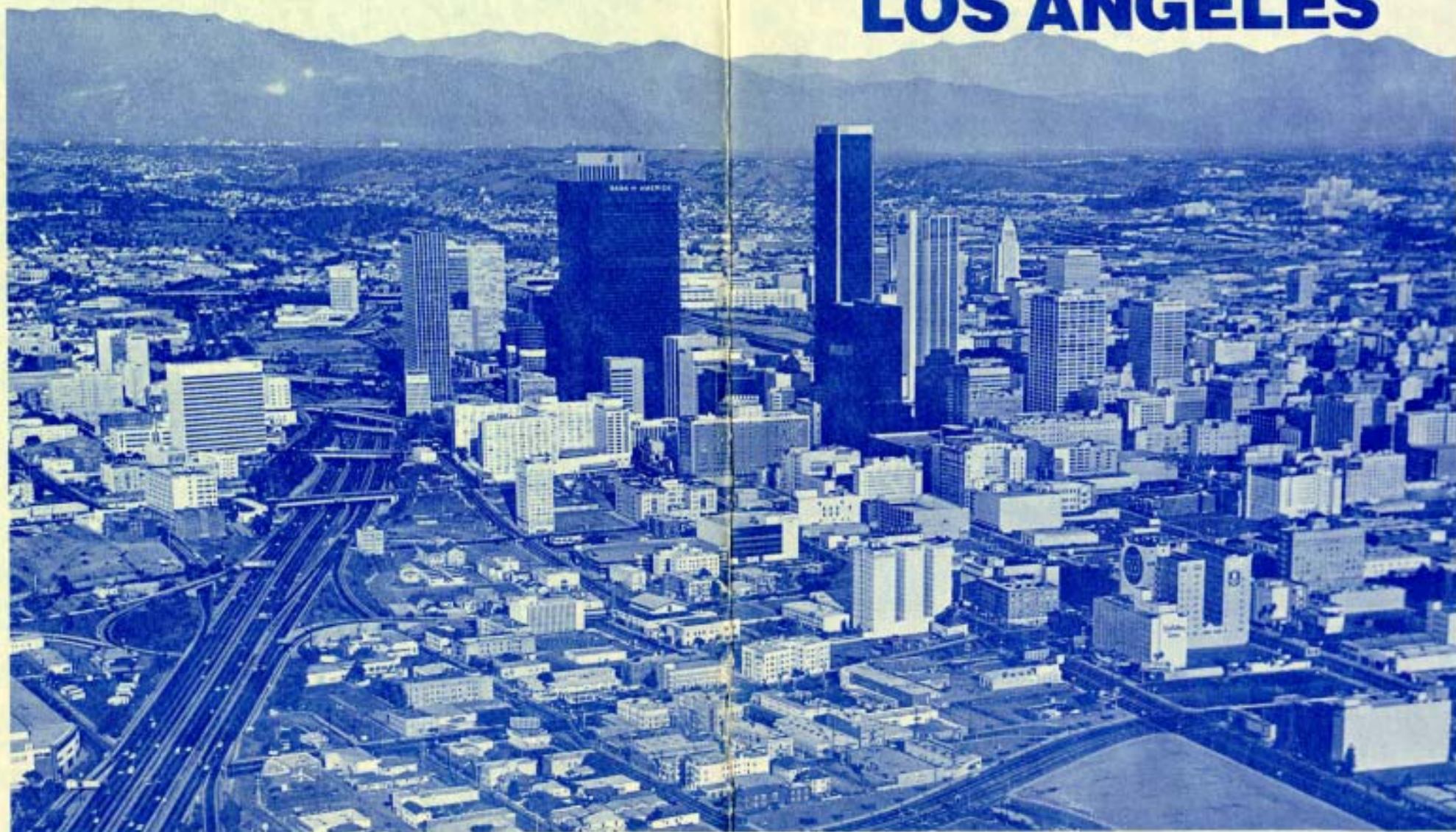


NUCLEAR WAR IN LOS ANGELES



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a report prepared as a public service by the

LOS ANGELES

FEDERATION OF SCIENTISTS

published by the

**INTERFAITH CENTER TO
REVERSE THE ARMS RACE**

It is obviously difficult for a group of scientists to remain emotionally detached from the product of an investigation such as this. Although we suspected before we started that the results would be unsettling, we are deeply disturbed by the magnitude of the possible holocaust.

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Interfaith Center to Reverse the Arms Race, 1980

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at All Saints Church
132 North Euclid Avenue
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TABLE OF CONTENTS

FORWARD.	1
INTRODUCTION.	3
BLAST EFFECTS.	5
THERMAL RADIATION EFFECTS.	8
CONCLUSION.	9
RECOMMENDATIONS.	10
BIBLIOGRAPHY.	11

This report was prepared by a special committee working in participation with the general membership of the Los Angeles Federation of Scientists. Institutional affiliations are for the purpose of identification only.

Committee Members

Thomas Amneus	Structural Engineer, Ret. formerly with California State Office of Architecture and Construction
Harvey Blend	Professor Department of Physics California State University - Fullerton
Jack R. Jennings	Senior Project Engineer Defense and Space Systems Group TRW Corporation
David J. Jhirad	Senior Member of the Technical Staff Jet Propulsion Laboratory California Institute of Technology
Robert M. Nelson	Senior Scientist Jet Propulsion Laboratory California Institute of Technology

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FORWARD

The report of the Los Angeles Federation of Scientists on the effects of nuclear war represents a serious contribution to the growing public concern about nuclear weapons. The important thing to note is that as horrendous as the effects described in the study are, they represent what is probably a gross *underestimate* of the likely outcome of a nuclear encounter. The uncalculable synergistic after effects will be far more serious. Nuclear war is simply intolerable.

Marvin L. Goldberger
President; Professor of Physics
California Institute of Technology

INTRODUCTION

There is a notion that a nuclear war can be limited to a remote region of the globe or merely to an exchange of missiles fired against opposing missile sites; that somehow the densely populated regions of our country would be bystanders in a “Nuclear Olympics” and when it was all over we would return home safely. Unfortunately, we believe the real situation is quite the opposite.

The United States has more than 9000 strategic nuclear warheads, approximately twice that of the Soviet Union. A recent study by the Office of Technology Assessment entitled “The Effects of Nuclear War” reports that by 1985 the USSR will have 8,300 strategic nuclear warheads and the US will have 13,900. This numerical difference in warheads is due mainly to different weapons strategies employed by the two countries. For example, the United States has, and will continue to have, a larger number of submarine-launched warheads; the Soviet Union has more land-based warheads. Also, the US warheads are smaller than the Soviet ones, but the US delivery vehicles are more accurate. The total explosive force of the 8,300 Soviet warheads is estimated to be 10,000 megatons*, which is an explosive force of about 2.5 tons of TNT for every person in the world.

We do not know exactly where Soviet missiles might strike in the event of war, but we believe that the Los Angeles basin would not escape attack. The city is a major center of commerce and industry, and the region is the home of many important military suppliers. The exact number of Soviet missiles that are targeted for Los Angeles is unknown, but based on reasonable assumptions, we can make an adequate approximation.

*One megaton is equal to the explosive force of 1 million tons of TNT. The atomic bomb that was dropped on Hiroshima in 1945 had an explosive force of less than 1/50 megaton (See Glasstone and Dolan).

BLAST EFFECTS

Of the total Soviet strategic arsenal, it is reasonable to assume that 2 percent (or 200 megatons) is intended for the Los Angeles basin in the event of an attack. The chances that the missiles would miss their targets are remote. Deborah Shapley reported recently in the journal *Science* that Soviet warheads have a 50 percent probability of striking within 400 meters of their intended targets, and unconfirmed reports have placed the number as low as 200 meters.

It has been suggested by some of our leaders that the United States, with its superiority in total nuclear weapons, might be the victor if it were to strike first, annihilating most of the Soviet weapons before they could be launched. Reputable authorities have assured us that far more than 10 percent of the Soviet missiles can be expected to survive a US first strike. To be conservative, we have assumed that 10 percent (or 20 megatons) of the Soviet force allocated for Los Angeles would be employed for a counterattack on the region. Hence, the 20 megaton attack that we describe here can be envisioned as an underestimation of a Soviet retaliatory strike. If the USSR struck first, of course, almost all of their warheads would land close to their intended targets. The effects we describe here would then be somewhat worse, but near total destruction is about as bad as things can" get.

There are three main destructive effects which follow from the detonation of a thermonuclear weapon. They are blast effects, heat effects, and radiation effects. Kevin Lewis, writing in the July, 1979, issue of *Scientific American* states, "When the nuclear explosion is set off in the air, the energy released instantly vaporizes the components of the warhead, creating a hot rapidly expanding fireball. The explosion gives rise to two prompt effects that in an attack on a city can be devastating. First, as the fireball expands, it sends a shock wave through the surrounding medium. The shock wave, which travels away from the point of the explosion at supersonic speeds, does blast damage to structures and people. The hot fireball also radiates thermal energy...which can cause burns and ignite materials that are not protected by some kind of opaque screen." In addition to the heat and blast effects, there are also nuclear radiation effects, such as fallout, which are important in the period following the explosion.

Most of the immediate casualties and damage to structures from thermonuclear weapons comes from the explosive blast. According to the Office of Technology Assessment report, "The blast drives air away from the site of the explosion, producing sudden changes in air pressure (called static overpressure) that can crush objects, and high winds (called dynamic pressure) that can move them suddenly or knock them down. In general, large buildings are destroyed by the overpressure, while people and objects such as trees and utility poles are destroyed by the wind." Static overpressure is measured in pounds per square inch (psi) above atmospheric pressure (15 psi).

An overpressure of 5 psi, or 720 pounds per square foot, will destroy a typical American home. The force against a 20' x 10' wall from such overpressures exceeds 70 tons. The Office of Technology Assessment Study reports that, "While a human body can withstand up to 30 psi of simple overpressure, the winds associated with as little as 2 to 3 psi could be expected to blow people out of typical modern office buildings. Most blast deaths result from the collapse of occupied buildings, from people being blown into objects or from buildings, or smaller objects being blown onto or into people." There is no way to determine the extent of injury to a specific individual located near the blast area; however, a common assumption made by weapons effects experts is that all the people within the area receiving an overpressure of 5 psi or greater will be killed.

A single 20 megaton weapon arriving from a Soviet counter-attack would inflict severe damage on the communities of the Los Angeles basin. Assuming that the weapon exploded at 16,000 feet above the Los Angeles Civic Center, the blast from the explosion would expose everything and everyone within a radius of 10 miles to an overpressure of 5 psi or greater, resulting in the immediate death of 1.8 million people. The area of destruction would extend from the Rose Bowl in Pasadena to Hollywood Park in Inglewood. It would include all of Hollywood, Burbank, Monterey Park, Pico Rivera, Downey and Hawthorne.

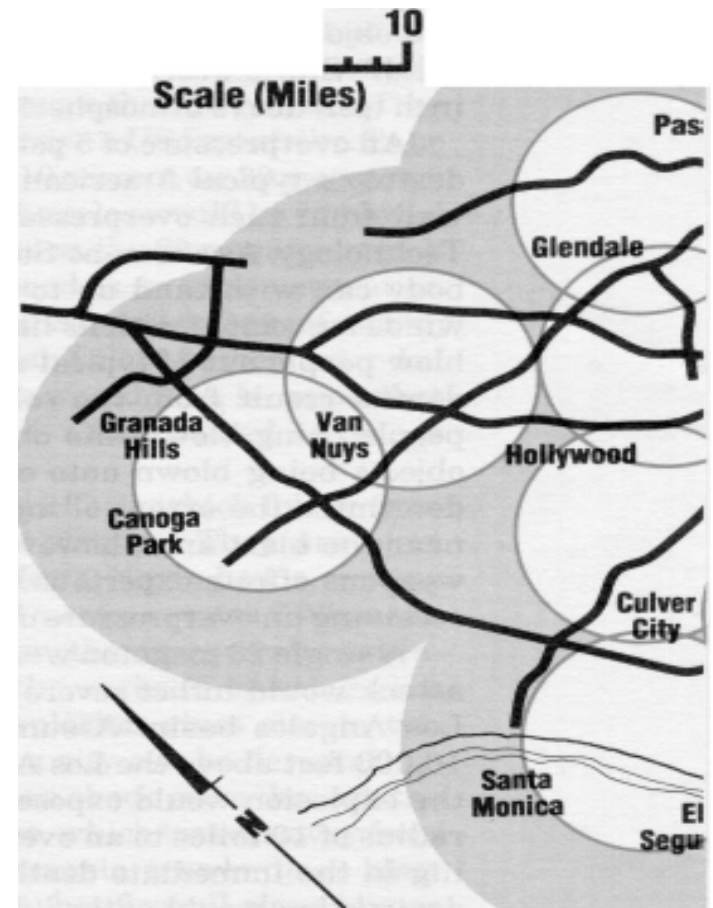
Since we are not privy to the thinking of Soviet military strategists, we have no way of knowing whether or not a counter-attack to a hypothetical United States first strike would take

the particular form of a single 20 megaton weapon. A more likely possibility is that the Soviet Union will use a large number of dispersed smaller weapons, because they produce a larger cumulative area of destruction than the equivalent explosive effect of one large weapon with the same total megatonnage. This is one reason why the United States and the Soviet Union have built large numbers of Multiple Re-entry Vehicles, also referred to as MRVs, which permit a large number of warheads to be launched from a single missile. There-fore, in what follows, we focus on the immediate effects of a dispersed formation of 20 one-megaton weapons striking the Los Angeles basin almost simultaneously.

The circles shown on the map in Figure 1 represent the areas of near complete death and destruction resulting from one-megaton blasts at an altitude of 8000 feet. Assuming a population density of 4600 persons per square mile in the Los Angeles area, 5.5 million deaths will occur within the first few minutes of the attack. The total area of destruction will encompass approximately 1200 square.

20 One-Megaton Air Bursts on a Portion of the Los Angeles Basin

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20 One-Megaton Air Bursts on a Portion of the Los Angeles Basin

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Scale (Miles)

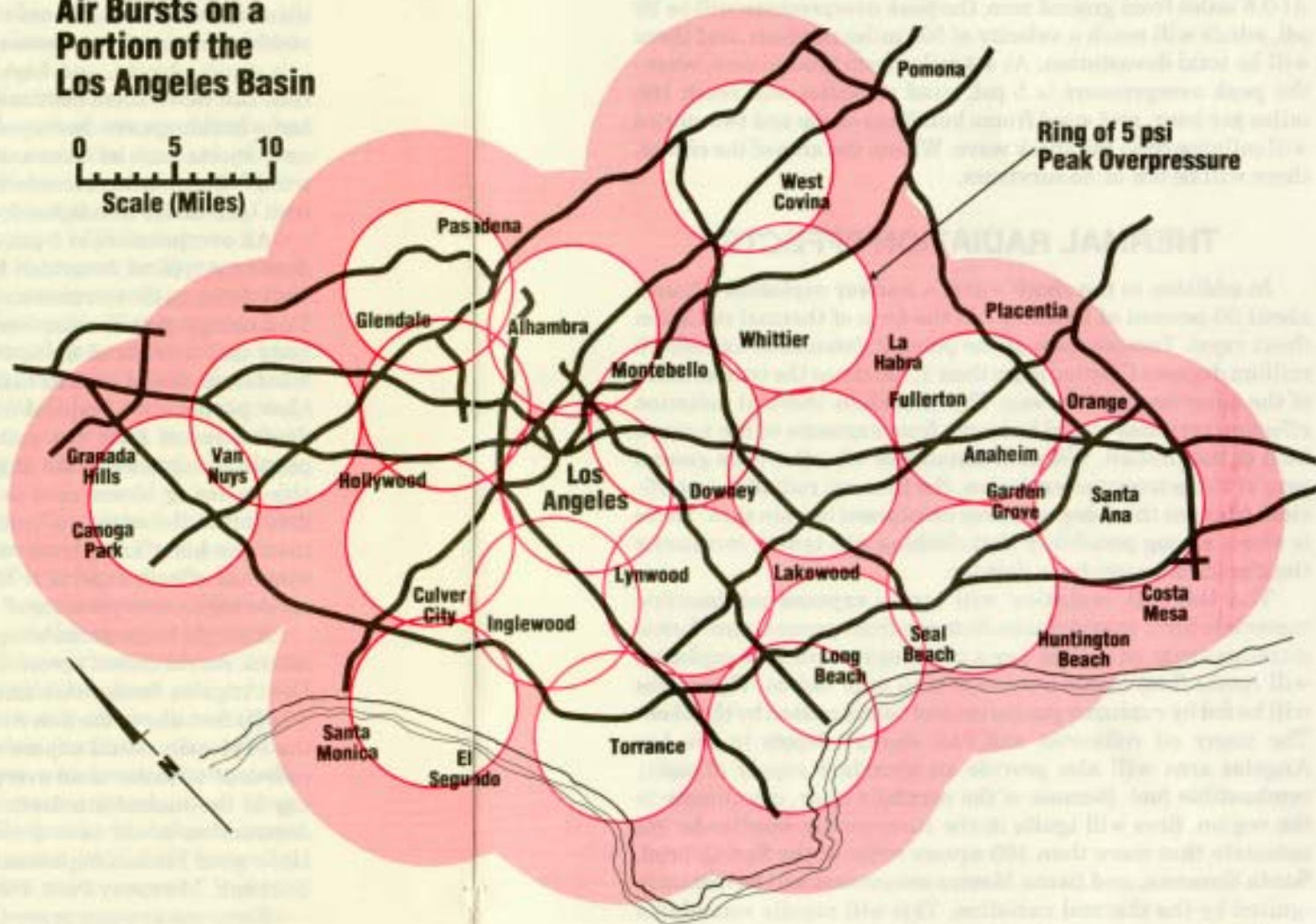


FIGURE 1

miles and will extend from Redondo Beach to Reseda, including the bordering communities of Burbank, Glendale, Pasadena, West Covina, Santa Ana, Seal Beach, Long Beach, and San Pedro. The magnitude of the destruction will depend on proximity to ground zero (the point on the ground under the explosion). At 0.8 miles from ground zero, the peak overpressure will be 20 psi, winds will reach a velocity of 500 miles per hour, and there will be total devastation. At 4.4 miles from ground zero, where the peak overpressure is 5 psi, wind velocities will reach 160 miles per hour, and wood frame buildings of one and two stories will collapse from the shock wave. Within the area of the circles, there will be few or no survivors.

THERMAL RADIATION EFFECTS

In addition to the shock wave, a nuclear explosion releases about 30 percent of its energy in the form of thermal radiation (heat rays). Temperature at the point of detonation exceeds 10 million degrees Celsius, more than 1,700 times the temperature of the outer layers of the sun. The immediate thermal radiation effect on civilians would be burns from exposure to the intense heat of the fireball. Within a distance of 6.5 miles from ground zero of a one-megaton explosion, the thermal radiation is sufficient to cause third degree burns on exposed human skin. There is also a strong possibility that clothing will ignite, increasing the chance of severe burn damage.

The thermal radiation will ignite exposed combustible materials for a considerable distance from ground zero. Lewis estimates that on a clear day a one-megaton nuclear explosion will ignite fires inside a circle of a 10 mile radius. These fires will be fed by ruptured gas mains and debris caused by the blast. The many oil refineries and fuel storage depots in the Los Angeles area will also provide an abundant supply of easily combustible fuel. Because of the normally clear, dry climate in the region, fires will ignite in the surrounding woodlands. We calculate that more than 100 square miles of the San Gabriel, Santa Susanna, and Santa Monica mountains will be instantly ignited by the thermal radiation. This will rapidly spread in a manner characteristic of the frequent wildfires that occur in the region during the dry season. The additional area receiving this

high thermal radiation exposure is shaded in Figure 1.

The sudden ignition of so much material over such a wide area has the capability of creating a mass fire. A conflagration usually requires that strong winds be present before the attack; however, a firestorm is a type of mass fire that is driven by the force of the rising hot gases from the fire itself. Such mass fires occurred in World War II after the bombings of Tokyo, Dresden and Hamburg with conventional weapons and also after the atomic attack on Hiroshima. The temperatures in such fires exceed 1000 degrees Celsius (over 1800 degrees Fahrenheit) and the heat will destroy many materials that are normally considered fireproof.

Near the burn and blast zone, survivors of the immediate effects will be threatened by poisoning from toxic gases produced by the fire or they will be asphyxiated because the fire will have consumed most of the oxygen. We estimate that 1 million cases of third degree burns will be caused by the thermal radiation effects and the fires. This is over and above the blast casualties previously determined. The burn and blast victims around the perimeter of the attack will lack adequate medical care because few medical facilities will survive the blast. The OTA report states that "...in 1977 there were only 85 specialized burn centers with probably 1,000 to 2,000 beds in the entire United States."

CONCLUSION

The blast and thermal radiation effects will produce more than 5 million fatalities and 1 million cases of severe burns. To this must be added the subsequent effect of fallout. The radioactive material released into the atmosphere will settle out over a period of days and create a downwind contamination pattern extending for hundreds of miles. Some material will reach the stratosphere where it will remain suspended for many months and possibly years and will ultimately be distributed over an extremely wide region.

The localized effect from fallout, however, will not cause many additional casualties because most of the population will be dead or dying due to the immediate blast and thermal effects. The few who might survive will find no hope in flight to surrounding cities because the scene described above will be

repeated in every population center in the United States.

The national death toll from such an extensive attack has been estimated to be between 105 and 165 million persons, within the first 30 days. Many of the survivors will be in need of medical attention, but the health care system will have been destroyed. The few who are uninjured will face poor prospects for surviving the next few months. The simultaneous destruction of the many interlocking functions on which our modern society depends would mean complete economic and social collapse.

We conclude that even under the very favorable military circumstances following a United States first strike, the Soviet retaliatory capability would be severe enough to demolish American population centers. It has been shown in other studies that the United States could inflict equally unacceptable damage on the Soviet Union in the event of a Soviet first strike. Nuclear war as an option for the solution of international conflict is obviously unacceptable.

RECOMMENDATIONS

◆ The United States has one of the largest nuclear weapons arsenals in the world. Yet, to our knowledge, there has been no extensive public discussion of the circumstances in which a US nuclear attack can be ordered. With the survival of the human race in the balance, it is imperative that this issue be exposed to thorough public debate and scrutiny.

◆ In spite of numerous suggestions in the Congress and elsewhere, the United States has never officially disavowed the first use of nuclear weapons. In our opinion, the announcement of such a position would be a first step toward bridging the current nuclear standoff.

◆ Some prominent analysts have argued that the United States could reduce its military expenditure by 40 percent and still maintain a complete and formidable defensive capability (Boston Study Group, 1979; Morrison and Walker, *Scientific American*, Oct., 1978). Expenditure for ballistic missile systems such as the MX represents a continuing waste of precious funds that might otherwise be spent for social needs such as education, health care, and tax relief. We must insist that Congress put a stop to this waste.

◆ The arms race has caused the US and USSR to squander valuable labor and material on the manufacture of machines of destruction. Such precious resources would be far better spent on improving the quality of human life.

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