

PART ONE
*Assessments and
Weapons*



PREVIOUS PAGE: *The XX-39 CLIMAX, part of Operation Upshot/Knothole, was a 61 kiloton device fired June 4, 1953, at the Nevada Test Site.* (US DEPARTMENT OF ENERGY. ONLINE AT www.nv.doe.gov/news&pubs)

Global Trends

The proliferation of weapons of mass destruction (WMD) is widely recognized as the most serious threat to the national security of the United States and other nations. Official and public attention to proliferation issues, however, has varied over the decades from near-hysteria to apathy. At the beginning of 2002 there seemed to be a balanced appreciation of the urgency of new efforts to prevent proliferation, deter use, and, if necessary, respond to the consequences of attacks involving nuclear, biological, or chemical weapons.

To sustain a balanced policy three aspects to the proliferation problem should be kept in mind: first, the current global situation is dangerous; second, it could have been much worse; and third, the right government policies could make the situation much better.

Weapons of mass destruction are twentieth-century inventions. There is nothing new, of course, about mass destruction. From ancient times a military campaign often meant the slaughter of tens of thousands of soldiers and civilians. As the industrial revolution mechanized warfare, the industrialized nations sought ways to kill more efficiently armored troops or unprotected populations dispersed over wide areas and to annihilate military and economic targets. Military researchers produced weapons that could deliver poison gas, germs, and nuclear explosions with artillery, aerial bombs, and, later, missiles.

Both the Central Powers and the Allies used poison gas for the first time in World War I. Japan inaugurated biological warfare in its attacks against the Chinese at the beginning of World War II, but all the belligerent nations had biological weapon research programs, and Germany used poison gas to kill millions of Jews and other prisoners in its concentration camps. At the end of that war, nuclear weapons were used for the first and last time when the United States struck Japanese cities. Global arsenals peaked during the Cold War decades of the 1960s, 1970s, and early 1980s, when both the NATO nations and the Warsaw Pact perfected and produced tens of thousands of chemical, biological, and nuclear weapons.

Since then, the absolute numbers of these weapons have decreased dramatically. Even before the end of the Cold War the United States and the Soviet Union, with the vast majority of global holdings, agreed to reduce their nuclear arsenals and to eliminate all their chemical and biological weapons. As the threat of global thermonuclear war receded, officials and experts agreed that the propagation of those weapons to other nations posed the most serious remaining threat. In January 1992, for example, the member states of the U.N. Security Council declared that the spread of weapons of mass destruction constituted a

“threat to international peace and security.” In 1998, the Defense Intelligence Agency (DIA) concluded bluntly in its annual threat assessment, “The proliferation of nuclear, chemical, and biological weapons, missiles, and other key technologies remains the greatest direct threat to U.S. interests world-wide.” President George W. Bush, in early 2001, said, “The grave threat from nuclear, biological, and chemical weapons has not gone away with the Cold War. It has evolved into many separate threats, some of them harder to see and harder to answer.”¹

There are two related proliferation risks today: that more nations will acquire these weapons and that subnational or terrorist groups might acquire or use them. For years, policy makers focused on the first risk, most recently involving the suspected programs of a few “rogue states.” After September 11, 2001, the terrorist use of weapons of mass destruction seems the more urgent danger, but tension in South Asia reminds us that the acquisition of those weapons, even by established nations, dares catastrophe.

This chapter provides a brief overview of global proliferation threats, describes mass destruction weapons and the nations that have or wish to have them, and the proliferation prospects for the next few years. The national arsenals are the most likely (and for nuclear weapons, the only practical) source for terrorist groups intent on acquiring weapons of mass destruction. Chapter 2 details the major elements of the non-proliferation regime, including the international network of treaties and agreements constructed over the past fifty years to prevent and reduce proliferation. Chapters 3, 4, and 5 describe in greater detail the characteristics of weapons of mass destruction and the specific national programs that exist or that may evolve. Chapters 6 through 22 review the history and status of the most significant national programs, including those countries that have given up nuclear and other weapons of mass destruction. Three of these chapters briefly describe the past and present programs of the United Kingdom, France, and the United States, not because these nations present direct proliferation risks, but to provide information on the recent changes in their policies and postures. The continued existence of large nuclear arsenals increases the perceived desirability of nuclear weapons and the likelihood that other nations will claim equivalent nuclear privileges.

Updates and expansion of the information in this volume, plus the latest developments, debates, and discussions are available on the web site of the Carnegie Endowment.

Proliferation Today

The nations of the world confront serious and immediate threats from the global presence of thousands of nuclear weapons and chemical weapons. They also face the possibility that some nation or group still has or soon could have biological weapons. A wide variety of delivery mechanisms for these weapons exists, including ballistic missiles, cruise missiles, aircraft, artillery, ships, trucks, and envelopes. There is also now a growing recognition of the added danger that terrorist organizations could kill thousands, not just with traditional mass destruc-

Table 1.1: **What Are Weapons of Mass Destruction?**

Nuclear Weapons
<p>A nuclear weapon is a device with explosive energy, most or all of which derives from fission or a combination of fission and fusion processes. Explosions from such devices cause catastrophic damage due both to the high temperatures and ground shocks produced by the initial blast and the lasting residual radiation.</p> <p>Nuclear fission weapons produce energy by splitting the nucleus of an atom, usually highly enriched uranium or plutonium, into two or more parts by bombarding it with neutrons. Each nucleus that is split releases energy as well as additional neutrons that bombard nearby nuclei and sustain a chain reaction. Fission bombs, such as those dropped on Hiroshima and Nagasaki, are the easiest to make, and they provide the catalyst for more complex thermonuclear explosions. In such weapons a fission explosion creates the high temperatures necessary to join light isotopes of hydrogen, usually deuterium and tritium, which similarly liberate energy and neutrons. Most modern nuclear weapons use a combination of the two processes, called boosting, to maintain high yields in smaller bombs.</p>
Biological Weapons
<p>Biological weapons intentionally disseminate infectious diseases and conditions that would otherwise appear only naturally or not at all. Such agents can be divided into bacteria (such as anthrax), viruses (such as smallpox), rickettsiae (such as Q fever), chlamydia, fungi, and toxins (such as ricin). The features that influence their potential for use as weapons include infectivity, virulence, toxicity, pathogenicity, the incubation period, transmissibility, lethality, and stability. The advent of genetic engineering has had a profound impact on the threat from biological weapons. Agents that are extremely harmful in nature can be modified to increase virulence, the production rate per cell, and survivability under environmental stress, as well as to mask their presence from immune-based detectors. Since most agents are living organisms, their natural replication after dissemination increases the potential impact of a strike, making such weapons even more attractive. Any country possessing a pharmaceutical or food storage infrastructure already has an inherent stabilization and storage system for biological agents. Aerosol delivery is optimal, while explosive delivery is also effective, but to a lesser extent owing to the possibility for organism inactivation because of heat from the blast.</p>
Chemical Weapons
<p>Chemical weapons use the toxic properties, as opposed to the explosive properties, of chemical substances to produce physical or physiological effects on an enemy. Classic chemical weapons, such as chlorine and phosgene, were employed during World War I and consisted primarily of commercial chemicals used as choking and blood agents, which caused respiratory damage and asphyxiation. The advent of such blistering agents as</p>
<p><i>(Table continues on the following page.)</i></p>

Table 1.1 (continued)

mustard gas and lewisite, which cause painful burns necessitating medical attention even in low doses, marked the first chemical weapons to produce a significant military effect. Mustard gas, because of its low cost and ability to produce resource-debilitating casualties, has been a popular weapon and was used to inflict numerous casualties during the Iran–Iraq War.

Nerve gases, or anti-cholinesterase agents, were discovered by the Germans in the 1930s and represent the beginning of modern chemical warfare. Such agents block an enzyme in the body that is essential for nervous system function, causing a loss of muscle control, respiratory failure, and eventually death. These gases, which are all liquids at room temperature, are lethal far more quickly and in far lower quantities than are classic agents and are effective both when inhaled and when absorbed through the skin. Nerve gases can be classified as either G-agents (sarin) or V-agents (VX), both of which are exceedingly volatile and toxic. Other types of chemical weapons include mental and physical incapacitants (such as BZ) and binary systems, both of which have undergone limited military development. Chemical weapons can be delivered through bombs, rockets, artillery shells, spray tanks, and missile warheads, which, in general, use an explosion to expel an internal agent laterally.

Radiological Weapons

Radiological weapons use conventional explosives such as dynamite and C-4 to disperse radioactive materials over large areas. The most common conception for their use is explosives surrounded by radioactive material in the form of pellets, powder, or even a radioactive gas. The area of dispersal would depend on the size of the explosion. Victims not injured in the explosion would receive life-threatening levels of radiation exposure. The radiation would inhibit or prevent emergency response teams from aiding the victims, and, depending on the size of the explosion, contaminate large areas for years pending expensive removal operations. Alternatively, a source of radioactive material, such as a nuclear reactor or spent-fuel storage depots, could be targeted with large explosive devices to disperse very high levels of radioactivity into the atmosphere and the surrounding area.

SOURCES

Federation of American Scientists. *Biological Weapons*. Available at www.fas.org/nuke/intro/bw/intro.htm.

Federation of American Scientists. *Chemical Weapons Introduction*. Available at www.fas.org/nuke/intro/cw/intro.htm.

U.S. Department of State. *Biological Weapons Convention*. Available at www.state.gov/www/global/arms/treaties/bwc1.html.

tion weapons, but by destroying or sabotaging critical urban and industrial infrastructures.

Nuclear Weapons

Nuclear weapons are the most deadly weapons ever invented. A single, compact nuclear weapon can instantly devastate a mid-sized city. Nuclear weapons are also the most difficult mass destruction weapons to manufacture or acquire. Today, only eight nations have such weapons. Five nuclear-weapon states are recognized by the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and enjoy special rights and privileges under international law. Listed in order of the size of their nuclear arsenals, they are: *Russia*, the *United States*, *China*, *France*, and the *United Kingdom*. This group acquired their arsenals during the twenty years after World War II and remained remarkably stable from 1964, when *China* tested its first nuclear weapon, until 1998, when *India* and *Pakistan* both detonated nuclear devices and declared their intention to deploy weapons. *India* and *Pakistan* have not yet openly deployed any weapons, but both are capable of configuring aircraft and missiles with tens of weapons over the next few years if they so desire. *Israel* is widely believed to have approximately 100 nuclear weapons but neither acknowledges nor denies their existence. *India*, *Pakistan*, and *Israel* are not parties to the NPT.

Apart from these eight countries, three others are known to be actively pursuing nuclear weapon programs. *North Korea* may have accumulated enough material to construct one or two weapons but agreed in 1994 to freeze and then transform its nuclear program away from military use. International inspectors destroyed most of *Iraq's* nuclear program after the Gulf War, though it has most likely restarted since *Iraq* blocked inspections in 1998. Finally, *Iran* is slowly but steadily pursuing an open civilian nuclear power program and is believed to be covertly developing expertise for nuclear weapons. All three are member states of the NPT and, as such, any nuclear weapon programs are illegal and, if proved, could subject the nations to additional sanctions or even military action through United Nations resolutions.

In the past twenty years, several major countries have abandoned nuclear programs, including *Argentina* and *Brazil*, and four others have relinquished their nuclear weapons to join the NPT as non-nuclear-weapon states. *Ukraine*, *Belarus*, and *Kazakhstan* gave up the thousands of nuclear weapons deployed on their territories when the Soviet Union dissolved. Over a period of two years, senior officials in both the Bush and Clinton administrations worked with great dedication to convince these non-Russian republics to renounce their deadly inheritance. Similarly, *South Africa*, on the eve of its transition to majority rule, destroyed the six nuclear weapons the apartheid regime had secretly constructed. President Nelson Mandela agreed with the decision, concluding that South Africa's security was better served in a nuclear-free Africa than in one with several nuclear nations, which is exactly the logic that inspired the original members of the NPT decades earlier. Africa is one of several areas of the world that have established nuclear-weapon-free zones, where the use or possession of

nuclear weapons is prohibited anywhere on the continent. *Libya* and (to a much lesser extent) *Algeria* have shown interest in nuclear weapons over the years but are not currently considered high-risk states.

Radiological weapons, although not as destructive as nuclear explosive weapons, also pose a serious danger, particularly as a terrorist threat. These are weapons that use conventional explosives, such as dynamite, to disperse radioactive materials, including the highly radioactive waste material from nuclear power reactors or other nonweapon sources. They may be attractive weapons for terrorists owing to the relative ease of their acquisition and use and mass disruption potential. A terrorist act involving the dispersal of radioactive materials would contaminate a wide area, making the treatment of casualties more difficult, exposing many people unhurt in the initial explosion to death and injury from radioactivity, and rendering large areas uninhabitable, pending sizable removal and cleansing operations.² As for chemical and biological agents, the invisible and uncertain danger from these weapons would cause widespread fear and horror.

Biological Weapons

Biological weapons, that is, weapons that intentionally use living organisms to kill, are second only to nuclear weapons in terms of their potential to cause mass casualties. Although instances of the deliberate spread of disease go back to the ancient Greeks and Assyrians, the efficient weaponization of biological agents did not occur until the twentieth century. With the exception of the Japanese attacks in China before and during World War II, these weapons have been little used in modern warfare. During the Cold War, the United States and the Soviet Union perfected biological weapons, each developing arsenals capable of destroying all

Table 1.2: World Nuclear Arsenals

Russia	20,000
United States	10,500
China	410
France	350
United Kingdom	185
Israel	60–100 suspected
India	10s possible
Pakistan	10s possible

Table 1.3: Countries Suspected of Developing Nuclear Weapons

Iran
Iraq
North Korea

human and most plant life on the planet. In 1969, President Richard M. Nixon announced that the United States would unilaterally and unconditionally renounce offensive biological weapons. He ordered the destruction of the entire U.S. biological weapon stockpile and the conversion of all production facilities to peaceful purposes. He reversed 45 years of U.S. reluctance and sought the ratification of the 1925 Geneva Protocol, which prohibited the use of biological and chemical weapons in war (subsequently ratified under President Gerald Ford). Nixon successfully negotiated the Biological and Toxin Weapons Convention (BWC), signed in 1972 and ratified by the Senate in 1975, which prohibits the development, production, stockpiling, acquisition, or transfer of biological weapons. The treaty requires all signatories to destroy all their biological weapons and biological weapon production facilities. The treaty has no verification mechanism, however, and the state parties to the treaty have been trying to negotiate a verification protocol or additional measures to strengthen the BWC.

It is often difficult to get a complete picture of which countries or groups have biological weapons or programs. Milton Leitenberg points out that official assessments rarely distinguish between *suspected*, *capability*, *developing*, and *weapon*. Worse, nations with such capabilities or programs are often lumped together in lists with countries with chemical weapon programs or capabilities.³ In this book we try to desegregate distinct programs and threats. National programs are distinguished by whether they have produced actual weapons, have only research and development programs, or have the basic capability to produce agents. The chapters on specific countries provide the full details of each program.

When the BWC originally entered into force in 1975, there were four nations thought to have biological weapons: the United States, the Soviet Union, China, and South Africa. By the beginning of 2002, 163 nations had signed, ratified, or otherwise acceded to the treaty; however, there are approximately twelve nations suspected of having biological warfare programs. This “dirty dozen” includes Iraq, Iran, Israel, Russia, North Korea, Syria, Libya, and possibly India, Pakistan, China, Egypt, and Sudan. United States officials have publicly identified many of these nations on several occasions, including at the 1996 and 2001 review conferences for the BWC and in annual reports to Congress from the Department of Defense and the former Arms Control and Disarmament Agency. Those nations are all suspected of pursuing offensive biological weapon programs prohibited by the BWC, though not all the countries, such as Israel, are members of the BWC. Almost all the programs are research programs, and only three nations—Iraq, Iran, and Russia—are believed to have

Table 1.4: Countries Suspected of Retaining Biological Weapons or Programs

China	Iraq	Pakistan
Egypt	Israel	Russia
India	Libya	Sudan
Iran	North Korea	Syria

produced and stockpiled agents; three others—North Korea, Israel, and China—may have done so.

BIOLOGICAL WEAPON PRODUCTION. *Iraq* remains the most serious proliferation threat. Despite having signed the BWC in 1972 and ratified the accord in 1991, Iraq has clearly pursued an active bioweapons program. After the Gulf War, the U.N. Security Council required Iraq to fully disclose and destroy its program. Iraq denied having a biological weapon program and pursued a policy of obstruction, denial, and evasion to conceal its efforts. Iraqi officials were forced to admit in 1995 that they had produced 30,000 liters of bulk biological agents, some in filled munitions, including Scud missile warheads and aerial bombs. Iraq may have produced up to four times the amount admitted and may have retained 6–16 missiles with biological weapon warheads.⁴ Since inspections ended in 1998, Iraq may have reconstituted its program. *Iran* currently maintains an offensive biological weapon program, including active research and the development of agents. In November 2001, Undersecretary of State John Bolton said that Iran had actually produced agents and weapons.⁵ Although the *Soviet Union* claimed that it had ended its extensive bioweapons program when it signed the BWC in 1972, President Boris Yeltsin in 1992 disclosed that work had, in fact, continued at substantial levels. There is still considerable uncertainty surrounding Russian weapon facilities, and the possibility exists that agents and weapons remain in Russia.

BIOLOGICAL WEAPON PROGRAMS. *Israel* is believed to have a sophisticated biological weapon program. Israel may have produced anthrax and more advanced agents in weaponized form as well as toxins. United States officials believe that *North Korea* has pursued biological warfare capabilities since the 1960s and has the capability to produce sufficient quantities of biological agents for military purposes within weeks of a decision to do so.⁶ *China* has a large, advanced biotechnical infrastructure that could be used to develop and produce biological agents. Chinese officials have repeatedly asserted that the country has never researched or produced biological weapons. United States officials, however, believe that the voluntary BWC declarations submitted by China are inaccurate and incomplete.

POSSIBLE BIOLOGICAL WEAPON RESEARCH PROGRAMS. There is considerable evidence that *Egypt* started a program in the early 1960s that produced weaponized agents.⁷ In 1996, U.S. officials reported that by 1972 Egypt had developed biological warfare agents and that there was “no evidence to indicate that Egypt has eliminated this capability and it remains likely that the Egyptian capability to conduct biological warfare continues to exist.”⁸ Currently, Egyptian officials assert that Egypt never developed, produced, or stockpiled biological weapons.⁹ *Syria* has a biotechnical infrastructure capable of supporting limited agent development but has not begun a major effort to produce biological agents or to put them into weapons, according to official U.S. assessments.¹⁰ *Libya* is also believed to have a program, but it has not advanced beyond basic research and development. *India* and *Pakistan* are not believed to have produced or stockpiled offensive biological

weapons, although official assessments note that both countries have the resources and capability to support biological warfare research and development efforts.¹¹ *Sudan* is not believed to have a biological weapon program, but U.S. officials have repeatedly warned of Sudanese interest in developing such a program. Other states of some concern include *South Africa*, which had a bioweapons program that the new unity government says it ended in 1992, and *Taiwan*, which, however, is now rarely mentioned in either official or expert reviews.

BIOTERRORISM. Over the past several decades terrorist attempts to acquire biological agents have fallen short of successful weaponization. Almost all threats to use biological agents, including hundreds of terrorist anthrax hoaxes against abortion clinics and other targets in the United States, have been false alarms. There have been only two significant biological attacks by terrorists in recent times. Some experts contend that the complexity of a biological weapon design for effective dissemination has by and large thwarted bioterrorism. The Japanese religious sect Aum Shinrikyo, for example, tried for several years, and with considerable funding and expertise, to produce and weaponize botulinum toxin and anthrax. The group's extensive efforts failed, and the cult resorted to using the chemical agent sarin for attacks in a Tokyo subway in 1994 and 1995. The first successful terrorist incident involving biological agents occurred in 1984 in Dalles, Oregon, when a religious cult, Rajneesh, disseminated salmonella bacteria in ten restaurants, infecting 750 people, but with no fatalities. When the bioterrorism attack that many had long feared finally came, it was not what the experts had predicted. In October 2001, someone sent letters containing anthrax to members of Congress and the media. The terrorist either did not realize sophisticated dispersal mechanisms were required for mass casualties from anthrax, or simply did not care. The letters killed 5 and infected 18 others. It could have been much worse, but this was the first time that a biological warfare agent was used against the U.S. population. Even this limited attack caused mass disruption and cost billions of dollars in decontamination and prevention expenses.

Chemical Weapons

Experts differ over whether chemical weapons properly belong in the category of "mass destruction weapons." Mass casualties require large amounts of chemical agents relative to either biological or nuclear weapons. Still, 5 metric tons

Table 1.5: Countries Suspected of Retaining Chemical Weapon Programs

China	Libya
Egypt	North Korea
India	Pakistan
Iran	Sudan
Iraq	Syria
Israel	

of the nerve gas sarin carried in bombs and dropped by two strike aircraft or the warheads of 36 Scud missiles could kill 50 percent of the people over 4 square kilometers.¹² (By comparison, a Hiroshima-size nuclear bomb of 12-kiloton yield would kill 50 percent of the population over 30 square kilometers.)

Chemical weapons have been used only in isolated instances since World War I, despite (or perhaps because of) the substantial numbers of weapons that are in national arsenals. The 1996 Chemical Weapons Convention (CWC) started a process of “deproliferation” whereby most nations declared their holdings (if any) and began eliminating their arsenals and production facilities. The CWC requires all state parties possessing chemical weapons to destroy them in a safe and environmentally friendly manner not later than ten years after the treaty entered into force, or by April 29, 2007, unless special extensions are granted. The treaty also requires all state parties to destroy or convert all present and past capabilities used to produce chemical weapons by that time. The declarations by the United States and Russia account for the vast majority of known chemical weapon stockpiles.

As of March 2002, 140 of the 145 state parties to the treaty had submitted their initial declarations of chemical weapon holdings and facilities. Four countries—the United States, Russia, India, and South Korea—have declared their possession of chemical weapon stockpiles totaling more than 70,000 metric tons of agents. Russia’s 40,000 metric tons is the largest declared stockpile, and that nation’s financial difficulties make complete elimination of that stockpile by 2007 impossible. Eleven nations have declared their possession of existing or former chemical weapon production facilities: Bosnia and Herzegovina, China, France, India, Iran, Japan, Russia, South Korea, the United Kingdom, the United States, and Yugoslavia. Thirty-two of the 61 declared facilities were destroyed or converted, 6,000 metric tons of chemical agents were destroyed, and one-fifth of the 8.6 million chemical weapons declared by the four possessor states were eliminated through treaty procedures from 1997 through March 2002.¹³

The most significant remaining national programs, in order of concern, are those in Iraq, North Korea, Iran, India, Israel, China, Syria, Egypt, Libya, Sudan, and perhaps Pakistan.

SUSPECTED CHEMICAL WEAPON STOCKPILES. *Iraq* developed a substantial inventory of chemical weapons, including stockpiles of V-agents, sarin, mustard gas, and tabun. The inspection teams of the United Nations Special Commission (UNSCOM) discovered and destroyed large quantities of these weapons, agents, and production facilities but believe that Iraq still has hidden stores of undisclosed weapons and various precursor chemicals. United States intelligence assessments state that *North Korea* also has had a long-standing chemical warfare program, including the ability to produce bulk quantities of nerve, blister, choking, and blood agents. North Korea is believed to have a large stockpile of these agents and weapons.¹⁴

Iran’s declaration at the May 1998 session of the CWC conference was the first time that that nation had admitted to having had a chemical weapon program, apparently developed in response to Iraqi chemical warfare attacks during the Iran–Iraq War. United States officials say that in the past Iran has stockpiled

blister, blood, and choking chemical agents and has weaponized some of these agents into artillery shells, mortars, rockets, and aerial bombs.¹⁵

Likewise, *India's* declaration under the CWC in June 1997 was the first time that that nation acknowledged it had a chemical warfare production program. While it has pledged to destroy all agents and production facilities, *India's* activities and exports of dual-use equipment and chemical precursors remain a cause for concern. *China* has ratified the CWC and has declared that it does not possess an inventory of chemical agents. Officials in the United States, however, believe that *China* has a moderate inventory of traditional agents, an advanced chemical warfare program (including research and development, production, and weaponization capabilities), and a wide variety of potential delivery systems.¹⁶

Israel is also believed to have an active research and development program for chemical warfare agents and to have produced and stockpiled weapons. *Syria* has not signed the CWC, and U.S. officials believe it has a significant stockpile of the nerve agent sarin. A 1990 intelligence assessment reported that *Syria* had weaponized these chemicals in 500-kilogram aerial bombs and warheads for its Scud-B missiles.¹⁷ *Egypt* was the first country in the Middle East to obtain chemical weapons and the first to use them. It reportedly employed phosgene and mustard gas against Yemeni royalist forces in the mid-1960s.¹⁸ It is believed still to have a research program and has never reported the destruction of any of its chemical agents or weapons. *Israel*, *Syria*, and *Egypt* are not members of the CWC. *Libya* is suspected of trying to establish an offensive chemical weapon capability and an indigenous production capability for weapons.

CHEMICAL WEAPON RESEARCH PROGRAMS. *Sudan* is also believed to have an active interest in acquiring the capability to produce chemical agents but is not believed to have done so yet. *Libya* is not a member of the CWC; *Sudan* is. *Pakistan* sometimes appears on a list of countries with chemical “capabilities” because it has the ability to manufacture chemical weapons should it choose to do so. While *Pakistan* has imported a number of dual-use chemicals, they are thought to be related to the development of commercial chemical industrial activities and not to a dedicated warfare program. *South Korea* ended its weapon program when it ratified the CWC in 1997 and has been destroying its chemical weapons and production facilities.

Missile Proliferation

Much of the proliferation debate over the past few years has centered not on the weapons themselves, but on one possible means for delivering these weapons: ballistic missiles. It has become common wisdom and a political habit to refer to the growing threat of ballistic missiles. The threat is certainly changing and is increasing according to some measures. Yet by several other important criteria the ballistic missile threat to the United States is significantly smaller than it was in the mid-1980s.

DECREASING ICBM ARSENALS. The number of intercontinental ballistic missiles (ICBM, those with ranges of more than 5,500 kilometers) has decreased dra-

Table 1.6: **Ballistic Missiles**

Twenty-four countries possess only short-range ballistic missiles (that is, with ranges of less than 1,000 kilometers).		
Afghanistan	Egypt	Syria
Argentina	Georgia	Taiwan
Armenia	Greece	Turkey
Azerbaijan	Iraq	Turkmenistan
Bahrain	Kazakhstan	Ukraine
Belarus	Libya	UAE
Bulgaria	Slovak Republic	Vietnam
Congo	South Korea	Yemen
Seven countries possess medium-range ballistic missiles (with ranges of 1,000–3,000 kilometers).		
China	North Korea	
India	Pakistan	
Iran	Saudi Arabia	
Israel		
One country possesses intermediate-range ballistic missiles (with ranges of 3,000–5,500 kilometers).		
China		
Five countries possess intercontinental ballistic missiles (with ranges of 5,500+ kilometers).		
China	United Kingdom	
France	United States	
Russia		

matically since the height of the Cold War. In 1987 the Soviet Union deployed 9,378 nuclear warheads on 2,380 long-range missiles aimed at the United States.¹⁹ At the beginning of 2002, Russia had fewer than 5,000 missile warheads deployed on approximately 1,022 missiles.²⁰ During this period China has maintained a force of about 20 Dong Feng–5 ICBMs. This represents a decrease of 57 percent in the number of missiles capable of striking the continental United States and a decrease of 46 percent in the number of nuclear warheads on those missiles.

These decreases will continue over the next ten years. Russia may decrease its force to as little as 1,000 warheads on its missiles if U.S.–Russian relations continue to improve, or as many as 3,800 warheads if relations deteriorate. Under China’s current policy of modernizing its nuclear arsenal, U.S. intelligence predicts that “by 2015, China likely will have tens of missiles capable of reaching

the United States,”²¹ although that number could increase substantially in response to U.S. missile defense deployments.

IRBM ARSENALS LARGELY ELIMINATED. Since the mid-1980s arms control agreements have nearly eliminated the arsenals of intermediate-range ballistic missiles (those with ranges of 3,000–5,500 kilometers). Presidents Ronald Reagan and Mikhail Gorbachev negotiated in 1997 and implemented the Intermediate-range Nuclear Forces Treaty (INF). The Soviet Union destroyed 660 missiles in this range, eliminating this entire class of missiles from the U.S. and Soviet arsenals. France deactivated and destroyed its 18 land-based and 32 submarine-based IRBMs, while China retains some 20 missiles in the intermediate range. No other nation has developed intermediate-range ballistic missiles, though if North Korea were to launch its developmental Taepo Dong II, it would add a few missiles to this category.

MORE MRBM PROGRAMS. The INF treaty also eliminated all medium-range missiles (those with ranges of 1,000–3,000 kilometers) from the U.S. and Russian arsenals. Although absolute numbers have declined, there is reasonable concern that new missile programs in several countries could threaten international peace. China has 80–100 missiles in the medium range, and several other countries have conducted tests of missiles that do not threaten the territory of the United States but could threaten other nations or deployed forces. North Korea has had one test of its Taepo Dong I missile to 1,320 kilometers. It could extend the range with a third stage and has reportedly deployed 1,300-kilometer No Dong missiles after a single test and may add a longer-range version that is currently under development. Iran has flight-tested the Shahab III, based on the No Dong, with an estimated range of 1,300 kilometers. There are three other programs that are not considered threats to the United States, but some nations view them as threatening. Israel has deployed approximately 50 Jericho II missiles with a range of 1,500 kilometers. India intends to begin production of the Agni II, with a range of about 2,000 kilometers, and may be working on a longer-range (3,500-kilometer) Agni III missile. Pakistan has flight-tested the Ghauri (which has a 1,300-kilometer range) and Ghauri II (in the 2,000-kilometer range) missiles, both based on the No Dong.

AGING SCUD INVENTORIES. Almost all the other nations that possess ballistic missiles have only short-range missiles. For most, their best missiles are aging Scuds that were bought or inherited from the former Soviet Union and that are now declining in military utility as time passes. North Korea is now the primary supplier of Scud-type missiles to the few countries that are interested in the weapon.

FEWER, POORER PROGRAMS. The number of countries trying or threatening to develop long-range ballistic missiles has not changed greatly in 15 years and is somewhat smaller than in the past. The nations now attempting to perfect long-range missiles are also smaller, poorer, and less technologically advanced than were the nations with missile programs 15 years ago.

Only China and Russia have the capability to hit the United States with nuclear warheads on intercontinental land-based ballistic missiles. This has not changed since Russia and China deployed their first ICBMs in 1959 and 1981, respectively. Confusion arises when policy makers speak of missile threats to the United States or to such U.S. interests as forward-deployed troops or allied nations. This merges very short-range missiles, of which there are many, with long-range missiles, of which there are few.

While several programs are a cause for serious concern and could develop into potential international threats, in general the ballistic missile threat is confined, limited, and changing slowly.

Conventional Weapons of Mass Destruction

The terrorist attacks of September 11 may force an expanded definition of weapons of mass destruction to include conventional attacks on critical infrastructure that are capable of causing mass casualties and mass disruption. In most official definitions, the term *weapons of mass destruction* is synonymous with “nuclear, biological, or chemical weapons.” However, one definition used by the Federal Bureau of Investigation notes that “a weapon crosses the WMD threshold when the consequences of its release overwhelm local responders.”²² These attacks on critical infrastructure are not a proliferation threat per se, but might be the weapons of choice for some terrorist groups.

There are, for example, 60,000 chemical plants in the United States. A saboteur could turn one of them into an American Bhopal, the town in India where an accident at a Union Carbide pesticide plant released a deadly gas cloud that killed 5,000 people. A trained nuclear engineer could set off a chain reaction at one of the 103 U.S. nuclear power plants, or an airplane could target the plant, triggering a nuclear disaster worse than that at Chernobyl or Three Mile Island. The concern extends beyond reactors to include the 78,000 metric tons of radioactive waste stored in dozens of facilities in the United States.²³ There are 9,300 “high-hazard” dams whose collapse would cause human deaths. Fifty thousand trucks carrying hazardous materials travel on America’s highways each day; a truck transporting gasoline or chlorine that explodes in a tunnel could kill hundreds of people. “E-terrorists” could attack some of the 24 government computer networks that the U.S. General Accounting Office recently found to be inadequately protected (including those of the Departments of Defense and the Treasury). Computer hackers could disable power grids, wreaking havoc on American cities.

These are not traditional proliferation problems, but they are now serious national security issues not easily addressed through traditional diplomatic or military measures. Including “conventional” weapons of mass destruction more prominently in threat assessments could force an expanded definition of national security and change traditional views of national defense priorities. If this happened, it would not replace existing proliferation problems (such as the state acquisition of nuclear and biological weapons), but add to them.

In this volume we do not discuss the new threats in any detail but we mark the subject for new research and analysis in the years ahead. Paul Pillar, the for-

mer deputy chief of the Counterterrorist Center at the Central Intelligence Agency argues, for example, “The specter of terrorists, especially international terrorists, using chemical, biological, radiological or nuclear means has been overhyped in the sense that it has diverted our attention from what in my view will continue to be the main threat, which is the infliction of loss of life through conventional means.”²⁴ Conventional terrorist attacks can quickly generate fears of WMD terrorism or lead to proposals for state response using advanced military, and even nuclear, weapons. They can also lead to the deployment of additional arms, however inappropriate they may be to the actual threat.

Effective Policies Prevented Worse Dangers

Ever since American scientists detonated the first nuclear bomb at Alamogordo, New Mexico, in July 1945, many officials and experts have feared the future. They worried that proliferation could run out of control, creating a bleak, dangerous world with dozens of nations armed with mass destruction weapons. Several times in the past few decades the public’s fear of nuclear war has moved millions of people worldwide to petition for an immediate change in their governments’ policies. More than once the very fate of the earth seemed to be at stake, as Jonathan Schell titled his book in 1982.

President John F. Kennedy worried that while only the United States, the Soviet Union, the United Kingdom, and France in the early 1960s possessed

Table 1.7: Fifteen States with Nuclear, Biological, or Chemical Weapons or with Research Programs

Country	Nuclear	Biological	Chemical
Russia	W	W	W
China	W	W	W
Israel	W	W	W
United States	W		W
France	W		
United Kingdom	W		
India	W	R	W
Pakistan	W	R	R
Iraq	R	W	W
North Korea	R	W	W
Iran	R	W	W
Egypt		W	W
Syria		R	W
Libya		R	W
Sudan		R	R

Key: Known or suspected Weapons or Agents = W
Known or suspected Research program = R

nuclear weapons, by the end of the decade, 15 or 20 nations would be able to obtain them. The concern was not that developing countries would acquire the bomb, but rather that the advanced industrial nations would do so, particularly Japan and Germany. Italy, Sweden, and other European nations were already actively pursuing nuclear weapon programs. Neutral Sweden, for example, was then developing plans to build 100 nuclear weapons to equip its air force, army, and navy.

Kennedy moved aggressively to counter those trends. He created the Arms Control and Disarmament Agency in 1961, began negotiations on a treaty to stop the spread of nuclear weapons, and negotiated the Limited Test Ban Treaty, ending nuclear tests in the atmosphere, under water, and in outer space.

United States diplomacy and international efforts to create legal and diplomatic barriers to the acquisition of nuclear weapons, codified in the Treaty on the Non-Proliferation of Nuclear Weapons in 1968, dramatically stopped the rush toward nuclear weapon status. Twenty years after Kennedy's warning, China (with Soviet help) had openly joined the ranks of the new nuclear nations; India had exploded a so-called peaceful nuclear device; and Israel was building a secret nuclear arsenal. All the other nations that had studied nuclear programs in the 1950s and 1960s had abandoned their pursuits. The treaty did little at that time, however, to constrain the nuclear arms race between the two superpowers in the 1960s and 1970s that was sometimes known as vertical proliferation.

Throughout the 1980s and 1990s, however, proliferation experts were again ringing alarms. As Leonard Spector said in 1984 in *Nuclear Proliferation Today* (the first book in the Carnegie Endowment's series on proliferation): "The spread of nuclear weapons poses one of the greatest threats of our time and is among the most likely triggers of a future nuclear holocaust. . . . The spread of nuclear arms also increases the risk of their falling into the hands of dissident military elements or revolutionaries. . . . The threat of nuclear terrorism is also growing."²⁵

Non-proliferation efforts have steadily advanced over the past two decades, but never easily and never without serious setbacks. While some nations renounced their weapons of mass destruction programs, others started new programs. Often a majority of nations were able to agree on new treaties and new restraints, only to have other nations block their progress or feign compliance.

After September 11, few doubt the need for urgent government action. President Bush said during his meetings with Russian President Vladimir Putin in November 2001, "Our highest priority is to keep terrorists from acquiring weapons of mass destruction. We will strengthen our efforts to cut off every pos-

Table 1.8: Countries That Abandoned Nuclear Weapon Programs in the 1990s

Argentina	Kazakhstan
Belarus	South Africa
Brazil	Ukraine

sible source of biological, chemical, and nuclear weapons material and expertise.” These new efforts can be built on the successes of previous actions.

Although nuclear, biological, and chemical arsenals in the United States and the Soviet Union once grew to enormous levels and the technology of these weapons has become increasingly accessible, the world has not been devastated by a thermonuclear war. Moreover, the number of new prospective nuclear nations has shrunk dramatically over the past 20 years, not increased, and the international norm has been firmly established that countries should not, under any circumstances, possess or use either biological or chemical weapons. Global expectations are that the existing stockpiles of nuclear weapons will be greatly reduced, even if their eventual elimination seems but a distant hope.

Only four nations since 1964 have overcome the substantial diplomatic and technical barriers to manufacturing nuclear weapons. The proliferation of biological and chemical weapons is broader, but it is still mainly confined to two regions of the world: the Middle East and Northeast Asia. Most of the world’s biological weapons have been destroyed, and the bulk of the global chemical weapon arsenals will likely be eliminated over the next ten years.

With all the serious challenges that exist, the non-proliferation regime has still had a remarkable record of success. But can it hold? Or are international conditions so different today that the regime can no longer work?

Twenty-first Century Proliferation

Some argue that with the end of superpower conflict the world confronts a fundamentally different proliferation problem. While the regime may have worked in the past, they doubt the holdouts can be convinced to adopt the same norms as those held by the regime founders. Many officials in the Bush administration believe that the entire process of negotiating and implementing non-proliferation treaties is both unnecessary and harmful to U.S. national security interests. They argue that some of the treaties, such as the Comprehensive Test Ban Treaty, the Anti-Ballistic Missile Treaty, and the Landmine Treaty, restrict necessary armaments, thus weakening the principal nation that safeguards global peace and security. Other treaties, such as the Chemical Weapons Convention and the Biological Weapons Convention, promote a false sense of security as some nations sign, then cheat on the agreements.

In this view, the construction of a new security paradigm over the next several years must begin by clearing the underbrush of useless and counterproductive treaties. As one influential expert report noted: “The U.S. is highly restricted politically in its capability to withdraw from or even modify established arms control agreements regardless of changes in the strategic environment. . . . Adaptability requires the capacity to both *augment and reduce* U.S. defensive and offensive forces” (emphasis in original).²⁶ Thus, the Bush administration has withdrawn from or rejected several major treaties, including the Anti-Ballistic Missile Treaty, the START II and III treaties, the Comprehensive Test Ban Treaty, the Small Arms Treaty, and the draft compliance protocol to the Biological Weapons Convention. Officials believe that the United States can provide for its

security and for the security of its allies with improved conventional U.S. forces, the deployment of comprehensive missile defenses, new, space-based weapon systems, and fewer—but perhaps newer—nuclear weapons. In this view, international relations will be based on reliable, bilateral agreements and alliance relations, and not on idealist, multi-lateral accords. Nations outside these alliance arrangements will be isolated and contained until democratic regimes can be brought into being. There will most certainly be conflicts, and some may involve weapons of mass destruction, but these can be contained.

In truth, the non-proliferation norm has never been universally recognized. As noted above, several key nations have stayed out of the regime; others are nominally in the regime but have been strongly suspected of cheating on their obligations; and skeptics within many nations criticize what they believe to be the idealistic approach, trying to prevent proliferation with “pieces of paper.”

The non-proliferation treaties did not emerge in a diplomatic vacuum. They are an integral part of the political and military balance-of-power and alliance systems of the late twentieth century. Alliance security arrangements, including the promise that the United States would extend a “nuclear umbrella” over Europe and Japan, undoubtedly made it easier for several industrial nations to abandon their nuclear weapon programs. The Soviet Union simply forced non-proliferation on its alliance system. The United States, too, was not adverse to using strong-arm tactics to compel Taiwan and South Korea, for example, to abandon nuclear weapon research. In many developing nations, ambitions ran into formidable financial and technological obstacles to nuclear weapon development, missile engineering, and biological agent weaponization.

At a time when there is increasing interest in unilateral approaches to security arrangements, it is important to point out that financial, technical, and alliance factors have not, in themselves, been sufficient barriers to proliferation. These factors were present in the 1960s and 1970s, but before the signing of the Non-Proliferation Treaty, nuclear proliferation was on the rise; afterward, it was on the decline. The critical importance of the NPT is that it provided the necessary international legal mechanism and established the global diplomatic norm that gave nations a clear path to a non-nuclear future.

Moreover, it is a path that is encouraged and enforced by the dominant political and military powers. The NPT and other treaties do not exist apart from or in opposition to alliance arrangements, rather they embody those arrangements. The non-proliferation regime is thus much more than the sum of pieces of paper. It is a series of agreements that, like the Magna Carta and the Declaration of Independence, capture the political reality of the time and are enforced by the collective political will of the participants.

The political will to constrain proliferation has rarely been stronger. Even before September 11, the joint statement of the ministers of the North Atlantic Council stated: “We continue to place great importance on non-proliferation and export control regimes, international arms control and disarmament as [a] means to prevent proliferation. . . . The Nuclear Non-Proliferation Treaty . . . is the cornerstone of the nuclear non-proliferation regime and the essential foundation for the pursuit of nuclear disarmament.”²⁷

Table 1.9: Countries without Weapons of Mass Destruction

Albania	Czech Republic	Liberia	St. Vincent & the Grenadines
Andorra	Denmark	Liechtenstein	Samoa
Angola	Djibouti	Lithuania	San Marino
Antigua & Barbuda	Dominica	Luxembourg	São Tomé & Príncipe
Argentina	Dominican Republic	Macedonia	Saudi Arabia
Armenia	Ecuador	Madagascar	Senegal
Australia	El Salvador	Malawi	Seychelles
Austria	Equatorial Guinea	Malaysia	Sierra Leone
Azerbaijan	Eritrea	Mali	Singapore
Bahamas	Estonia	Marshall Islands	Slovakia
Bahrain	Fiji	Mauritania	Slovenia
Bangladesh	Finland	Mauritius	Solomon Islands
Barbados	Gabon	Mexico	South Africa
Belarus	Gambia	Micronesia	Spain
Belgium	Georgia	Moldova	Sri Lanka
Belize	Germany	Monaco	Suriname
Benin	Ghana	Mongolia	Swaziland
Bhutan	Greece	Morocco	Sweden
Bolivia	Grenada	Mozambique	Switzerland
Bosnia and Herzegovina	Guatemala	Namibia	Tajikistan
Botswana	Guinea	Nauru	Tanzania
Brazil	Guinea-Bissau	Nepal	Thailand
Brunei	Guyana	Netherlands	Togo
Bulgaria	Haiti	New Zealand	Tonga
Burkina Faso	Honduras	Nicaragua	Trinidad & Tobago
Burundi	Holy See	Niger	Tunisia
Cambodia	Hungary	Nigeria	Turkey
Cameroon	Iceland	Norway	Turkmenistan
Canada	Indonesia	Oman	Tuvalu
Cape Verde	Ireland	Palau	Uganda
Central African Republic	Italy	Panama	Ukraine
Chad	Jamaica	Papua New Guinea	United Arab Emirates
Chile	Japan	Paraguay	Uruguay
Colombia	Jordan	Peru	Uzbekistan
Comoros	Kazakhstan	Philippines	Vanuatu
Congo	Kenya	Poland	Venezuela
Congo Republic	Kiribati	Portugal	Yemen
Costa Rica	Kuwait	Qatar	Zambia
Côte d'Ivoire	Kyrgyzstan	Romania	Zimbabwe
Croatia	Laos	Rwanda	
Cuba	Latvia	Saint Kitts and Nevis	
Cyprus	Lebanon	Saint Lucia	
	Lesotho		

Note: Some nations such as Afghanistan, Ethiopia, Somalia, South Korea, and Vietnam, are not on this list because they may have small numbers of undeclared chemical weapons.

Most allies of the United States share this view of the central importance of treaties (and non-proliferation agreements, in particular) to international security. To most, they are a highly effective (and cost-effective) defense. Even when the treaties are breached, as they have been, weapon use is deterred by the threat of devastating retaliation. The United States by itself has the ability to destroy any opponent with its overwhelming conventional armed forces. Most allies acknowledge an important role for active defensive systems, should nuclear or biological weapons be used. While effective defenses against missiles outside the atmosphere seem impractical (because they could be overwhelmed by light-weight decoys and other countermeasures), defenses against short-range Scuds and Scud derivatives may prove practical and could be deployed to protect troops and defended areas.

It appears, for example, that active diplomacy may very well succeed in eliminating North Korea's nuclear program and the threat that the country will produce or export advanced missile systems. Similarly, if reform elements continue to make progress in Iran and if the United States can both improve relations and convince key nations to eliminate their remaining assistance to missile and nuclear programs, Iran might once again become a regional power having friendly relations with the United States. In many ways, the South Asian programs represent the most difficult challenge, both for the risks of regional war they present and their ripple effect on other Asian states.²⁸ Even here, though, there remains the possibility that treaties and agreements can be constructed to parallel the NPT regime while taking into account the particularities of the South Asian situation.

As Henry Sokolski points out, "I think it's fair to say the burden is on those who would tear down the traditional arms control regime to show how they would achieve the same goals by other means."²⁹ It is possible that the powerful moderating mechanisms in the U.S. foreign policy process, realistic appraisals of the continuing importance and successes of international non-proliferation agreements, and the influence and preferences of U.S. allies will combine in the new decade to develop dynamic new approaches to sustain and even expand the regime. If not, future editions of this book may well include a growing list of nuclear nations, and more, not fewer, states with chemical and biological weapons.

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