and local governments must cooperate to carry out the role Washington expects of them. DCPA admits that if a local government is reluctant or rejects the plan, the CD program's implementation must wait until local authorities change their minds.[109]

State plans are expected to provide for supplying food and other essentials to the population and for supporting local government operations (for example, state police are to assist local traffic control efforts). Local governments of host areas are to provide traffic control and parking, temporary lodging and food, and fallout shelters. Plans by local governments within risk areas are to provide for the initial relocation move, commuting of evacuated essential workers to their jobs in risk areas, and blast protection for those still in those areas. Maps and evacuation instructions are to be prepared for risk area residents and ready for publication in local newspapers in case evacuation becomes necessary.

The food redistribution plan depends almost entirely on present means of commercial distribution. The costs for austere emergency rations and other supplies for evacuees (for prestocking) at today's prices would be approximately a half billion dollars. Thus, it is considered more cost effective to rely on adjusting the existing food distribution system.[110]

In 1978, the Department of Defense allocated $230 million a year for FY's 1980-84 to fund a CD program adequate to insure a two-thirds survival rate with one week notice of an attack.[111] The current projected CD budget is $100-110 million a year. Funds are not available to rehearse evacuation plans "or for improving current marginal capabilities in such areas as Direction and Control, Warning, Communications, Radiological Defense, Emergency Public Information, and Training."[112] "Paper plans only" insure no more than a 50 percent, survival rate. DCPA has indicated that a 50 percent survival rate does not affect the strategic balance and does not enhance U.S. ability to resist coercion.[113]

War Emergency Plan: The California Example (1.8-4)

The basis of California's CD planning is the War Emergency Plan, which was published in 1970 and is currently being revised to cover crisis relocation. It is based on the assumption that adequate planning and warning can limit civilian casualties.[114] The plan elaborates a State War Emergency Organization and assigns tasks to each element. Provisions are made for a Direction and Control Group, Staff Sections, Emergency Resources Management, and Emergency Services.[115] Also provided for are sub-state level regional organizations for wartime. State Mutual Aid Regions consist of several counties. Within each Region are (County) Operational Area Organizations and within each of these are City and County (i.e. unincorporated areas) Organizations. These organizations are all given specific responsibilities.[116] Additionally, manpower from each department of the State government has been assigned an emergency service or system. For example, the California Highway Patrol is assigned to the Law Enforcement Service. The Military Department is assigned to both the Welfare and Law Enforcement Services.[117]

The provisions of California's War Emergency Plan are being expanded under a Nuclear Civil Protection Planning contract with the Federal Emergency Management Agency (FEMA). In addition to the 1970 version plan with provisions for Fire and Rescue, Law Enforcement, Medical and Health, and Reception and Care/Emergency Welfare, the 1980 plan increases these emergency services to include Movement Operations and Shelter Development/Engineering plans.[118]

Parts of the plan delineate specific time periods such as Preparedness Period (Increased Readiness and Crisis Relocation)[119] and Attack and Early Post-Attack Periods.[120] Another part of the plan includes System and Support Annexes. These annexes include Direction and Control, Movement Operations, Reception and Care, Law and Order, Fire and Rescue, Medical and Health, Shelter Development, Economic Considerations and Controls, and Resources Management. The Resources Management Annex has completed appendices entitled Construction/Engineering, Health, Housing, Industrial Production, Manpower, Supply/Procurement, Telecommunications, and Utilities.[121]

As of May 1980, parts of the California plan remain incomplete. These are the Food, Fuel, and Transportation Appendices. Their impact on other parts of the plan is apparent when it is remembered that the purpose of the Resources Management Annex is to "(o)versee...distribution and/or redistribution of food and other essential supplies." and to (a)rrange for transportation to meet essential needs."[122] The importance of the missing appendices is underscored when it is recalled that the shortage of materials for fallout shelters in host areas is assumed to be solvable by diversion of materials from other areas.[123] The missing appendix for food resources management is especially critical since the federal government expects this responsibility to be assumed by the state governments.

The Riverside County Operational Area General Plan for Nuclear Civil Protection basically follows the guidelines of the California State NCP. Specific plans have been elaborated for various kinds of operations (i.e. Increased Readiness, Crisis Relocation, and Attack Operations). Systems or functional plans are organized as annexes (i.e. Direction and Control, Law and Order, Medical and Health, Reception and Care, and Resources and Support).[124]

Essential to the workings of the plan are several supporting documents. The Riverside County Operational Data Manual "provides essential information regarding the resources available within the county, as well as those that would have to be provided by outside sources, all of which would be required to effectively conduct emergency operations."[125] There are several special purpose plans that are published separately from the General Plan as support documents (i.e. Crisis Relocation, Crisis Relocation Movement Control, Emergency Public Information, and Fallout Shelter Development).[126]

The smallest unit of analysis for CD planning in Riverside County is the local planning zone. Some zones, for example, Zone 11 - City of Riverside, have plans for evacuation.[127] Others, for example, Zone 66 - City of Indio, have plans to serve

as host areas.[128] The degree of risk of nuclear attack to the local area has been the deciding factor in determining whether or not a city is to be evacuated or to serve as a host area.

An examination of state, county, and city plans reveals certain problems in their preparation. These include:

1. There is a lack of planning in the key areas of food, fuel, and transportation.

2. Preliminary studies indicate certain communications weaknesses.

3. Crisis Relocation Planning must confront problems inherent in dealing with unknown quantities.

4. Planning is based on the assumption that enough time will be available during a crisis to alleviate deficiencies in preparation.

The ommission in state planning for food, fuel, and transportation seriously affect Riverside County's CD preparations. County emergency planners expect local government emergency planners to stockpile food in shelters for immediate needs; the state is expected to redirect food supplies commensurate with local needs.[129] The county's Movement Control Plan calls for vehicles to be refueled by gas truck. Although the refueling point is identified in the plan, it is not clear who is responsible for providing the gas trucks. According to the state officials, California's War Emergency Plan is in its third year of development and it is hoped that the key problem areas noted above will be addressed by the end of Fiscal Year 1981.

It is estimated that Riverside County will need shelters for 1,197,000 people who will be relocated from Los Angeles and San Diego Counties. Riverside County lacks sufficient resources for shelter construction and must get them from evacuated areas.[130] These requirements for resources cannot be met until state plans are completed.

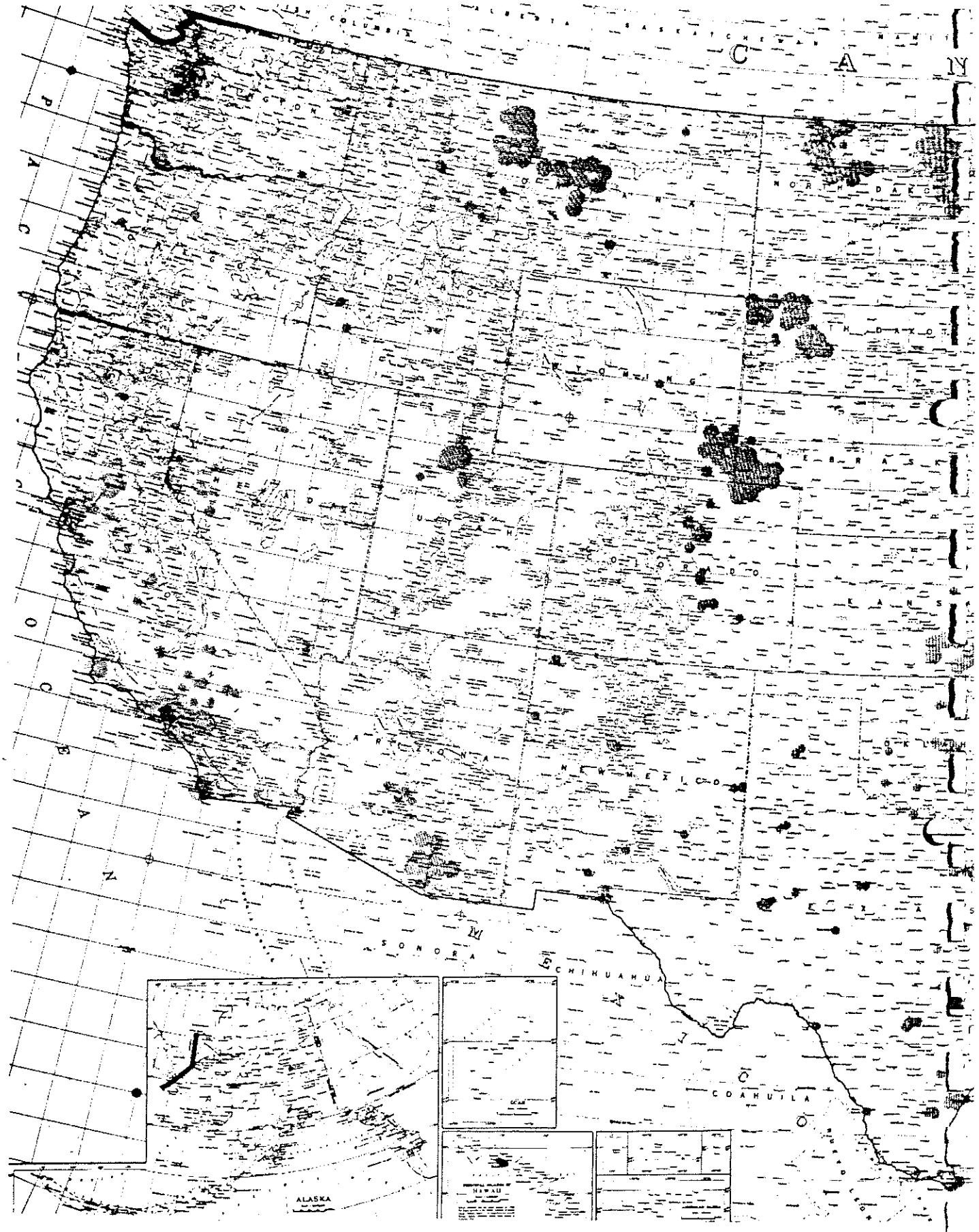
Communications problems could adversely affect execution of the plans for orderly evacuation, law enforcement, and traffic control. Many of the county police departments' radio sets lack frequencies compatible with other departments. Current plans call for using police units from evacuated areas in other parts of the county.[132] Until the problem of compatible radio frequencies is solved, police operations in support of evacuation will be hindered.

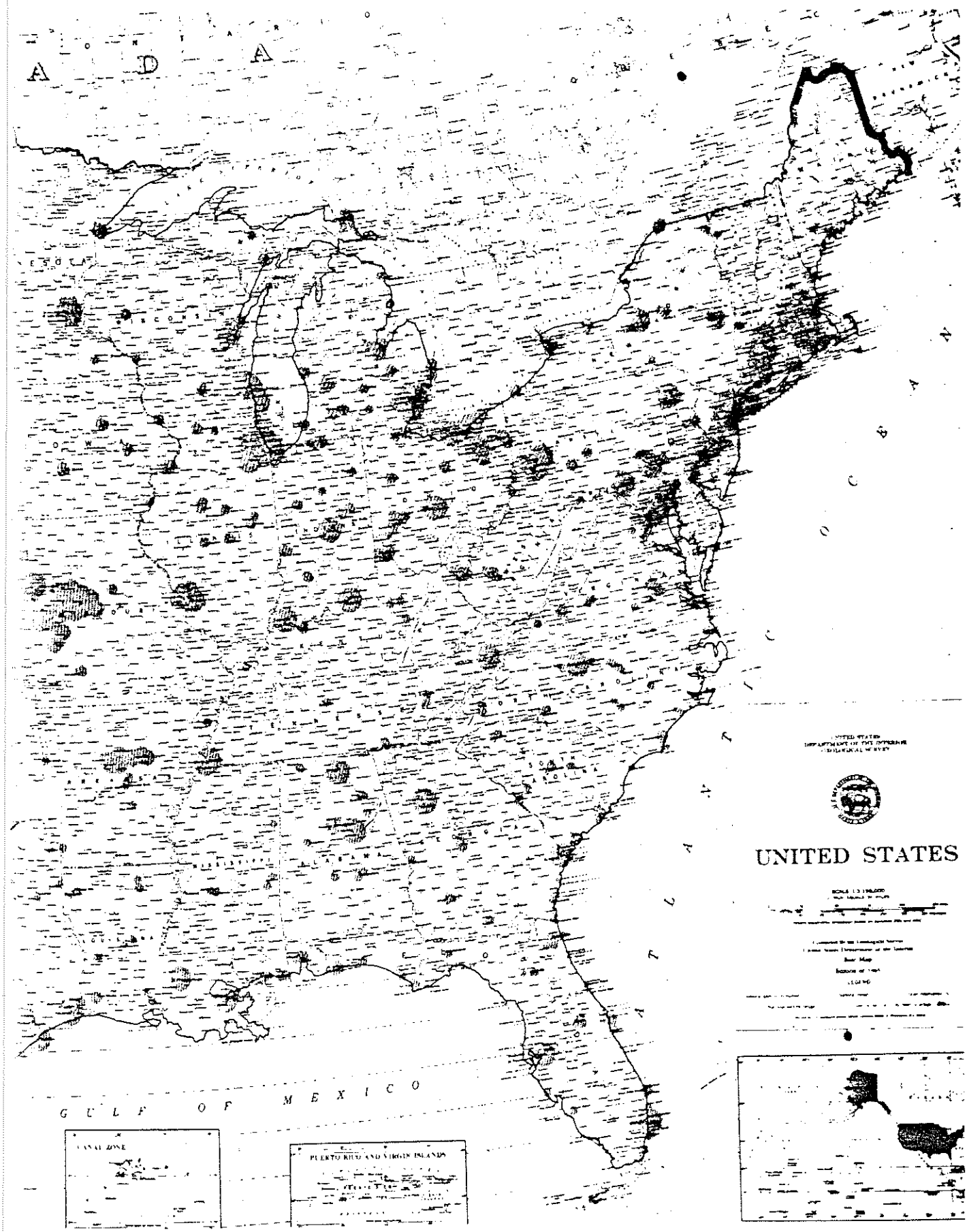
The author of the county's Crisis Relocation Movement Plan admits that planning for evacuation is an uncertain process. A planner cannot be certain of the number of people who will respond to orders to evacuate in a crisis, the number of vehicles they will use, the number of people who will evacuate "spontaneously" (i.e. without government orders), and the exact destination evacuees will choose.[133]

Some critical tasks may not be accomplished until it is too late. Many actions necessary to carry out CD plans are not scheduled to be accomplished until increased readiness is announced. This includes preparations for the stockpiling of shelters[134] and preparation of signs needed to control crisis traffic movement.[135] None of the mentioned local plans have any specific time for review and update before announcement of increaseed readiness. U.S. "high-risk" areas, e.g., those likely to be bombed in nuclear war, are shown in Figure 1.8-1.

Figure 1.8-1[136]

U.S. HIGH RISK AREAS
(Potential Nuclear Targets)




A D A
UNITED STATES
G U L F O F M E X I C O
CANAL ZONE
PUERTO RICO AND VIRGIN ISLANDS

Conclusions (1.9)

The emergency issue of vulnerability of energy systems is recognized by the U.S. Office of Technology Assessment of the former Defense Civil Preparedness Agency (now the Federal Emergency Management Agency). The "industrial attack" option in a U.S. -Soviet Union nuclear exchange is assumed to be that petroleum facilities will be targeted.*

At this point in U.S. history, understanding the problem of energy vulnerability is at a general state. Most studies and official reports consider the primary effects of nuclear targeting on some facilities, but little work has addressed sub-system components and other scenarios for widespread damage for the U.S. economy through massive distruptions in conventional supplies of electricity and fuels. In this first section. we have outlined historic lessons in energy targeting, provided an overview of centralized systems, focused on vulnerability of these systems to sabotage and disruption, and discussed civil defense planning for contingencies.

In the following section, a more detailed survey and discussion of centralized U.S. energy systems is given, including future courses for electricity and synthetic fuels development.

*To comply with the mandate of the recently enacted Energy Security Act, it has been estimated that approximately forty synthetic fuel plants, each with a capacity of 50,000 barrels per day, will be required. Although these plants may not be considered prime strategic targets in an all out nuclear exchange, they are very attractive secondary targets. Also due to their highly centralized nature, they may well be prime targets for terrorist attacks.

In World War II, the Allies destroyed over 90 percent of the German synthetic fuel industry. To destroy 90 percent of the newly proposed U.S. synthetic fuel industry (representing an initial investment of over $80 billion) would require an extremely minimal fraction of the Soviet targeting capability, much less than one percent of the Soviet nuclear arsenal.

SECTION I

ENERGY AND VULNERABILITY

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SECTION 2

ENERGY: EXISTING SYSTEMS AND TRENDS