CHAPTER FIVE

ATTACKING RUSSIAN CITIES: TWO COUNTERVALUE SCENARIOS

The nuclear dangers that the United States and Russia survived during the Cold War have persisted into the twenty-first century. Both countries continue to affirm the importance of nuclear weapons to their national security and currently retain over 14,000 strategic warheads in their combined arsenals. The United States government remains convinced that nuclear weapons serve as useful tools in the conduct of foreign policy. Our government claims that they can and should play a variety of roles beyond deterring the use of nuclear weapons, such as deterring or responding to conventional, chemical, or biological attacks, as well as shielding allies around the globe. We find that, rather than enhancing security, these extended roles in fact undermine it, and contradict the attainment of the nation's most important security goal, which is to lessen the threat of nuclear attack and prevent the spread of nuclear weapons to hostile states or groups. Abandoning these illusory roles can—along with dropping the major attack option—lead to a significantly smaller arsenal. In this chapter we take a fresh look at that fundamental question: "How much is enough?" or more specifically, "How many nuclear weapons are necessary for deterring a nuclear attack on the United States, which is arguably the only reason for continuing to possess them at all?"

At times during the Cold War, the U.S. definition of deterrence included our ability to destroy at least 25 percent of Soviet citizenry. The Major Attack Option we presented in Chapter Four did not try to accomplish this, because it targeted nuclear forces, not population centers. The two scenarios we present below demonstrate that deterrence, defined in this way, can be reached with remarkably few warheads. Before presenting our calculations, we briefly review population targeting in U.S. nuclear policy—revisiting the Cold War planning assumptions and judgments about the need and ability to destroy urban-industrial areas.

"ASSURED DESTRUCTION": TARGETING POPULATION CENTERS

Nuclear warheads have long been targeted not just at military forces, but at population centers as well. Indeed, from the end of World War II until well into the Cold

War, the primary purpose of nuclear weapons was to destroy an entire city with just one or two weapons. During the war in Europe and the Pacific, area bombing of cities with high-explosive and incendiary bombs intensified, becoming commonplace and an accepted strategy in the conduct of war. The bombing of Dresden on February 13–15, 1945, resulted in 135,000 deaths and that of Tokyo on March 9–10, 1945 caused 83,000 deaths. According to an authority on the history of the SIOP, "The same factors that contributed to the emphasis on urban/industrial targeting in World War II continued to be factors in the early nuclear era."[1] The military, and particularly the U.S. Air Force, believed that atomic bombs could do the job better than conventional bombs. In August 1945 the atomic bombings of the Japanese cities of Hiroshima and Nagasaki resulted in over 210,000 deaths by the end of the year using only two bombs.

Early U.S. nuclear war plans involved only the bombing of cities: the 1948 war plan FLEETWOOD "called for the use of 133 bombs in a single massive attack against 70 Soviet cities." War plan TROJAN "provided for a total of 300 atomic bombs to be dropped on Russia and included the all-out bombing of Soviet cities and industry." As we have seen in Chapter Two, the first SIOP, created late in the Eisenhower administration, called for "attacks on all major Soviet and other Communist cities in the event of war. In some cases ten bombs were targeted on a single city. In the event of war, 360 to 525 million casualties were predicted."[2]

In a November 21, 1962 memo to President Kennedy, Secretary of Defense McNamara provided a justification for his proposed strategic nuclear force acquisitions and sought to quantify the destruction sufficient to deter a nuclear attack on the United States by the Soviet Union:

McNamara's analysis was presented in the famous mutually assured destruction (MAD) curve, demonstrating a point of diminishing returns, or a "knee," in an attack of Soviet urban-industrial targets at 400 equivalent megatons. The equivalent megatonnage of a nuclear weapon is expressed by $Y^{2/3}$, where Y is the yield of the weapon measured in kilotons or megatons. Equivalent megatonnage is roughly proportional to the area under a nuclear blast receiving a given peak overpressure. In other words, using the measure of equivalent megatonnage, a 1,000 kiloton (or 1 megaton) weapon does not destroy by blast ten times the area of a 100 kt weapon, but rather only about 4.6 times as much (i.e., $1{,}000^{2/3}/100^{2/3}$).

McNamara's calculation of damage to Soviet urban/industrial targets as measured in equivalent megatons is given in Table 5.1. The reverse calculation, where the Soviet forces attack U.S. urban/industrial targets is given in Table 5.2. In the early 1960s, before there were MIRVed missiles, the average yield of a U.S. ICBM warhead was approximately one megaton, which in Table 5.1 corresponds to an equal number of weapons. In discussing the table, McNamara stated:

Therefore relatively few weapons inflicted "assured destruction"—what McNamara viewed as the core of the U.S. deterrent strategy.

A decade after McNamara, U.S. military war planners developed more refined analytical techniques to quickly calculate the fraction of a city's population that would be killed by a given number of nuclear weapons having the same yield, accuracy, and reliability. This shorthand method became known as the "Q and A parameters" (see Box, page 117). Population densities for attacked cities were assembled into P-95 circles for use in countervalue calculations.[3] Most likely, a lack of computing power at the time motivated the development of the Q and A

TABLE 5.1
McNamara's "Assured Destruction" Calculations for a U.S. Attack on Soviet Urban/Industrial Targets
In McNamara's words: "The destructive potential of various size U.S. attacks on Soviet cities is shown in the following table, assuming both the existing fallout protection in the Soviet Union, which we believe to be minimal, and a new Soviet nation-wide fallout shelter program."[4] In this table "mil." denotes millions and "Ind. Cp." denotes industrial capacity.

	Limited Urban Fallout Protection				Nation-Wide Fallout Program				
Delivered Megatons/ Warheads	Urban (mil.)	Urban (%)	Total (mil.)	Total (%)	Urban (mil.)	Urban (%)	Total (mil.)	Total (%)	Ind. Cp. (%)
100	20	15	25	11	16	12	17	7	50
200	40	29	46	19	30	21	32	13	65
400	57	41	68	28	48	35	51	21	74
800	77	56	94	39	71	52	74	31	77
1200	90	65	109	45	84	61	87	36	79
1600	97	70	118	49	92	67	95	39	80

parameters. The goal of the Q and A technique was to routinely and efficiently allocate thermonuclear warheads in order to kill a specified fraction of civilians in urban areas. That the P-95 population data format was until recently in use by U.S. nuclear war planners can be seen in a 1999 USSTRATCOM briefing where the nomenclature "P-95 circles" and "rural cells" are used to analyze Algeria's population. Another view-graph from this briefing states that a P-95 circle: "[is] Used in urban areas of 25,000 people or more; [is a] 0.5–7 nautical mile radius circle containing 95 percent of population within; [and] Contains a minimum of 2500 people;" and rural cells are defined as "20' by 30' gridded cells containing rural population."[5]

In 1979, fifteen years after Robert McNamara publicly presented his MAD curve to Congress, Science Applications, a Pentagon contractor, wrote a classified report for the Defense Nuclear Agency entitled, .[6] In the introduction the authors wrote:

The Science Applications report provides an extensive mathematical analysis of how to kill millions of people in a nuclear war, and even takes into account the influence of the Soviet civil defense program. The report argues that if population targeting is a goal, then the U.S. war plan should target those who are evacuated.

TABLE 5.2

McNamara's "Assured Destruction" Calculations for a Soviet Attack on U.S. Urban/Industrial Targets

In McNamara's words: "The yield of each warhead is assumed to be 10 Mt. As in the case of the counterpart table (i.e., Table 5.1, above), U.S. fatalities are calculated under conditions of a limited, as well as a full, nation-wide fallout shelter program."[8] In this table "mil." denotes millions and "Ind. Cp." denotes industrial capacity.

	Limited Fallout Protection				Nation-Wide Fallout Program				
Delivered Warheads (10 MT)	Urban (mil.)	Urban (%)	Total (mil.)	Total (%)	Urban (mil.)	Urban (%)	Total (mil.)	Total (%)	Ind. Cp. (%)
100	79	53	88	42	49	33	53	25	39
200	93	62	116	55	64	43	74	35	50
400	110	73	143	68	80	53	95	45	61
800	121	81	164	78	90	60	118	56	71

Using U.S. intelligence information, the report claimed that the Soviet Union had established evacuation procedures calling for a buffer zone around each major city. The zone was ring shaped: "8 nautical miles (14.8 kilometers) in thickness whose inner boundary is located along the periphery of the city proper. It is intended to ensure that people evacuated beyond this zone will not be subjected to more than 1.4 psi (0.1 kg/cm^2) from yields of a megaton or less detonating along the city periphery."[10] Thus 1.4 psi was considered by the Soviets as the blast overpressure threshold for an

Q AND A PARAMETERS FOR POPULATION ATTACKS

Taken from *The Feasibility of Population Targeting*

"A total of 1532 USSR population centers representing a projected 1981 population of 144 million people were depicted by 10 city classes. Each city was defined by a number of population centers (P-95's) that varied from 1 to 92 in number, depending upon the size of the individual city. Radii of these P-95's varied from 0.25 to 1.0 nautical miles (nm), and the distribution of population within the P-95 was assumed to be circular normal. Weapons were allocated against this database so as to maximize the effectiveness of each successive weapon considering the damage expectancy of all preceding weapons. The results of these hypothetical attacks provided the necessary data which, when subjected to curve-fitting and other analytical techniques, yielded two parameters, Q and A, for each combination of weapon yield, accuracy, and reliability.

"These parameters were used in the formula: $D_i(n) = 1 - Q_i^{n^A}$, where D_i is the fraction of population of city class i killed by n weapons of the type for which the Q/A parameters were calculated. Q_i is equal to one minus the single-shot kill probability (1-SSPK) of a single weapon, and A is a factor which modifies the exponent n to account for the nonuniform distribution of population and the overlapping coverage of successive weapons. In effect, the formula is a variation of the expression: $DE_{CUM} = 1 - [(1 - DE_1)(1 - DE_2)\dots(1 - DE_n)]$, which is used to calculate the cumulative damage expectancy (DE_{CUM}) to a single target resulting from the application of several different (n) weapons. The Q/A formula simply uses a modified version of this basic expression to represent the cumulative damage to the several P-95's of a given city from n weapons having identical characteristics . . .

"Several important assumptions were embodied in the original development of the original Q/A approach. First, the entire population was assumed to be located in multistory concrete buildings and in an unwarned nighttime posture. The weapons height of burst was optimized for the multistory structure. Next, the fatality calculations considered only blast and prompt radiation effects. Finally, the aimpoint of the nth weapon was optimized given the fatalities expected from the preceding n-1 weapons . . .

"Despite the limitations described above, there are several very attractive features in the technique. In addition to the fact that the basic procedure is already in being, the computer resources required are minimal, thus permitting a large number of attack alternatives to be analyzed economically. Further, the database contains a large portion of the Soviet population."[11]

urban population at risk. The report concluded, apparently using the McNamara criteria of 25 percent casualties as an adequate measure for deterrence, that of an estimated Soviet population of 246 million at the time, 60 million casualties would, in their language "develop adequately the relationship between weapons requirements and fatalities as a function of various levels of shelter and evacuation."[12]

It is worth underscoring the fact that targeting major Soviet cities, as articulated by McNamara in the early 1960s, persisted for twenty years into the Reagan administration as a core component of the concept of deterrence.

TWO COUNTERVALUE SCENARIOS

NRDC does not have any information about the role of countervalue targeting in the current SIOP, but what we do know about U.S. nuclear war planning emphasizes historical continuity. In this section, we evaluate the consequences of two scenarios in which small pieces of the current U.S. nuclear arsenal attack Russian cities and exceed the goals articulated by McNamara. This exercise demonstrates the destructive power of very few nuclear weapons, using nuclear deployments that are plausible if the United States reduces its forces to such low levels: one silo field of single-warhead MM III ICBMs or one fully-laden Trident SSBN.

Russia is currently comprised of 89 regions with an area of 16.9 million square kilometers and a population of 152 million[13], making it about twice as big as the United States with half the population. The Ural Mountains split Russia into a "European" portion that contains most of the people while an "Asiatic" portion includes most of the land mass. The 53 Russian regions west of the Urals have about three quarters (102 million) of the population. According to the last Soviet census conducted in 1989, 22 of the 34 Soviet cities with a population over 500,000 were located in European Russia, including Moscow (8.8 million) and St. Petersburg (5 million).

FIGURE 5.1
A Trident II SLBM Being Launched

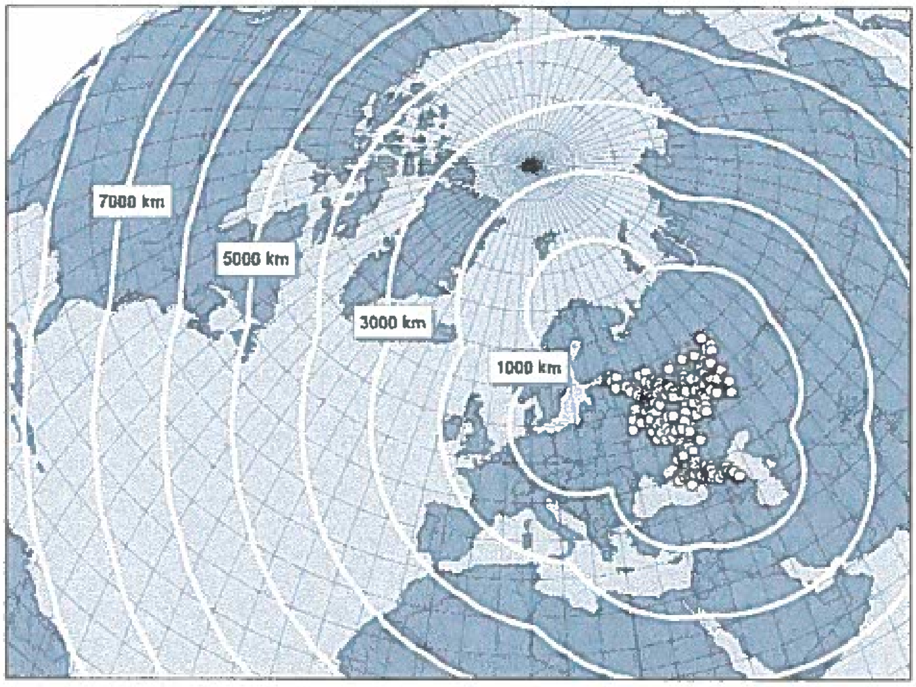


FIGURE 5.2
A Map Showing the 192 Targets in European Russia for the Trident Scenario and Buffered Distances

To target these various population centers, our two scenarios utilize America's premiere strategic weapons: Trident II and Minuteman III. These long-range ballistic missile systems were designed during the Cold War to meet specific military requirements to destroy hardened targets such as Soviet ICBM silos and underground command bunkers. Our scenarios explore the capabilities of Trident and Minuteman III against "soft" targets—Russian cities. We demonstrate that ballistic missiles designed for use in a first strike, or prompt counterforce, can be employed as a retaliatory weapon, or as part of a "strategic reserve,"

TABLE 5.3
Trident and Minuteman III Weapon System Parameters for the Two NRDC Countervalue Scenarios
Sources: U.S. Congress, (Washington, DC: Congressional Budget Office, July 1986); John M. Collins and Dianne E. Rennack, (Congressional Research Service, The Library of Congress, September 6, 1991), Tables 5 and 6.

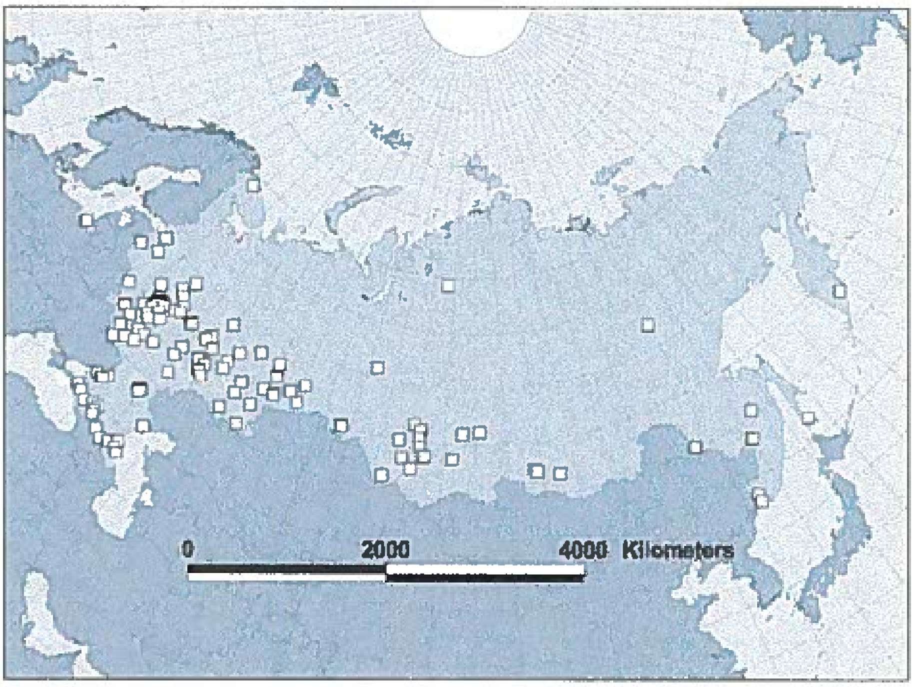
NRDC Scenario and Weapon System	Total Number of Missiles	Warhead MIRV, Yield and Type	Total Number Warheads and Total Yield	Range (km)	Accuracy (meters)	Reliability (%)
Scenario 1: Trident II D-5	24 (one deployed submarine)	8, 475 kt W88 warheads per missile	192 warheads and 91,200 kt	7,400 (at full payload)	125	80%
Scenario 2: Minuteman III	150 (all ICBMs at Minot Air Force Base, North Dakota)	1, 300 kt W87 warhead per missile	150 warheads and 45,000 kt	> 13,000 km[a]	225[b]	80%[c]

[a] The range is for the three warhead Minuteman III. The range of a single warhead Minuteman III would be greater since the payload is lighter.

[b] For the three warhead Minuteman III using the Mk-12A RV.

[c] We assume the reliability figures of the Minuteman III are similar to the published values for the Trident II.

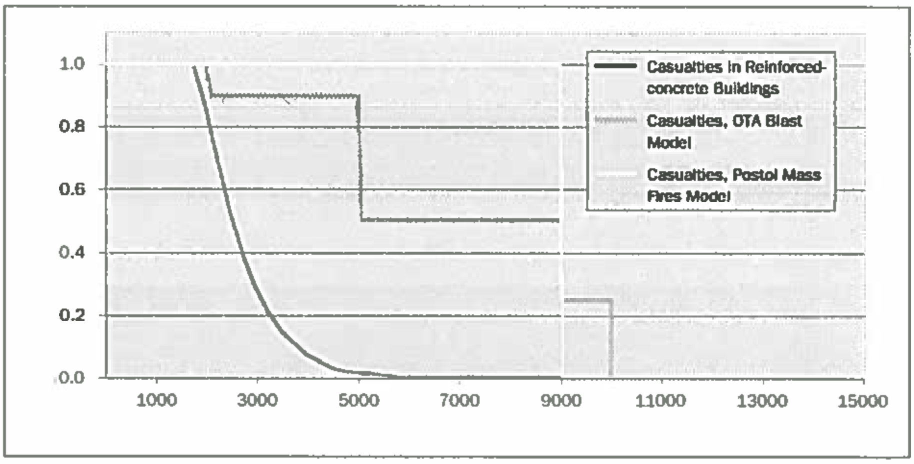
FIGURE 5.3
A Map Showing the 150 Aimpoints Throughout Russia for the Minuteman III Scenario



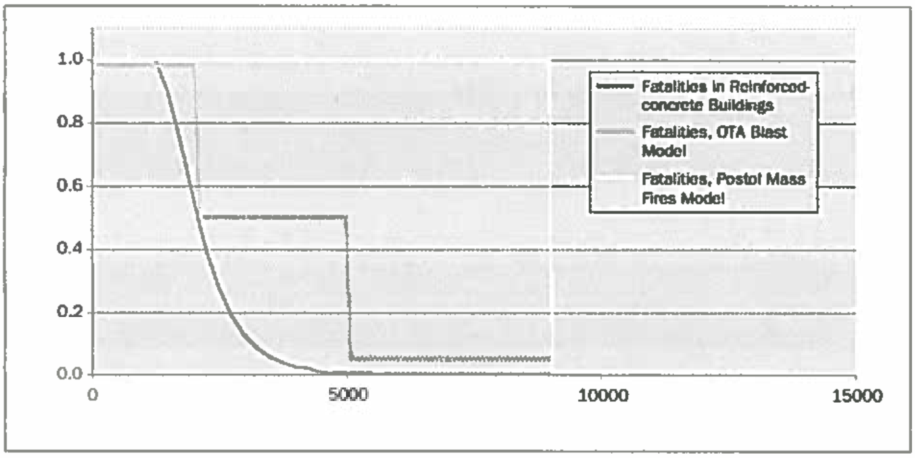
intended to hold Russia's urban citizens at risk.[14] For instance, the more populous western portion of Russia can be threatened by Trident SSBNs on patrol in the mid-Atlantic at points roughly north of New York City and east of Greenland. Minuteman III ICBMs can threaten all of Russia from their silos in the western United States. The conclusions of our exercise illustrate how few of these weapons we need for deterrence.

The First Countervalue Attack Scenario

Our first scenario involves an attack by the full complement of missiles aboard one Trident submarine. Currently, U.S. Trident SLBMs are deployed in three configura-

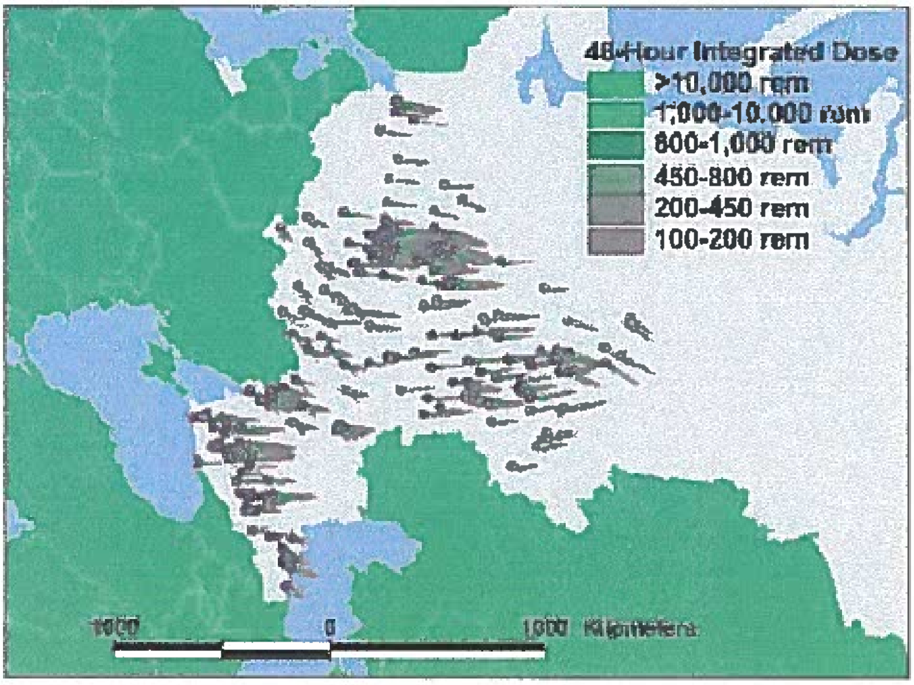


For a 475-kt W88 air burst (at 2 km height of burst) for three models: casualties in severely and moderately damaged; reinforced concrete buildings; casualties as would be predicted from the OTA blast model; and casualties as would be predicted from Postol's mass fires model.



For a 475-kt W88 air burst (at 2 km height of burst) for three models: fatalities in severely and moderately damaged; reinforced concrete buildings; fatalities as would be predicted from the OTA blast model; and fatalities as would be predicted from Postol's mass fires model.

tions: Trident I C-4 SLBMs armed with up to eight W76 (100-kiloton) warheads; Trident II D-5 SLBMs armed with up to eight W76 warheads; and Trident II SLBMs armed with up to eight W88 (475-kiloton) warheads. By 1990 or 1991, the United States had produced only about 400 W88 warheads. The government had planned initially to produce many more, but production was cut short when the government shut down several key nuclear weapons production plants, beginning with the Rocky Flats Plant in Colorado where plutonium pits were produced. The existing 400 warheads are enough for two Trident submarines with a full complement of 24, 8-warhead MIRVed SLBMs. Our scenario assumes one fully loaded SSBN carrying only W88 warheads, a plausible future deployment.

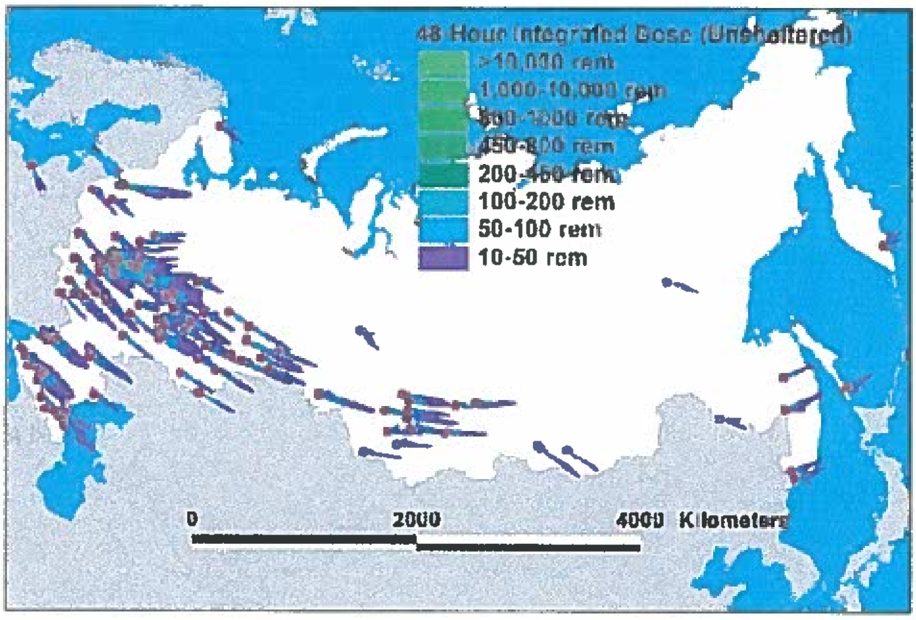


Second Countervalue Attack Scenario

In the second countervalue scenario, we show the results of an attack by the 150 single-warhead Minuteman III ICBMs based at Minot Air Force Base in North Dakota. Under START II all MIRVed ICBMs would be banned. The Air Force is replacing the propulsion and guidance systems for Minuteman III ICBMs so that they will last at least until 2020, at a total cost of $5 billion, including $1.9 billion for the new ICBM guidance system (the NS-50 guidance system).[15] At the same time, the three-warhead configuration for the Minuteman III, with W78 and W62 warheads, is scheduled to be replaced by a single-warhead configuration using the Peacekeeper (W87) warhead. Our scenario uses the Minuteman with the 300-kt W87 warhead, a plausible future strategic deployment.

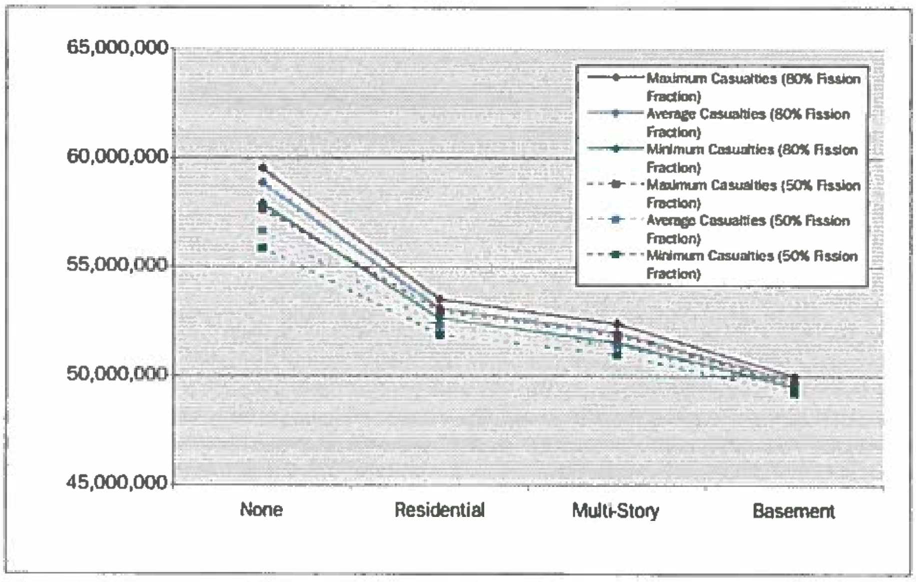
Damage radii are computed for W87 and W88 air bursts (at a height of burst of 1,800 meters and 2,000 meters, respectively), and W87 and W88 ground bursts.

Wood-Framed, Single Story and Multistory	08P0	4,703	3,243	5,438	3,780	06P0	5,866	3,777	6,736	4,405
1-2 Story, Masonry Load-Bearing Walls	10P0	3,849	2,653	4,501	3,092	09P0	4,263	2,930	4,940	3,415
Adobe Walls	11P0	3,376	2,407	4,020	2,805	09P0	4,263	2,930	4,940	3,415
3-5 Story, Masonry Load-Bearing Walls	11P0	3,376	2,407	4,020	2,805	10P0	3,849	2,653	4,501	3,092
Single Story, Very Light Reinforced Concrete Framed	12Q7	3,577	2,686	4,296	3,201	10Q7	4,728	3,361	5,599	4,008
Multistory Monumental (up to 4 stories), Masonry Load-Bearing Walls	12P1	3,022	2,260	3,679	2,643	10P0	3,849	2,653	4,501	3,092
Multistory, Reinforced Concrete Framed (2–10 Stories)	16Q7	1,654	1,762	2,146	2,096	14Q7	2,426	2,051	3,001	2,442
Multistory, Steel Framed (2–10 Stories)	18Q7	923	1,454	1,279	1,727	14Q7	2,560	2,164	3,166	2,576
Multistory, Reinforced Concrete, Earthquake Resistant (2–10 stories)	18Q7	923	1,454	1,279	1,727	16Q7	1,654	1,762	2,146	2,096
Multistory, Steel Framed, Earthquake Resistant	20Q8	521	1,265	786	1,510	17Q8	1,434	1,671	1,924	2,000



We used the LandScan population distribution to determine the choice of 192 aimpoints for W88 warheads and 150 aimpoints for W87 warheads in order to produce near maximal casualties. We achieved this by summing the population in a four-kilometer-radius neighborhood around each LandScan cell, rank ordering the sums, and selecting as aimpoints cells with the largest summed population but separated by eight kilometers.

Figure 5.2 shows the aimpoints for the Trident submarine calculation and buffered distances illustrative of the Trident on-station patrol areas. Figure 5.3 shows the aimpoints for the Minuteman III scenario. The aimpoints for the Trident scenario



One- and Two-Story Brick Homes (High-Explosive Data from England)	Severe	25	20	10
	Moderate	<5	10	5
	Light	0	<5	<5
Reinforced-concrete Buildings (Nuclear Data from Japan)	Severe	100	0	0
	Moderate	10	15	20
	Light	<5	<5	15

were calculated for European Russia only, assuming an Atlantic Ocean patrol. The aimpoints for the Minuteman scenario were selected throughout all of Russia.

Since the warheads in the Trident scenario are MIRVed, the eight warheads from a single SLBM are constrained to attack targets within an area known as the missile's "footprint." The size and shape of the footprint are determined by several factors, including the amount of fuel in the RV bus used to achieve distinct final trajectories for the MIRVed warheads. We do not know the size and shape of the Trident footprints, but plausibly assume that the Trident scenario aimpoints for warheads from a single missile must not be separated by more than 200 kilometers. The choice of population aimpoints for the Trident scenario is "less optimal" than the Minuteman III scenario due to the constraint posed by the MIRV footprint. A large but geographically isolated city (Kaliningrad or Murmansk, for example) would not be targeted under the Trident scenario because doing so would "inefficiently" allocate all eight warheads to the vicinity of the city.

Damage to Structures

Vulnerability Numbers for various building types are given in Table 5.4, along with the severe and moderate damage radii for W87 and W88 air bursts (at a height of burst of 1,800 meters and 2,000 meters, respectively), and W87 and W88 ground bursts. These calculations show that wood-framed houses can be severely damaged over large areas from a single W87 air burst (69 km^2) or W88 air burst (143 km^2). As would be expected, the severe damage radii for the more sturdy structure types are appreciably smaller.

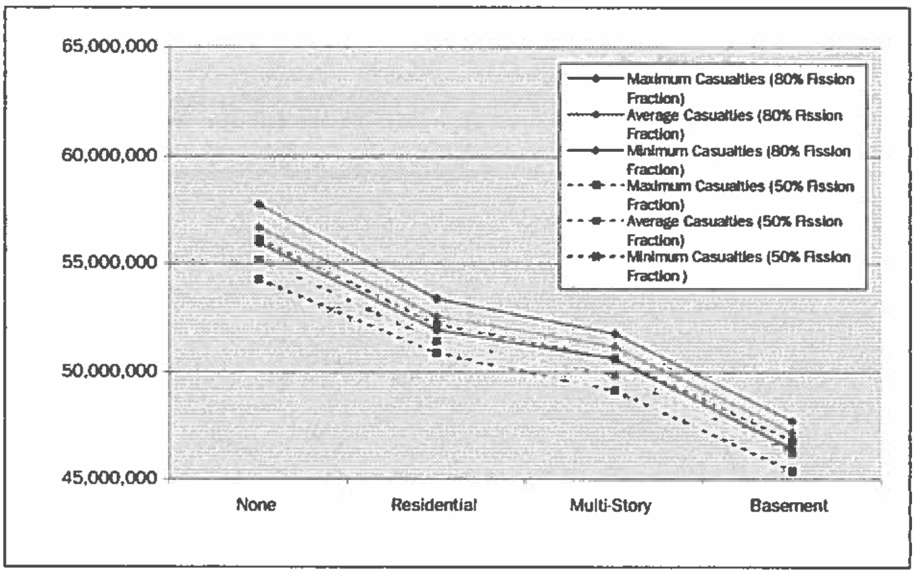
Table 5.4 lists the building types in order of decreasing vulnerability to nuclear weapons effect. For the first six building types listed in Table 5.4, air bursts will severely damage such structures over about twice the area of ground bursts. But for the last three structure types, lowering the height of burst to ground level actually increases the total area over which such buildings can be severely damaged. Unlike ground bursts, air bursts may produce no local fallout. USSTRATCOM may seek to limit local fallout in the attack for a variety of reasons, including concern over long-term contamination of the environment within or beyond Russia's borders. But if

Trident, Air Bursts	23,948	17,596	50,671	34,946	54,281
MM III, Air Bursts	14,321	9,373	51,225	31,544	56,247

U.S. intelligence data indicates that Russian cities are comprised predominantly of the more sturdy structure types, ground bursts may be selected in order to maximize the damage and the casualties. For these two scenarios, we compared the results for air bursts and ground bursts.

Casualties

To calculate casualties from these bursts, we used data on the estimated casualty production in buildings for three degrees of structural damage from the World War II bombing of Britain and the nuclear bombing of Japan (see Table 5.5). A highly conservative calculation of the casualties from an attack on Russian cities could assume that the population would reside in reinforced concrete buildings at the time of the attack. Casualties as a function of distance from ground zero would then be computed by combining the damage-distance function derived from the vulnerability number (Table 5.4) with the casualty production estimate (Table 5.5). Figure 5.4 shows casualties as a function of distance from ground zero for a 475-kt W88 air burst (at 2 km height of burst) for: casualties in severely and moderately damaged, reinforced concrete buildings; casualties as would be predicted from the OTA blast model (see Chapter

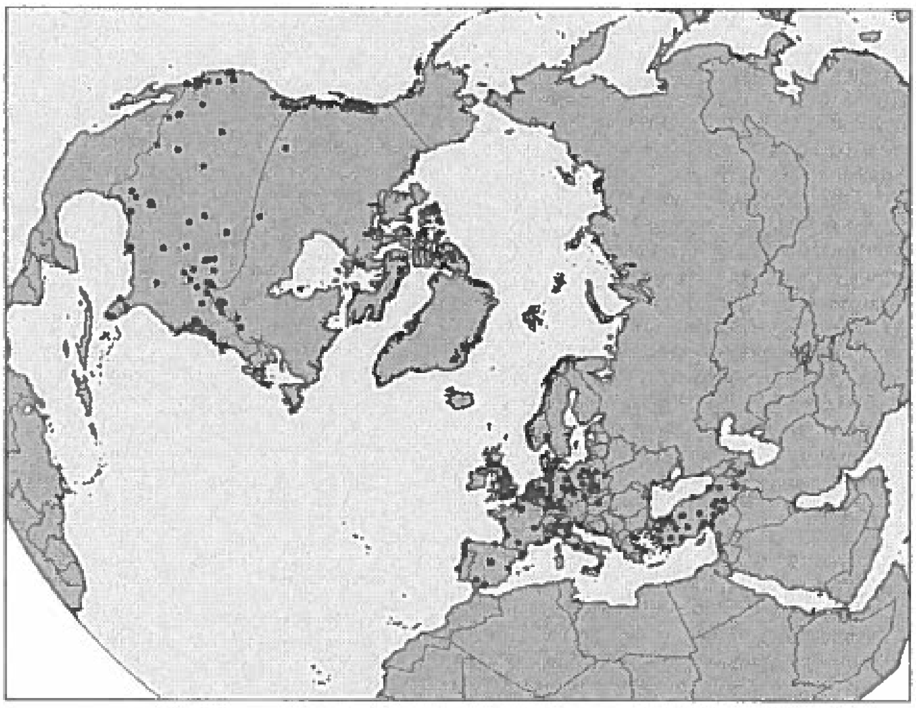


Three), and casualties as would be predicted from Postol's mass fires model (also see Chapter Three). Figure 5.5 shows the analogous plot for fatalities. For air bursts, casualties and fatalities range from 31 million to 56 million (see Table 5.6). If ground bursts were selected in the attack on Russian cities, the lethality of the extensive fall-out patterns obscures the differences between these models of how casualties occur.

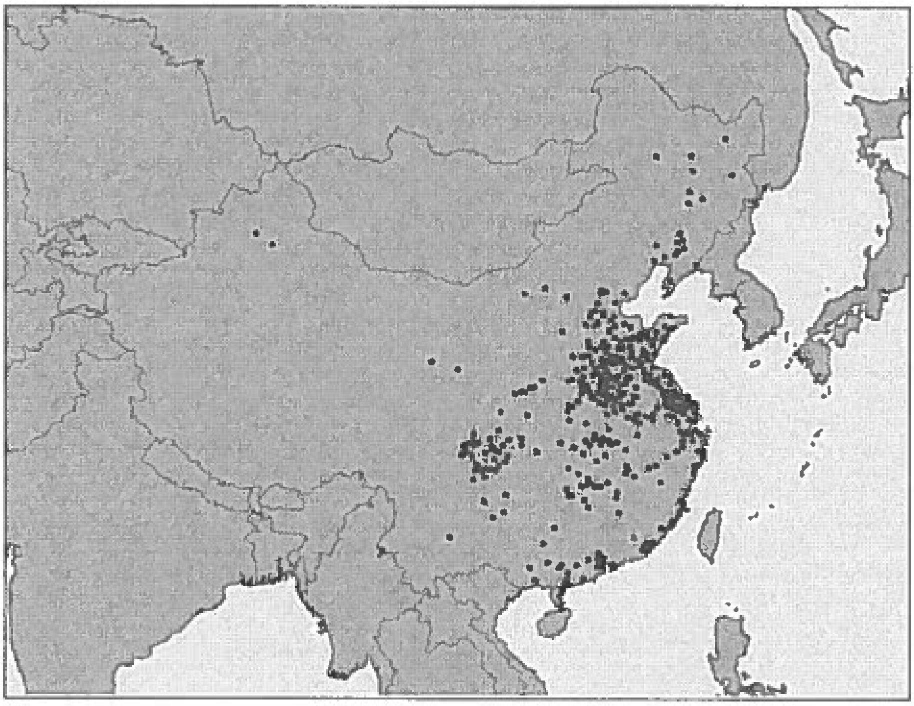
Both the OTA-Blast model and the mass fires model predict that over one-third of all Russians could be killed or severely injured by what is a small fraction of today's arsenal (see Table 5.6 and Figures 5.6 through 5.9). By choosing ground bursts rather than air bursts, casualties would approach 60 million people. This "assured destruction" would occur using only either one Trident submarine (fully-laden with W88 warheads) or one field of 150 Minuteman III warheads.

The calculations presented above, which utilize Russian population figures for 1999, demonstrate that relatively few Trident-delivered or Minuteman III-delivered nuclear warheads would inflict enormous casualties in what is termed a counter-value attack against Russian cities, probably far more casualties than are usually thought. We now extrapolate the results of this exercise to determine what fraction of the population of the United States, China, Great Britain, or France, for example, can be threatened by such small numbers of high-yield nuclear weapons. If, as McNamara posited, deterrence comes from the threat of destroying 25 percent of an enemy's population, these calculations demonstrate how few weapons are required

United States	258,833,000	64,708,250	124
Canada	28,402,320	7,100,580	11
United Kingdom	56,420,180	14,105,045	19
France	57,757,060	14,439,265	25
Germany	81,436,300	20,359,075	33
Italy	57,908,880	14,477,220	21
Spain	39,267,780	9,816,945	20
All NATO Member Countries[17]	754,933,329	188,730,000	300
Russia	151,827,600	37,956,300	51
China	1,281,008,318	320,252,079	368
North Korea	22,034,990	5,508,747	4
Iran	64,193,450	16,048,363	10
Iraq	20,941,720	5,235,430	4
Syria	14,045,470	3,511,368	2
Libya	5,245,515	1,311,329	2



The 300 population targets for all NATO member countries (threatening 189 million persons) shown above, and the 368 population targets in China (threatening 320 million persons) shown below. Today hundreds of high-yield nuclear weapons can threaten hundreds of millions of people in densly-populated urban areas.



to deter nations from initiating nuclear attacks. Alternatively, these calculations show the vulnerability of modern societies to thermonuclear arsenals of a size far smaller than those currently deployed by the United States and Russia.

To perform these calculations, population was summed within circles of radius nine kilometers centered on each LandScan population grid cell. For the countries shown in Table 5.7, LandScan cells with the largest nearby population were selected as aimpoints under the constraint that the aimpoints be separated by 18 kilometers (i.e., under the constraint that the nine-kilometer circles are not overlapping). As we have seen in Figures 5.4 and 5.5, nine kilometers is the radius inside which mass fires from 475-kt (W88) air bursts would be anticipated in urban areas using the model of Dr. Postol. Based on our analysis, Table 5.7 shows the numbers of high-yield weapons required to achieve McNamara's "assured destruction" criteria of 25 percent of the population killed. Figure 5.10 contrasts the 300 "assured destruction" aimpoints for all NATO member countries with the 368 such aimpoints in China. What is remarkable about these results is that very few high-yield nuclear weapons can threaten one quarter of the population of the United States, its allies or, under SIOP targeting, its enemies.