Chapter III

CIVIL DEFENSE

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INTRODUCTION

Effective civil defense measures have the potential to reduce drastically casualties and economic damage in the short term, and to speed a nation's economic recovery in the long term. Civil defense seeks to preserve lives, economic capacity, postattack viability, and preattack institutions, authority, and values. The extent to which specific civil defense measures would succeed in doing so is controversial.

Some observers argue that U.S. civil defense promotes deterrence by increasing the credibility of U.S. retaliation and by reducing any Soviet "destructive advantage" in a nuclear war. Others, however, argue that a vigorous civil defense program would induce people to believe that a nuclear war was "survivable" rather than "unthinkable," and that such a change in attitude would increase the risk of war.

CIVIL DEFENSE MEASURES

Civil defense seeks to protect the population, protect industry, and improve the quality of postattack life, institutions, and values. This section considers several measures that support these goals.

Population Protection

People near potential targets must either seek protective shelter or evacuate from threatened areas to safer surroundings; if not at risk from immediate effects, they must still protect themselves from fallout. Both forms of protection depend on warning, shelter, supplies, life-support equipment (e. g., air filtration, toilets, communication devices), instruction, public health measures, and provision for rescue operations. I n addition, evacuation involves transportation, This section examines each form of protection.

Blast Shelters

Some structures, particularly those designed for the purpose, offer substantial protection against direct nuclear effects (blast, thermal radiation, ionizing radiation, and related effects such as induced fires). Since blast is usually the most difficult effect to protect against, such shelters are generally evaluated on blast resistance, and protection against other direct effects is assumed. Since most urban targets can be destroyed by an overpressure of 5 to 10 psi, a shelter providing protection against an overpressure of about 10 psi is called a blast shelter, although many blast shelters offer greater protection. Other shelters provide good protection against fallout, but little resistance to blast–such "fallout shelters" are disccused in the next section. Blast shelters generally protect against fallout, but best meet this purpose when they contain adequate life-support systems. (For example, a subway station without special provisions for water and ventilation would make a good blast shelter but a poor fallout shelter.)

Nuclear explosions produce "rings" of various overpressures. If the overpressure at a given spot is very low, a blast shelter is unnecessary; if the overpressure is *very* high (e. g., a direct hit with a surface burst), even the best blast shelters will fail. The "harder" the blast shelter (that is, the greater the overpressure it

can resist), the greater the area in which it could save its occupants' lives. Moreover, if the weapon height of burst (HOB) is chosen to maximize the area receiving 5 to 10 psi, only a very small area (or no area at all) receives more than 40 to 50 psi. Hence, to attack blast shelters of 40 to 50 psi (which is a reasonably attainable hardness), weapons must be detonated at a lower altitude, reducing the area over which buildings, factories, etc., are destroyed.

The costs of blast shelters depend on the degree of protection afforded and on whether the shelter is detached or is in a building constructed for other purposes. However, a large variation in costs occurs between shelters added to existing buildings and those built as part of new construction. The installation of shelters in new construction, or "slanting," is preferable, but it could take as long as 20 years for a national policy of slanting to provide adequate protection in cities.

An inexpensive way to protect population from blast is to use existing underground facilities such as subways, where people can be located for short periods for protection. If people must remain in shelters to escape fallout, then life-support measures requiring special preparation are needed.

Other lethal nuclear effects cannot be overlooked. Although, as noted above, blast shelters usually protect against prompt radiation, the shelters must be designed to ensure that this is the case.

Another problem is protection against fallout. If a sheltered population is to survive fallout, two things must be done. First, fallout must be prevented from infiltrating shelters through doors, ventilation, and other conduits. Other measures to prevent fallout from being tracked or carried into a shelter must also be taken. More important, the shelter must enable its occupants to stay inside as long as outside radiation remains dangerous; radiation doses are cumulative and a few brief exposures to outside fallout may be far more hazardous than constant exposure to a low level of radiation that might penetrate into a shelter.

Since radiation may remain dangerous for periods from a few days to several weeks, each shelter must be equipped to support its occupants for at least this time. Requirements include adequate stocks of food, water, and necessary medical supplies, sanitary facilities, and other appliances. Equipment for controlling tern perature, humidity, and "air quality" standards is also critical. With many people enclosed in an airtight shelter, temperatures, humidity, and carbon dioxide content increase, oxygen availability decreases, and fetid materials accumulate. Surface fires, naturally hot or humid weather, or crowded conditions may make things worse. If unregulated, slight increases in heat and humidity quickly lead to discomfort; substantial rises in temperature, humidity, and carbon dioxide over time could even cause death. Fires are also a threat to shelterers because of extreme tern peratures (possibly exceeding 2,000" F) and carbon monoxide and other noxious gases. A large fire might draw oxygen out of a shelter, suffocating shelterers. World War I I experience indicates that rubble heated by a firestorm may remain intolerably hot for several days after the fire is put out.

Fallout Shelters

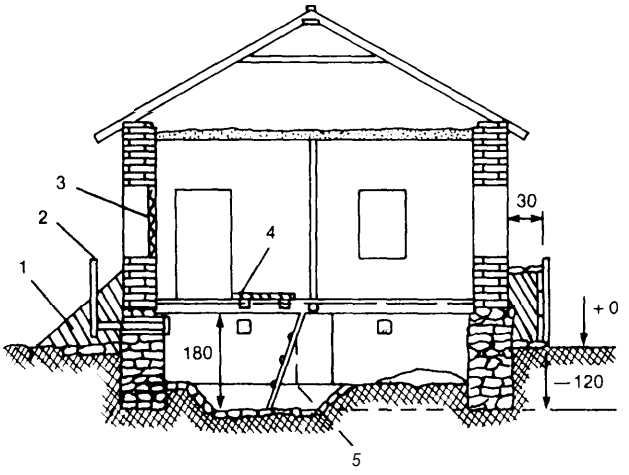
In the United States, fallout shelters have been identified predominantly in urban areas (by the Defense Civil Preparedness Agency (DCPA) shelter survey), to protect against fallout from distant explosions, e.g., a Soviet attack on U.S. intercontinental ballistic missiles (ICBMs). On the other hand, Soviet fallout shelters are primarily intended for the rural population and an evacuated urban population.

Fallout protection is relatively easy to achieve. Any shielding material reduces the radiation intensity. Different materials reduce the intensity by differing amounts. For example, the thickness (in inches) of various substances needed to reduce gamma radiation by a factor of 10 is: steel, 3.7; concrete, 12; earth, 18; water, 26; wood, 50. Consider an average home basement that provides a protection factor (PF) of 10 (reduces the inside level of radia-

tion to one-tenth of that outside). Without additional protection, a family sheltered here could still be exposed to dangerous levels of radiation over time. For example, after 7 days an accumulated dose of almost 400 reins inside the basement would occur if the radiation outside totaled 4,000 roentgens. This could be attenuated to a relatively safe accumulation of 40 reins, if about 18 inches of dirt could be piled against windows and exposed walls before the fallout begins. Thirty-six inches of dirt would reduce the dose to a negligible level of **4** reins **(400 - 100). Thus, as DCPA notes,** "fallout protection is as cheap as dirt. " Moving dry, unfrozen earth to increase the protection in a fallout shelter requires considerable time and effort, if done by hand. A cubic foot of earth weighs about 100 lbs; a cubic yard about 2,700 Ibs. Given time, adequate instructions, and the required materials, unskilled people can convert home basements into effective fallout shelters.

The overall effectiveness of fallout shelters, therefore, depends on: (a) having an adequate shelter—or enough time, information, and materials to build or improve an expedient shelter; (b) having sufficient food, water, and other supplies to enable shelterers to stay sheltered until the outside fallout decays to a safe level (they may need to remain in shelters for periods ranging from a few days to over 1 month, depending on fallout intensity); and (c) entering the shelter promptly before absorbing much radiation. (An individual caught by fallout before reaching shelter could have difficulty entering a shelter without contaminating it.)

Over the years, home fallout shelters have received considerable attention, with the Government distributing plans that could be used to make home basements better shelters. Such plans typically involve piling dirt against windows and (if possible) on floors above the shelter area, stocking provisions, obtaining radios and batteries, building makeshift toilets, and so forth. Such simple actions can substantially increase protection against radiation and may slightly improve protection against blast. However, few homes in the South and West have basements.



Basement of a stone house adapted for shelter: (1) earth embankment; (2) exhaust duct; (3) curtains on windows; (4) airtight hatch; (5) recessed pit. Material requirements: lumber, 0.5 m³; nails, 1 kg; earth, 3 to 5 m³; labor, 15 to 29 hours (man-hours).

With adequate time, instructions, and materials, an "expedient" shelter offering reasonable radiation protection can be constructed. This is a buried or semi buried structure, shielded from radiation by dirt and other common materials. Expedient shelter construction figures prominently in Soviet civil defense planning.

Evacuation

Evacuation is conceptually simple: people move from high-risk to low-risk areas. I n effect, evacuation (or crisis relocation) uses safe distances for protection from immediate nuclear effects. The effectiveness of crisis relocation is highly scenario-dependent. If relocated people have time to find or build shelters, if the areas into which people evacuate do not become new targets, and if evacuated targets are attacked, evacuation will save many lives.

Although evacuating is far less costly per capita than constructing blast shelters, planning and implementing an evacuation is difficult. First, people must be organized and transported to relocation areas. This is a staggering

logistics problem. Unless people are assigned to specific relocation areas, many areas could be overwhelmed with evacuees, causing severe health and safety problems. Unless private transportation is strictly controlled, monumental traffic jams could result. Unless adequate public transportation is provided, some people would be stranded in blast areas. Unless necessary supplies are at relocation areas, people might rebel against authority. Unless medical care is distributed among relocation areas, health problems would multiply.

Once evacuated, people must be sheltered. They might be assigned to existing public shelters or to private homes with basements suitable for shelter. If materials are available and time permits, new public shelters could be built. Evacuees require many of the same life-support functions described previously under fallout shelters; providing these in sufficient quantity would be difficult.

Evacuation entails many unknowns. The time available for evacuation is unknown, but extremely critical. People should be evacuated to areas that will receive little fallout, yet fallout deposition areas cannot be accurately predicted in advance. Crisis relocation could increase the perceived threat of nuclear war and this might destablize a crisis.

Whether people would obey an evacuation order depends on many factors, especially public perception of a deteriorating international crisis. If an evacuation were ordered and people were willing to comply with it, would time allow compliance? If the attack came while the evacuation is underway, more people might die than if evacuation had not been attempted. Sufficiency of warning depends on circumstances; a U.S. President might order an evacuation only if the Soviets had started one. In this case, the United States might have less evacuation time than the Soviets. The abundance of transportation in the United States could in theory permit faster evacuation, but panic, traffic jams, and inadequate planning could nullify this advantage. Disorder and panic, should they occur, would impede evacuation.

The success of evacuation in the United States would likely vary from region to region. Generally, evacuation requires little planning in sparsely populated areas. In some areas, especially the Midwest and South, evacuation is feasible but requires special planning because fallout from attacks on ICBMs might mean longer evacuation distances. Evacuation from the densely populated Boston-to-Washington and Sacramento-to-San Diego corridors, with their tens of millions of people and limited relocation areas, may prove impossible.

The Soviet Union reportedly has plans for large-scale evacuation of cities, and recent debate on its effectiveness has stimulated discussion of a similar plan, known as “crisis relocation”" for the United States. Some key considerations are:

- Tactical warning of a missile attack does not give enough time for an evacuation. Evacuation plans thus assume that an intense crisis will provide several days’ strategic warning of an attack, and that the leadership would make use of this warning.
- Unlike in-place blast sheltering, peacetime expenditures on evacuation are relatively small, since most expenditures occur only when a decision has been reached to implement plans.
- Evacuation involves considerably more preattack planning than a shelter-based civil defense plan, as logistical and other organizational requirements for moving mill ions of people in a few days are much more complex. Plans must be made to care for the relocated people. People must know where to go. Transportation or evacuation routes must be provided. A recent survey of the U.S. population revealed that many would spontaneously evacuate in a severe crisis, which could interfere with a planned evacuation.

Some U.S. analysts argue that detailed Soviet evacuation plans, together with evidence of practical evacuation preparations, indicate a reasonable evacuation capability, Others claim that actual Soviet capabilities

are far less than those suggested in official plans and that, in particular, an actual evacuation under crisis conditions would result in a mixture of evacuation according to plan for some, delay for others, and utter chaos in some places. In any case, a large evacuation has never been attempted by the United States. The extent of Soviet evacuation exercises is a matter of controversy.

Crisis relocation of large populations would have major economic impacts. These are the subject of a current DCPA study in which the Treasury, Federal Reserve Board, and Federal Preparedness Agency are participating. Results to date indicate that economic impacts of relocation, followed by crisis resolution and return of evacuees, could continue for 1 to 3 years, but that appropriate Government policies could significantly reduce such impacts. If blast shelters for key workers are built in risk areas, and if workers are willing to accept the risks, essential industries could be kept functioning while most people were in relocation areas. Such a program would substantially reduce the economic impacts of an extended crisis relocation.

Protection of Industry and Other Economic Resources

Efforts to preserve critical economic assets, and thereby accelerate postattack recovery, could take several forms. For example, if there is warning, railroad rolling stock might be moved from urban classification yards into rural locations, perhaps saving many cars and their cargo. Some industrial equipment and tooling might be protected by burial and sandbagging. Other industrial facilities, such as petroleum refineries and chemical plants, may be impossible to protect. Industrial defense measures include measures to make buildings or machinery more resistant to blast pressure (hardening), dispersal of individual sites and of mobile assets (e. g., transport, tools, equipment, fuel), proliferation of "redundant" and complementary capabilities, and plans to minimize disruption to an economy and its components in wartime by coordinated shutdown of industrial processes, speedy damage control, and plant repair.

There is no practicable way to protect an industrial facility that is targeted by a nuclear weapon with 1980's accuracy. Protective measures might, however, be helpful at industrial facilities that are not directly targeted, but that are near other targets.

Some equipment within structures can be protected against blast, fire, and debris with suitable measures. Other equipment, especially costly and critical equipment, and finished products, can be sheltered in semiburied structures and other protective facilities. A recent study' demonstrated that special hardening measures could save some machinery at blast overpressures higher than necessary to destroy the building in which the machinery is housed. However, it is unknown whether the amount of equipment that could actually be protected would make much difference in recovery.

Another method of protecting industrial capabilities is the maintenance of stock piles of critical equipment or of finished goods. Stockpiling will not provide a continuing output of the stockpiled goods, but could ensure the availability of critical items until their production could be restarted. Stockpiles can obviously be targeted if their locations are known, or might suffer damage if near other potential targets.

Finally, dispersal of industry, both within a given facility consisting of a number of buildings and between facilities, can decrease damage to buildings from weapons aimed at other buildings. A Soviet text on civil defense notes that:

> Measures may be taken nationally to limit the concentration of industry in certain regions. A rational and dispersed location of industries in the territories of our country is of great national economic importance, primarily from the standpoint of an accelerated economic development, but also from the stand-

'T. K. Jones, "Industrial Survival and Recovery After Nuclear Attack A Report to the Joint Committee on Defense Production, U S Congress" (Seattle, Wash The Boeing Aerospace Co , November 1976)

point of organizing protection from weapons of mass destruction. [2]

However, there is little evidence that the U.S.S.R. has adopted industrial dispersion as national policy. Despite reports of Soviet industrial decentralization over the last decade or so, Soviet industry appears more concentrated than ever. An excellent example is the Kama River truck and auto facility, a giant complex the size of Manhattan Island where about one-fifth of al I Soviet motor vehicles is produced. Clearly, Soviet planners have chosen industrial efficiency and economies of scale over civil defense considerations. Similarly, the United States has no directed policy of decentralization, and other facts suggest that nuclear war is not a significant civil planning determinant. There are those who reason that this "disregard" for many of the consequences of nuclear war indicates that policymakers betieve nuclear war is a very low possibility.

2P. T. E gorov, 1 A S hlyakov, and N. 1. A labin, *Civil* **Defense. Translated by the Scientific Translation Service (Springfield, Va : Department of Commerce, National Technical Information Service, December 1973), p 101.**

Planning for Postattack Activities

The economic and social problems following a nuclear attack cannot be foreseen clearly enough to permit drafting of detailed recovery plans. In contrast, plans can be made to preserve the continuity of government, and both the United States and the Soviet Union surely have such plans.

U.S. AND SOVIET CIVIL DEFENSE

U.S. Civil Defense

U.S. attitudes have been ambivalent toward civil defense ever since the Federal Civil Defense Act of 1950 responded to the first Soviet test of atomic bombs in 1949. Indeed, much of the U.S. civil defense was a reaction to external factors rather than part of a carefully-thought-through program. The "duck and cover" program and the evacuation route program, both of the early 1950's, responded to the threat of Soviet atomic bombs carried by manned bombers. Lack of suitable protection against fire and blast led to plans for rapid evacuation of cities during the several hours separating radar warning and the arrival of Soviet bombers.

The first Soviet test of thermonuclear weapons in 1953 necessitated changes in these plans. The much higher yield of these weapons meant that short-distance evacuations and modestly hard blast shelters in cities were ineffective for protecting people, and that simply "ducking" in school corridors, while perhaps better than nothing, was not part of a serious civil defense plan. H-bombs also raised the specter of radioactive fallout blanketing large areas of the country. Previously, civil defense could be conceptualized as moving people a short distance out of cities, while the rest of the country would be unscathed and able to help the target cities. Fallout meant that large areas of the country—the location of which was unpredictable— would become contaminated, people would be forced to take shelter in those areas, and their inhabitants, thus pinned down, would be unable to offer much help to attacked cities for several weeks.

The advent of ICBMs necessitated further changes. Their drastically reduced warning times precluded evacuations on radar warning of attack.

With previous plans made useless by advances in weapons technology, the United States cast around for alternative plans. One approach was to identify and stock fallout shelters, while recognizing the impracticability of protecting people from blast. After the Berlin crisis of 1961, the President initiated a program to provide fallout shelters for the entire population. The National Shelter Survey

Program was commenced on a crash basis. The President proposed:

1. the survey, identification, and stocking of existing shelters;
2. the subsidization of fallout shelter installation in new construction; and
3. the construction of single-purpose fallout shelters where these were needed.

Only the first step in this program was authorized. The Government also urged people to build home fallout shelters.

The civil defense program was broadened in the early 1970's to include preparedness for peacetime as well as wartime disasters. The 1970's also saw a new emphasis on operational capabilities of al I available assets, including warning systems, shelters, radiological detection instruments and trained personnel, police and fire-fighting forces, doctors and hospitals, and experienced management. This development program was called On-Site Assistance.

I n the mid-1970's, contingency planning to evacuate city and other high-risk populations during a period of severe crisis was initiated.

At present, U.S. civil defense has the following plans and capabilities:

Organization. – The Federal civil defense function has been repeatedly reorganized since the Federal **Civil** Defense **Act** of 1950. The most recent organization gave prime responsibility for civil defense to the Defense Civil Preparedness Agency (DCPA), housed in the Defense Department. The Federal Preparedness Agency (FPA) in the General Services Administration conducts some planning for peacetime nuclear emergencies, economic crises, continuity of Government following a nuclear attack, and other emergencies. The Federal Disaster Assistance Administration (FDAA), in the Department of Housing and Urban Development, is concerned with peacetime disaster response. In 1978, Congress assented to a Presidential proposal to reorganize civil defense and peacetime disaster functions into a single agency, the Federal Emergency Management Agency, which will incorporate DC PA, FPA, FDAA, and other agencies.

Civil Protection. -The United States is look-ing increasingly at crisis relocation (CR), under which city-dwellers would move to rural "host" areas when an attack appeared likely. CR would require several days of warning, so it would be carried out during a crisis rather than on radar warning of missile launch. The United States has conducted surveys to identify potential fallout shelters in host areas, and blast and fallout shelters in risk areas. Through FY 1971, about 118,000 buildings had been marked as shelters; about 95,000 other buildings have been identified as potential shelters but have not been marked. Marking would be done in crises. In the early 1960's, the Federal Government purchased austere survival supplies for shelters. The shelf life of these supplies has expired; shelter stocking is now to be accomplished during a crisis.

Direction and Control.–The Federal Government has several teletype, voice, and radio systems for communicating in crises between DCPA, FDAA, and FPA headquarters, regional offices, States, and Canada. State and local governments are planning to integrate communication systems into this net. DCPA has eight regions, each with emergency operating centers (EOCs). Six of these centers are hardened against nuclear blast. Forty-three States have EOCs, and EOCs with fallout protection are operational or under development in locales including about half the population.

Attack Warning.–Warning can be passed over the National Warning System to over 1,200 Federal, State, and local warning points, which operate 24 hours a day. Once warning has reached local levels, it is passed to the public by sirens or other means. Almost half of the U.S. population is in areas that could receive outdoor warning within 15 minutes of the issue of a national warning. Dissemination of warning to the public, however, is inadequate in many places.

Emergency Public Information.–Fallout protection, emergency power generators, and remote units have been provided for radio stations in the Emergency Broadcast System, to

permit broadcast of emergency information under fallout conditions. About a third of the stations are in high-risk areas and could be destroyed by blast. A program has been initiated to protect 180 stations from electromagnetic pulse (EM P). About one-third of the more than 5,000 localities participating in the civil defense program have reported development of plans to provide the public with information in emergencies.

Radiological Defense. — This function encompasses radiological detection instruments, communication, plans and procedures, and personnel trained to detect and evaluate radiological hazards. Between FY 1955-74, the Federal Government had procured about 1.4 million rate meters, 3.4 million dose meters, and related equipment. Effective radiological defense would require an estimated 2.4 million people to be trained as radiological monitors in a crisis.

Citizen Training.–The civil defense program once provided substantial training for the public via news media must now be relied on to educate citizens on hazards and survival actions. DCPA offers classroom and home study training for civil defense personnel.

Several points emerge from this discussion:

1. On paper, civil defense looks effective. The United States has more than enough identified fallout shelter spaces for the entire population, which include underground parking, subways, tunnels, and deep basement potential blast shelters. The United States has a vast network of highways and vehicles; every holiday weekend sees a substantial urban evacuation. CB and other radios can aid communication after an attack. The United States has enormous resources (food, medical supplies, electrical-generating capability, etc.) beyond the minimum needed for survival.
2. However, no one at all thinks that the United States has an effective civil defense.
3. U.S. civil defense capability is weakened because some elements are in place while others are not or have not been maintained. Shelters will not support life if their occupants have no water. Evacuation plans will save fewer people if host areas have inadequate shelter spaces and supplies, or if people are poorly distributed among towns.
4. Faced with drastic technological change, moral and philosophical questions about the desirability of civil defense, and budgetary constraints, Federal plans have been marked by vacillation, shifts in direction, and endless reorganization.

Soviet Civil Defense

Soviet civil defense has faced the same technical challenges as the United States — atomic bombs, hydrogen bombs fallout, ICBMs, limited warning, and so on. The Soviet Union has consistently devoted more resources to civil defense than has the United States, and has been more willing to make and follow long-term plans. However, it is not known how Soviet leaders evaluate the effectiveness of their civil defense.

The Soviet civil defense organization is a part of the Ministry of Defense and is headed by Deputy Minister Colonel-General A. Altunin. Permanent full-time staff of the organ izaiion is believed to number over 100,000. Some civil defense training is compulsory for all Soviet citizens, and many also study first aid. There has also been a large shelter-building program.

The Soviets reportedly have an extensive urban evacuation plan. Each urban resident is assigned to a specific evacuation area, located on COIlective farms; each farmer has instructions and a list of the people he is to receive. If fallout protection is not available, it is planned that simple expedient shelters would be constructed quickly. Soviet plans recommend that shelters be located at least 40 km [25 miles] from the city district to provide sufficient protection against the effects of a l-Mt weapon

exploding at a distance of 10 to 20 km [6 to 12 miles].

In July *1978,* the Central Intelligence Agency (CIA) released its unclassified study, "Soviet Civil Defense. "3 In brief, the report finds that Soviet civil defense is "an ongoing nationwide program under military control. " It notes several motivations for the Soviet program: the traditional Soviet emphasis on homeland defense, to convince potential adversaries they cannot defeat the Soviet Union, to increase Soviet strength should war occur, to help maintain the logistics base for continuing a war effort following nuclear attack, to save people and resources, and to promote postattack recovery. It observes that Sov'iet civil defense "is not a crash effort, but its pace increased beginning in the late 1960' s." It points to several difficulties with the Soviet program: bureaucratic problems, apathy, little protection of economic installations, and little dispersal of industry.

According to the report, the specific goals of Soviet civil defense are to protect the leadership, essential workers, and others, in that priority order; to protect productivity; and to sustain people and prepare for economic recovery following an attack. In assessing Soviet efforts to meet these goals, the CIA found:

> The Soviets probably have sufficient blast-shelter space in hardened command posts for virtually all the leadership elements at al I levels (about 110,000 people) Shelters at key economic installations could accommodate about 12 to 24 percent of the total work force
>
> A minimum of 10 to 20 percent of the total population in urban areas (including essential workers) could be accommodated at present in blast-resistant shelters
>
> The critical decision to be made by the Soviet leaders in terms of sparing the population would be whether or not to evacuate cities. Only by evacuating the bulk of the urban population could they hope to achieve a marked reduction in the number of urban casualties. An evacuation of urban areas could probably be accomplished in two or three days, with as much as a week required for full evacuation of the largest cities
>
> Soviet measures to protect the economy could not prevent massive industrial damage
>
> (Regarding postattack recovery), the coordination of requirements with available supplies and transportation is a complex problem for Soviet planners even in peacetime, let alone following a large-scale nuclear attack

Assessing the effectiveness of Soviet civil defense, the CIA study found that a worst case attack could kill or injure well over 100 mill ion people, but many leaders would survive; with a few days for evacuation and shelter, casualties could be reduced by more than 50 percent; and with a week for preattack planning, "Soviet civil defenses could reduce casualties to the low tens of millions. "

The U.S. Arms Control and Disarmament Agency (AC DA) released "An Analysis of Civil Defense in Nuclear War" in December 1978.[4] This study concluded that Soviet civil defense could do little to mitigate the effects of a major attack. Blast shelters might reduce fatalities to 80 percent of those in an unsheltered case, but this could be offset by targeting additional weapons (e. g., those on bombers and submarines that would be alerted during a crisis) against cities. Evacuation might reduce fatalities to a range of 25 million to 35 million, but if the United States were to target the evacuated population, some 50 million might be killed. Furthermore, civil defense could do little to protect the Soviet economy, so many evacuees and millions of injured could not be supported after the attack ended.

The sharp disagreement about Soviet civil defense capability revolves around several key issues:

Can **the Soviets follow their stated civil defense plans?** Some believe that the Soviets would fill their urban blast shelters to maximum occupancy rather than leave unevaluated people without protection and would evacuate all persons for whom no urban shelter spaces

[3] *Soviet* **Civil** *Defense* (Washington, D C Director **of Central Intelligence, July 1978), the text quotation below is from** pp *2-3*

[4] "An Analysis **of** Civil **Defense** in **Nuclear War"** (Washington, **D** C **U S. Arms Control and Disarmament Agency, December 1978)**

were available. Others believe that administrative confusion and other difficulties might render the Soviets far more vulnerable in practice.

How widely would evacuees be dispersed? It is obvious that the more widely dispersed an urban population is, the fewer casualties an attack on cities will produce. It is equally obvious that the more time there is for an evacuation, the more widely people can disperse. Nevertheless, there is great uncertainty over how well an evacuation would perform in practice. A Boeing study estimates that if urban dwellers walked for a day away from the cities, the population of cities would be more or less distributed over a circle of radius 30 miles [48.3 km].[5] If they did not dig shelters, a U.S. attack would kill about **27 percent of the Soviet population; if they dug expedient shelters, the attack would** kill about 4 percent. If the Soviets fully implemented their evacuation plans but the evacuees were not protected from fallout, then 8 percent of the total population would die; if they constructed hasty shelters, 2 percent would die. ACDA, however, argues that even if the Soviet Union is totally successful in implementing its evacuation, the United States could, if the objective is to kill people, use its reserve weapons against the evacuated population and ground burst its weapons, thus inflicting from **70 million to 85 million** fatalities.

How well would evacuees be protected from fallout? Some believe that Soviet evacuees could be fully protected against very high radiation levels if they are allowed a 1- to **2-week preattack** "surge" period. (Tests conducted by the Oak Ridge National Laboratory have shown, for example, that American families can construct adequate fallout shelters in 24 to 36 hours, if they are issued the necessary tools and instructions.)[b] The ACDA study assumes that from one-third to two-thirds of the evacuees would have little protection against fallout. The two cases are not necessarily exclusive, since the ability to dig in depends on assumptions, especially time available for preparations before an attack. Some assume a lengthy and deepening crisis would precede nuclear strikes. Others believe that error or miscalculation would lead to nuclear war, leaving the United States or the Soviet Union unprepared and not having ordered evacuation. In addition, should an attack occur when the earth is frozen or muddy, construction of expedient shelters would be difficult.

How effective is Soviet industrial hardening? Soviet civil defense manuals provide instructions for the last-minute hardening of key industrial equipment in order to protect it from blast, falling debris, and fires. A considerable controversy has developed in the United States as to how effective such a program would be. The Boeing Company and the Defense Nuclear Agency carried out a number of tests that led them to conclude that "techniques similar to those described in Soviet Civil Defense manuals for protecting industrial equipment appear to hold great promise for permitting early repair of industrial machinery and its restoration to production.'" Others have challenged this conclusion: for example, the ACDA civil defense study concluded that "attempts to harden above-ground facilities are a futile exercise, and that even buried facilities which are targeted cannot survive. "

To understand this issue, one must recognize that it is virtually impossible to harden an economic asset so that it would survive if it were directly targeted. By lowering the height of burst, the maximum overpressure can be increased (at a small sacrifice to the area covered by moderate overpressures), and even missile silos can be destroyed by sufficiently accurate weapons. However, many economic targets are relatively close together (for example, separate buildings in a single factory), and it is possible and efficient to aim a single

5. K. Jones, "Effect of Evacuation and Sheltering on Potential Fatalities From a Nuclear Exchange" (Seattle, Wash.: The Boeing Aerospace Co., 1977),

6. J Condie, et al , "Feasibility of Citizen Construction of Expedient Fallout Shelters" (Oak Ridge, Term,: Oak Ridge National Laboratory, August 1978), See also R. W. Kindig, "Field Testing and Evaluation of Expedient Shelters" (Denver, Colo.: University of Colorado, February 1978)

[7] Edwin N. **York,** *Industrial Survival/Recovery* **(Seattle, Wash.: The Boeing Aerospace Co., undated).**

weapon so that it destroys a number of targets at once. If each target is adequately hardened, then the attacker must either increase the number or yield of weapons used, or else accept less damage to the lower priority targets, However, the practicability of hardening entire installations to this extent is questionable, and the more likely measure would be to harden key pieces of machinery, The uncertainties about the Soviet program include the following:

- How much hardening could be done in the days before an attack?
- Would the United States target additional or larger weapons to overcome the effects of hardening?
- To what extent would the survival of the most important pieces of machinery in the less important Soviet factories contribute to economic recovery?

CONCLUDING NOTE

These pages have provided a brief description of civil defense as it might affect the impact of nuclear war. However, no effort has been made to answer the following key questions:

- Would a civil defense program on a large scale make a big difference, or only a marginal difference, in the impact of a nuclear war on civil society?
- What impact would various kinds of civil defense measures have on peacetime diplomacy or crisis stability?
- What civil defense measures would be appropriate if nuclear war were considered likely in the next few years?
- What kind and size of civil defense program might be worth the money it would cost?