

Chapter 5

A Nuclear Defense Policy for Israel, Without Shelters

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Background

The intensive and wide ranging coverage of the Iranian effort to obtain a nuclear capability and the possibility that diplomatic efforts will not achieve success demand discussion of Israel's strategic approach to the nuclear threat.

Dealing with a nuclear threat incorporates four levels of response: deterrence, prevention, mitigation, and recovery. Discussion of mitigation necessarily addresses the issue of passive defense of the home front in general and the need for nuclear bomb shelters in particular. There have been discussions of this topic in the past in countries that were under nuclear threat. In the United States a decision was made not to construct shelters. Switzerland, despite not being under direct threat, prepared shelters for the entire population.

Constructing shelters for Israel's civilian population is not a new idea. Protective facilities for civilians have been built in Israel over the years (e.g., shelters, protective spaces, security rooms) based on different engineering specifications, ability to withstand damage by conventional weapons, and with suitable sealing specifications to protect against chemical and biological weapons. To date, public discussion about nuclear shelters has been negligible. A number of years ago the head of the protective defense department in the Home Front Command considered Israel's technical ability to construct shelters as if it were only a matter of making the right decision and allocating the necessary resources.

This paper addresses the issue of Israel's building shelters to protect civilians against a nuclear attack. It reviews the possible levels of contending

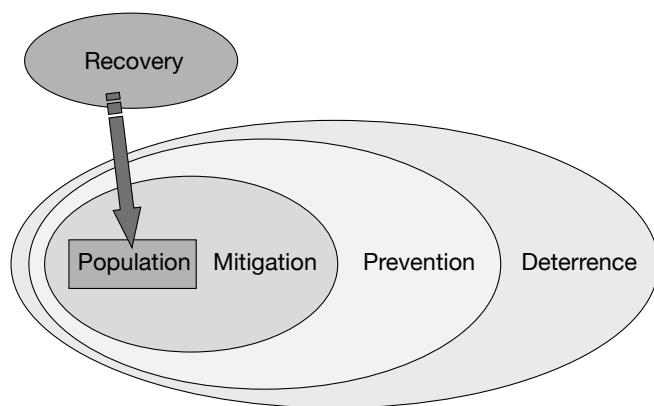


Figure 1. Layers of Response to the Threat

with the nuclear threat, surveys the approaches of selected countries to dealing with the threat, and analyzes the value of investing in shelters. The answer to the question of whether Israel should build shelters suitable for withstanding a nuclear attack depends on an analysis of the national implications of the results of such an attack. And in fact, from a national perspective, it is not correct to invest in nuclear shelters, and Israel should focus on other aspects of the response.

Layers of the Response to the Threat

The Iranian nuclear threat to Israel comprises a wide spectrum of possibilities, from a daylight strike on Israel using powerful nuclear weaponry, to an attack on Tel Aviv using a sole warhead when the civilian population has received ample warning and is suitably protected, to the use of nuclear arms as deterrence only.

Deterrence, prevention, mitigation, and recovery are levels of response vis-à-vis the Iranian nuclear threat, with each level offering several possible measures (figure 1). Israel can adopt different measures at the various levels, though not all of the steps merit development and investment of resources.

Deterrence involves ongoing, multidimensional activity and encompasses a large number of varied areas (political, military-strategic, economic, and so on), designed to deter enemies from taking action against Israel. Deterrence theory was developed during the Cold War by superpower strategists facing the nuclear escalation, and “the balance of

terror” formulated to underlie it deterred the superpowers from using such weapons against each other. Would this strategy also work when smaller nations are in a situation of conflict?

The 1999 Kargil crisis between India and Pakistan over the Kashmir region is an example of how nuclear deterrence can influence a conflict. An analysis of the case¹ shows that deterrence has limited the conflict and prevented it from escalating into a war.

Today, Israel employs a policy of ambiguity with regard to its nuclear capability, which thus far is adequate for providing a deterrent.² It is possible that if Iran achieves a nuclear capability, Israel’s policy will have to change, for example to an open declaration of its nuclear capability and the subsequent generation of a balance of fear, just as emerged between the superpowers, followed by a development of second strike ability, and so on.

Prevention refers to active measures executed in order to prevent an attack with nuclear weapons. These measures should be employed while complementing the deterrence component. Measures that can be taken on this level include:

- Taking action when the weapons are in the development stage. There are two possibilities here: the first is “sitting tight,” which will ultimately result in Iran’s achievement of a nuclear capability. In such a case, as between the superpowers during the Cold War, deterrence will play a crucial role in Israel’s strategy. The second option is action to prevent development, that is, action on the diplomatic level or offensive action to prevent the achievement of a nuclear capability (such as in the attack on the Iraqi nuclear reactor).
- Action after the weapons have been produced but have yet to be launched, namely, offensive action designed to impede the launch of the weapons.
- Action to prevent damage after the weapons have been launched, i.e., interception systems to prevent the weapons striking Israel once launched. Israel has developed capabilities on this level, including a missile interception system (the Arrow system).

Mitigation encompasses the framework of passive measures designed to limit the damage once the explosion occurs. The defense means against a nuclear threat on this level include: evacuation of the civilian population,

shelters (against shock waves or nuclear fallout, be they fixed or temporary shelters), dispersion or reinforcement of industrial facilities, and economic assets. Clearly, it is not practical to evacuate the population or to disperse and reinforce industrial facilities in dealing with a nuclear threat. Likewise and in a similar vein, shelters for the civilian population are not an appropriate solution for the nuclear threat.

Recovery: the damage that a nuclear attack will inflict on the fabric of life vis-à-vis its social, financial, and personal dimensions is incomprehensible. It is also not clear whether it would be possible to undertake a process of recovery and restore normal life. Certainly recovery would take a long time – many years – during which extensive physical recovery work would be carried out, and which would include cleansing wide areas of radioactive fallout, enormous investment in financial infrastructures, and considerable investment in health resources. It is clear to all that for now, there is no possibility of Israel's investing resources in this level of deployment.

Measures Taken by Other Countries

Various countries have emphasized different aspects of the response to the nuclear threat. The United States adopted the offensive approach; in other words, it focused on the deterrence layer and did not invest in building shelters for the civilian population. Switzerland, on the other hand, took a defensive approach and focused on the mitigation layer and, as such, invested in the construction and maintenance of shelters.

United States

The main area of American activity was in the development of its offensive ability for the purpose of bolstering deterrence. The US increased the number of its nuclear warheads, increased their power (megaton hydrogen bombs), and developed a second strike capability (primarily by developing a fleet of nuclear submarines).

An overall analysis of the required balance between the various dimensions of the American strategy was submitted to President Eisenhower in the Gaither report.⁴ The report determined primarily that the best way to protect the American nation was to maintain and guarantee an effective response capability.

The United States also attempted to address the prevention layer. During the Cold War the Americans tried to develop and deploy missile interception systems, even though some American strategists thought such systems were actually detrimental to deterrence. This effort ended with the ABM treaty, which allowed each side to deploy only two anti-missile systems. In practice, the Americans deployed only one system, which was shut down after a few years. A “Star Wars” concept developed during the Reagan presidency years and attracted considerable resources, although no weapon systems were deployed. The US currently does not have any national missile interception systems, primarily because of the heavy costs involved.

The main components of passive defense examined by the United States in the process of attempting to formulate American nuclear strategy were: population evacuation; shelters (against shock waves or radioactive fallout, permanent or temporary shelters);³ and dispersal and reinforcement of industrial facilities. In order to implement these measures, warning systems, civilian communications systems, damage control systems, and other such systems must also be provided.

The main issues raised in American strategic discussions on the subject of passive protection of the civilian population in general and on shelters for the civilian population in particular were:

- The right way to protect American civilians: are shelters an appropriate means?
- Can passive means of protection be developed at all that would be effective and significantly reduce the number of casualties and the extent of damage to the country in a nuclear attack?
- Can large numbers of civilians be transferred to the shelters in real time?
- How would life be conducted during prolonged stays in the shelters?

It is significant that with all the investments by the US and other countries in various military technologies, the technology of shelter construction has not changed meaningfully since World War II. Several features are needed to withstand a nuclear threat: thick concrete walls, deep excavation, and a filtering and ventilating system, and even then the occupants’ survival is not guaranteed if the strike is close to the shelter.

In accordance with the strategy that was eventually adopted, investment in civilian protection in the US was very limited and was conducted according to the intensity of the threat on the country. In this regard three budgetary outlay peaks can be noted in the area of civilian protection, all very small in comparison to other defense expenditures:⁵

- During the Korean War in the early 1950s, when the annual outlay peaked at about \$150 million.
- With the launch of the first Soviet satellite (Sputnik) in 1957, when the annual outlay peaked at about \$190 million.
- The Cuban missile crisis in 1963, when the annual outlay peaked at about \$475 million.

The US policy was ultimately based on deterrence. Means of protection such as anti-missile systems, shelters, and other measures were considered to be elements that upset the balance of power. Congress consistently opposed proposals by various administrations to invest in civilian protection measures due to the high cost and the low level of benefit expected from such investment.

During President Bush's term of office, there was a new interest in developing and deploying missile interception systems against limited threats inflicted by "rogue states" such as North Korea and Iran, as a supplement measure of deterrence. However, there is no intention of developing a national widely deployed missile defense system.

Switzerland

Switzerland opted to build up its military strength based on its defense capability. The Swiss strategic concept focuses on demanding a high price from a potential attacker, which places a question mark over the value of attacking Switzerland. This capability comprises several strata: maximizing the cost a potential attacker will pay if it decides to launch an offensive; limiting the rewards to be gained by a potential attacker; limiting the loss incurred by a potential attacker if it does not attack; maximizing the rewards gained by a potential attacker if it does not attack; and limiting the damage suffered by Switzerland and its population if an attack does take place.⁶

In order to realize the latter objective it was decided that every citizen should have a chance to survive violence that might be leveled against

Switzerland. One of the means of implementing this defense concept was the construction of an extensive system of shelters for the civilian population, whereby the shelters are also designed to provide protection against weapons of mass destruction (nuclear, biological, and chemical weapons). This approach did not substantially change even after the fall of the Soviet Union and the Eastern bloc. Some changes, however, were introduced:⁷

- Redefining the balance of threats to Switzerland – the low probability of conflict between countries compared with the increase in the threat of terror or the threat of natural disasters, such as earthquakes and snow avalanches.
- Financial adjustment – the national component in building new shelters decreased and outlay by the individual on shelters increased.

In 1979, around 80 percent of the population⁸ had ventilated shelters, while the rest had standard shelters. 1974 was a peak year in terms of national spending on civilian defense – about 750 million Swiss francs (about \$300 million). As of 1981 the residents themselves assumed responsibility for the outlay on construction of shelters, whereby those who do not build shelters in their homes pay a shelter charge designated for the extension and maintenance of public shelters. Public outlay on shelters (construction and maintaining existing shelters) in 1998 was 22 million Swiss francs (about \$15 million) per annum.

Value of Investment in Nuclear Shelters in Israel

The relative value of investing in nuclear shelters in Israel comprises two dimensions: the benefits of the shelters and the cost of the system.

The Benefits Offered by a System of Nuclear Shelters

The need for passive means of protection – shelters and masks – for the Israeli population, and the extent of investment needed in such means, has been examined with regard to other conventional and non-conventional (chemical and biological) threats.⁹ The conclusion drawn was that it was possible to limit the number of casualties to an acceptable national level by relatively simple means. Thus, there was no benefit to be gained by increasing investment in such means.

Building nuclear shelters could seemingly be a relevant component in dealing with a nuclear threat if in national terms shelters limit the number of casualties to an acceptable level (without discussing here the issue of how many casualties is considered acceptable).

It is clear that there is no need for shelters for scenarios where the chances of protecting the population in them are negligible. These scenarios include all surprise attack scenarios and scenarios in which the shelters are located in remote places and the population must be evacuated and relocated there before the attack. A surprise attack on Tel Aviv on a regular weekday, for example, could cause 250,000 fatalities and 500,000 injuries – an estimation published in the press¹⁰ – but such a scenario clearly makes shelters irrelevant, as the population would not be able to access the shelters in time and protect itself. This scenario, however, where the population would not reach the shelters in time, is far more likely than other scenarios that give the population sufficient time to reach the shelters.

Scenarios where nuclear shelters may be relevant in dealing with a nuclear threat are those that represent a family of military conflicts that deteriorate to actual nuclear attacks, but not before the population has placed itself in nuclear shelters.

A scenario in which a singular bomb of several kilotons – the equivalent of the atom bombs dropped on Hiroshima and Nagasaki in 1945¹¹ – is dropped on Tel Aviv and its natural population (without the daily influx of workers and people visiting for leisure purposes) is the most suitable for the discussion of the feasibility of shelters protecting against a nuclear threat for the following reasons:

- If there is no benefit to be gained from investing in shelters for the civilian population against even a relatively small nuclear warhead, as featured in the scenario, there is certainly no benefit to shelters if the attack is more powerful.
- In such a scenario, one can easily compare the extent of damage to Tel Aviv and the damage inflicted on Hiroshima and Nagasaki.

Documents that analyze the results of the nuclear attack on Hiroshima and Nagasaki and experiments conducted by the Americans on such weapons allow assessment of the damage that would be inflicted by a nuclear bomb on Israel. The scale of damage that could be inflicted on Tel Aviv by a 20 kiloton nuclear bomb comprises:

*Shock wave damage to buildings:*¹²

- A large portion of buildings within a range of about 500 meters from the strike (an area of about 750,000 sq meters or about 180 acres) would be completely destroyed and severe damage would be inflicted on an additional distance of several hundred meters.
- Buildings 1,000-2,000 meters away from the strike location would suffer moderate to light damage.
- Severe damage would be caused to electricity, communications, water, and sewage infrastructures by the shock wave.

Fires: the immediate fireball radius, a result of thermal radiation released by the explosion, would be about 100-150 meters, followed by a firestorm spreading to far larger areas.

Casualties: the explosion would cause fatalities and injuries because of the shock wave, heat radiation, and ionization radiation. Table 1 indicates the expected number of casualties in Tel Aviv caused by a bomb of 20 kilotons (similar to the bomb dropped on Nagasaki) in accordance with the current engineering profile of shelter for the population of Tel Aviv. Again, the calculation is based¹³ on Tel Aviv's natural population and those of the surrounding cities, without considering the number of daily visits for work and other purposes.

Table 1. An Estimated Number of Casualties in a Nuclear Attack on Tel Aviv

Distance from strike (km)	No. of local residents* (thousands)	Population density* (residents/1,000 sq m)	Casualties**(thousands)		
			Dead	Severe injuries	Light injuries
0-1	53	15-16	20-30	6-9	5-8
1-2	55	8-9	8-16	6-10	10-12
2-4	255	6-7	2-3	9-18	15-30
Total	365	7	30-50	20-35	30-50

* 2005 Tel Aviv Statistics Yearbook

** Figures rounded off

For purposes of comparison, tables 2 and 3 present the number of casualties at Hiroshima and Nagasaki.¹⁴ Note that as these bombs exploded in the air about 500 meters above the ground, a relatively small number of casualties were due to ionization radiation following radioactive fallout.

Table 2. The Number of Casualties in the Nuclear Attack on Hiroshima

Distance from strike (km)	No. of local residents (thousands)	Population density (residents/1,000 sq m)	Casualties (thousands)	
			Fatalities	Injuries
0-1	31,200	10-11	26,700	3,000
1-2.5	144,800	8-9	39,600	53,000
2.5-5	80,300	1-2	1,700	20,000
Total	256,300	3-4	68,000	76,000

Table 3. The Number of Casualties in the Nuclear Attack on Nagasaki

Distance from Strike (km)	No. of local residents (thousands)	Population density (residents/1,000 sq m)	Casualties (thousands)	
			Fatalities	Injuries
0-1	30,900	10-11	27,300	1,900
1-2.5	27,700	1-2	9,500	8,100
2.5-5	115,200	about 2	1,300	11,000
Total	173,800	2-3	38,000	21,000

Other Effects: A nuclear explosion generates electromagnetic radiation with special properties (EMP – electromagnetic pulse), which causes damage to the electronic components of various instruments, thereby causing them to malfunction. The significance of the expected damage to electronic components is:

- Damage to computers and cellular telephones, which will cause extensive functional breakdown in information systems and communications systems within the range of the EMP effect.
- Damage to transistors operating on batteries would likely be limited, though radio transmitters are expected to be damaged. As a result, a considerable decline in the ability to forward messages to residents is expected.
- Damage to the electricity supply will interfere with the operation of electrical devices – TV, radio, internet, and so on – and will affect the ability to transmit messages to the public.

This assessment of damages must be followed by an assessment of the possible benefit of shelters. The more reinforced the construction and the more circumscribed the structural damage, the more the number of

casualties is expected to be limited, as indicated by table 4, which shows the severity of the casualties at Hiroshima and Nagasaki based on the extent of damage to the structures in which they were located during the attack.¹⁵ The table is based on statistics of 1,600 people who were located in reinforced concrete structures at a distance of up to 1,000 meters from the strike.

Table 4. Severity of Casualties at Hiroshima and Nagasaki from Structural Damage

Damage to building	Severity of injury based on damage to buildings			
	Fatalities	Severely injured	Lightly injured	Uninjured
Severe damage	88%	11%	-	1%
Medium damage	14%	18%	21%	47%
Light damage	8%	14%	27%	51%

Shelters for the civilian population would reduce the expected number of casualties in Tel Aviv. The question is how efficient the shelters would be and by how much they would lower the number of casualties. If shelters are built to accommodate all of Tel Aviv's natural population and are suitably reinforced, the number of casualties among civilians located in the shelters could be significantly reduced. Table 5 includes an estimate of the casualties in Tel Aviv if the residents took cover in shelters.

Table 5. Estimated Number of Casualties in Tel Aviv with Residents in Shelters

Distance from strike (km.)	No. of local residents* (thousands)	Population density* (residents/1,000 sq m)	Casualties** (thousands)		
			Dead	Severe injuries	Light injuries
0-1	53	15-16	5-10	1-2	2-3
1-2	55	8-9	3-4	3-4	8-9
2-4	255	6-7	1-2	5-6	10-15
Total	365	7	7-14	9-12	20-27

* 2005 Tel Aviv Statistics Yearbook

** Figures rounded off

In this scenario shelters are expected to reduce the number of fatalities from about 30,000-50,000 to around 7,000-14,000, and the number of wounded from 50,000-85,000 to 30,000-40,000. In other words, protection would reduce the expected number of fatalities fourfold and the total number of wounded (severe to light injuries) twofold. The shelters as a hypothetical solution for the scenario analyzed here achieve an impressive reduction in the number of casualties. However, even with such protection the number of casualties in such an attack would be on a level and intensity hitherto unknown. The number of fatalities is similar to the number expected from a powerful earthquake that Israel is prepared for. In scenarios in which the attack originates from a number of nuclear facilities or more powerful nuclear warheads, the severity of the disaster would be greater.

Cost of Constructing Nuclear Shelters

The scope of national investment in shelters in Israel in order to achieve this reduction in the number of casualties renders the plan impractical. A quick calculation of the cost of construction alone of the shelters – without necessary routine annual maintenance – shows that Israel would have to invest at least NIS 50-100 billion in the project,¹⁶ up to twice the Ministry of Defense annual budget. Even a world power like the United States was not able during the Cold War to meet the costs of passive defense of its population.

Analysis of the Implications

This discussion has focused on the value of constructing nuclear shelters for the civilian population and has indicated the lack of inherent value, both in terms of the cost – an impossible outlay – and in terms of the benefit, as even when the population is protected, the damage caused by a nuclear attack would be a national disaster, and should be regarded as unacceptable.

Analysis of implications would not be complete without relating to the problem in a wider sense. While vis-à-vis the threats to which Israel has been exposed thus far – conventional, chemical, and biological – the mitigation level could have been maintained as part of contending with the threats, examination of the nuclear threat clearly indicates that the

mitigation component is not a sustainable element, and Israel has to prevent the actual attack.

In conclusion, in a nuclear confrontation between powers, deterrence is the main component of the adopted strategy. Shelters for the population of a country under threat were never a practical option. Thus investing in nuclear shelters for the population is not a viable economic option, and should not comprise a component of the basket of measures worthwhile investing in to deal with a nuclear threat. Since, therefore, the mitigation component is not a realistic element in terms of nuclear threat, deterrence and prevention are the only practical ways of dealing with a nuclear threat against Israel.

Notes

- 1 Micha Bar, "The Effect of Nuclear Deterrence on Military Options: The Kargil Crisis," *Ma'arachot* 414 (September 2007).
- 2 According to foreign sources, Israel possesses a nuclear capacity.
- 3 F. K. Berrien, Carol Schulman, Marianne Amarel, "The Fallout Shelter Owners: A Study of Attitude Formation," *Public Opinion Quarterly* 27, no. 2 (1962).
- 4 The Gaither report was submitted to President Eisenhower in 1957. See further reference in David Alan Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960," *International Security* 7, no. 4 (1983).
- 5 William H. Kincade, "Repeating History: The Civil Defense Debate Renewed," *International Security* 2, no. 3 (1978).
- 6 Dietrich Fischer, "Invulnerability without Threat: The Swiss Concept of National Defense," *Journal of Peace Research* 19, no 3 (1982).
- 7 *Swiss Civil Protection Concept: Report of the Federal Council to the Federal Assembly Concerning the New Civil Protection Concept*, October 2001.
- 8 The population of Switzerland is around 7.5 million.
- 9 David Klein, *Home Front Defense: An Examination of the National Cost*, Memorandum no. 58, Tel Aviv: Jaffee Center for Strategic Studies, 2001. See also David Klein, "Israel's Home Front Defense Policy," in Shai Feldman (ed.), *After the War in Iraq: Defining the New Strategic Balance* (Brighton: Sussex Academy Press and Jaffee Center for Strategic Studies, 2003), chapter 14.
- 10 Reuven Pedatzur and Yaakov Yatzah: "250,000 Dead; Half a Million Wounded," *Haaretz*, April 4, 2007.
- 11 The bomb dropped on Hiroshima was about 12 kilotons, and the bomb dropped on Nagasaki was about 22 kilotons.
- 12 Samuel Glasstone and Philip J. Dolan, *The Effects of Nuclear Weapons* (prepared and published by the United States Department of Defense and Energy Research and Development Administration, 3rd edition, 1977), Figure 5.140: Damage-Distance relationships for above ground structures. Severe damage to structures means a building that is destroyed or requires overall repair (generally demolition

and rebuilding). Moderate damage means damage that requires fundamental repairs before the building is usable. Mild damage means broken windows, damage to the facade, and other damages that require limited repairs.

- 13 Glasstone and Dolan, *The Effects of Nuclear Weapons*, chapter 12.
- 14 Glasstone and Dolan, *The Effects of Nuclear Weapons*, chapter 12.
- 15 Glasstone and Dolan, *The Effects of Nuclear Weapons*, Table 12.21. Casualties in reinforced-concrete buildings in Japan related to structural damage.
- 16 For an extended stay in a shelter, each occupant needs an area of at least 1-1.5 sq m (taking into account sleeping areas and a public area); 7 million residents have to be housed in shelters; the cost of constructing 1 sq m of an underground shelter is NIS 5,000-10,000. Total cost: NIS 50-100 billion.