CHAPTER 1

Global Trends

The proliferation of nuclear, biological, and chemical weapons 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 years from near hysteria to apathy. During this first decade of the twenty-first century, concern is very high, with passionate international debates over which strategies can best prevent the spread and use of these weapons.

To inform these debates, this second edition of *Deadly Arsenals* revises and updates all the chapters, figures, and tables from the first edition published in 2002. This edition includes new chapters on Iraq, Iran, Libya, North Korea, and new information and analysis on other countries, which are needed to capture the dramatic developments of the past three years. All the parts of the book emphasize factual and historical analysis of weapons programs. The book is intended to serve as a proliferation atlas and ready reference for students, experts, and concerned citizens alike.[1]

One significant change in the new edition is that it no longer employs the term "weapons of mass destruction." Though used widely by officials and the media, this phrase conflates very different threats from weapons that differ greatly in lethality, consequence of use, and the availability of measures that can protect against them. Chemical weapons are easy to manufacture, but they inflict relatively limited damage over small areas and dissipate fairly quickly. Biological weapon agents can be made in most medical laboratories, but it is very difficult to turn these agents into effective weapons, and prompt inoculation and quarantine could limit the number of victims and the areas affected. Nuclear weapons are difficult to produce, but one weapon can destroy an entire city, killing hundreds of thousands instantly and leaving lingering radiation that would render large areas uninhabitable for years. A failure to differentiate these threats can lead to seriously flawed policy. For example, the repeated use of the term "weapons of mass destruction" to describe the potential threat from Iraq before the 2003 war merged the danger that it still had anthrax-filled shells, which was possible, with the danger that it had nuclear bombs, which was highly unlikely. Similarly, saying that Syria has weapons of mass destruction merges the danger that it has chemical weapons, which is almost certainly true, with the danger that it has a nuclear bomb, which is certainly not true. The first threat is real, but its elimination requires an entirely different set of policies than does the second. The term also blurs the possible responses to threats, justifying for some the use of nuclear weapons to prevent a potential chemical weapons attack. This study

disaggregates these threats, considering weapons and programs as they actually appear.

The Twentieth Century's Deadly Legacy

Nuclear, biological, and chemical weapons were 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 more efficiently kill 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.

Poison gas was used for the first time during World War I, as both the Central Powers and the Allies tried attacks with chlorine gas, mustard gas, and other agents to break the trench warfare stalemate. 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 invented and used nerve gas to kill millions of Jews and other prisoners in its concentration camps. Nuclear weapons were used for the first and last time at the end of that war, when the United States struck Japanese cities. Global arsenals peaked during the Cold War years of the 1960s, 1970s, and early 1980s, when both the NATO nations and the Warsaw Pact perfected and produced tens of thousands of nuclear, biological, and chemical bombs.

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, which had 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 acquisition of those weapons by other nations or groups posed the most serious remaining threat. In January 1992, for example, the U.N. Security Council declared that their spread constituted a "threat to international peace and security." In 1998, the U.S. Defense Intelligence Agency concluded 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 worldwide." In early 2001, President George W. Bush 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."[2]

This chapter provides a brief overview of global proliferation threats, describes the weapons and the nations that have or wish to have them, and outlines the prospects for the next few years. Chapter 2 details the major elements of the nonproliferation regime, including the international network of treaties and agreements constructed over the past 50 years to prevent and reduce proliferation. Chapters 3, 4, and 5 describe in greater detail the characteristics of the various weapons and the specific national programs that exist or may evolve.

Chapters 6 through 21 review the history and status of the most significant national programs, including those countries that have given up nuclear weapons. (The appendixes to the book include detailed information on the main nonproliferation treaties and nuclear supplier organizations, along with an extensive glossary of nonproliferation and weapons terms; a list of abbreviations and acronyms also appears at the end of the book.)

Updates and expansion of the information in this volume, plus the latest developments, debates, and discussions, are available at the Carnegie Endowment's proliferation web site (www.ProliferationNews.org).

Weapons and Trends

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 the added danger that terrorist organizations could kill thousands with these weapons or by sabotaging critical urban and industrial infrastructures.

Although a terrorist attack on these infrastructures using conventional weapons is the most likely threat—as seen by the terrorist attacks on September 11, 2001, in New York and Washington and on March 11, 2004, in Madrid—the explosion of a nuclear weapon would be the most devastating.[3] This calculation of "risk times consequences" should force us to focus most of our attention on this catastrophic possibility while not neglecting the threats from chemical and biological weapons and doing all we can to prevent conventional attacks.

The development of accurate threat assessments and effective national policies requires understanding the technologies of the various types of weapons, the history of their spread, and the successes and failures of nonproliferation efforts. The sections below give a brief overview, with greater detail provided in the country chapters that follow (see table 1.1). It is followed by a global assessment of the current threats and of past and proposed nonproliferation policies.

Nuclear Weapons

Nuclear weapons are the most deadly weapons ever invented—the only true weapons of mass destruction. A single, compact nuclear device can instantly devastate a midsized city. Nuclear weapons are also the most difficult of the three types of weapons to manufacture or acquire. Today, only eight nations are known to have nuclear 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. In order of the size of their nuclear arsenals, they are *Russia*, *the United States*, *China*, *France*, and *the United Kingdom* (see table 1.2). The members of this group acquired their arsenals during the 20 years after World War II, and the group remained remarkably stable

Table 1.1. **A Weapons Guide**

Nuclear Weapons
A nuclear weapon is a device with explosive energy, most or all of which is derived 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. Nuclear fission weapons produce energy by splitting the nucleus of an atom—usually of 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.
Biological Weapons
Biological weapons intentionally disseminate agents of infectious diseases and of conditions that would otherwise appear only naturally or not at all. These 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 of these agents 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 can be modified to increase their virulence, production rate per cell, and survivability under environmental stress, as well as to mask their presence from immune-based detectors. Because most biological agents are living organisms, their natural replication after dissemination increases the potential impact of a strike, making biological weapons even more attractive. Any country possessing a pharmaceutical or food storage infrastructure already has an inherent stabilization and storage system for biological agents. Though aerosol delivery is optimal, explosive delivery is also effective, but to a lesser extent, owing to the possibility of organism inactivation caused by heat from the blast.
Chemical Weapons
Chemical weapons use the toxic properties, as opposed to the explosive properties, of chemical substances to cause physical or physiological harm

to 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 mustard gas and lewisite, which even in low doses cause painful burns necessitating medical attention, marked the first use of 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; it 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 the functioning of the nervous system, 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 smaller 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 method for their use is as 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 be exposed to life-threatening levels of radiation. This radiation also would inhibit or prevent emergency response teams from aiding the victims and, depending on the size of the explosion, would 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.

Table 1.2. **World Nuclear Arsenals**

Known Programs	Number of Weapons
Russia	16,000
United States	10,300
China	410
France	350
United Kingdom	200
Israel	100–70 suspected
India	75–110 possible
Pakistan	50–110 possible
Suspected Programs	
Iran	
North Korea	

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, two others may be actively pursuing nuclear weapons programs. *North Korea* acknowledges a program and may have accumulated enough material to construct as many as nine weapons. The 1994 agreement that had frozen the nation's plutonium program broke down in 2002, and it soon announced its withdrawal from the NPT. In January 2005, North Korean officials declared publicly for the first time that they had nuclear weapons. *Iran* is slowly but steadily pursuing an open civilian nuclear power program and may be covertly developing expertise for nuclear weapons. Iran is a member state of the NPT and, as such, any nuclear weapons program is illegal and, if proved, could subject it to additional sanctions or even military action through U.N. resolutions.

Since the signing of the NPT in 1968, however, many more countries have given up nuclear weapons programs than have begun them.[4] There are fewer nuclear weapons in the world and fewer nations with nuclear weapons programs than there were 20 or 30 years ago.[5]

In the past 20 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, thanks in great measure to the dedicated diplomacy of the George H. W. Bush and Bill Clinton administrations. Similarly, *South Africa*, on the eve of its transition to majority rule, destroyed the six nuclear weapons its 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.) *Iraq* gave up its nuclear program after the 1991 Gulf War and subsequent U.N. disarmament efforts, though the United States led a coalition of nations to invade Iraq, claiming that the country still had major programs for nuclear, biological, and chemical weapons. *Libya* gave up its nuclear and chemical weapons programs and long-range missile program in December 2003 after negotiations with the United States and the United Kingdom. *Algeria* showed some interest in nuclear weapons over the years but turned away from these programs in the 1990s and is no longer considered a high-risk state.

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.[6] As with chemical and biological agents, the invisible and uncertain danger from these weapons would cause widespread fear and horror. There is also the risk of a "reverse dirty bomb" that brings the conventional explosive to an existing radioactive source (e.g., storage pools for spent-fuel rods from civilian nuclear reactors), triggering an explosion that could be many times more deadly than the accident at Chernobyl.

Biological Weapons

Biological weapons are weapons that intentionally use living organisms to kill. They are second only to nuclear weapons in 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 not been 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 human life and many food crops on the planet. In 1969, President Richard M. Nixon announced that the United States would unilaterally and unconditionally renounce biological weapons. He ordered the destruction of the entire U.S. biological weapons 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 (and which was 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. This treaty requires all signatories to destroy all their biological weapons and biological weapon production facilities. The treaty has no verification mechanism, however, and the states that are parties to it have been trying to negotiate a verification protocol and additional measures to strengthen it.

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 that have chemical weapons programs or capabilities.[7] This book differentiates the 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, 4 nations were thought to have biological weapons: the United States, the Soviet Union, China, and South Africa. By the spring of 2005, 169 nations had signed the treaty; however, seven nations are suspected of having some level of offensive biological warfare research programs: China, Egypt, Iran, Israel, North Korea, Russia, and Syria (table 1.3). U.S. 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. These nations are all suspected of pursuing offensive biological weapons programs prohibited by the BWC, though not all the countries, such as Israel, are members of the BWC. Almost all the programs are research efforts, and only one nation—Russia—is believed to have produced and stockpiled weapon agents; four others—Iran, North Korea, Israel, and China—may have done so.

BIOLOGICAL WEAPONS PRODUCTION. 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 WEAPONS PROGRAMS. *Israel* is believed to have a sophisticated biological weapons program; it may have produced anthrax and more advanced agents in weaponized form as well as toxins. U.S. officials believe that *North Korea* has pursued biological warfare capabilities since the 1960s and may have the capability to produce sufficient quantities of biological agents for military purposes within weeks of a decision to do so.[8] *China* has a large, advanced

Table 1.3. **Countries Suspected of Retaining Biological Weapons or Programs**

China
Egypt
Iran
Israel
North Korea
Russia
Syria

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. U.S. officials, however, believe that the voluntary BWC declarations submitted by China are inaccurate and incomplete.

POSSIBLE BIOLOGICAL WEAPON RESEARCH PROGRAMS. *Iran* may have an offensive biological weapons program, including the capability to produce small quantities of biological weapons agents. In November 2001, U.S. undersecretary of state John Bolton said that Iran had actually produced agents and weapons,[9] but he had a more cautious assessment in 2004: "I cannot say that the United States can prove beyond a shadow of a doubt that Iran has an offensive biological weapons program. The intelligence I have seen suggests that this is the case."[10] There is considerable evidence that *Egypt* started a program in the early 1960s that produced weaponized agents.[11] 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."[12] Egyptian officials assert that Egypt never developed, produced, or stockpiled biological weapons.[13] *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.[14] *Sudan* is not believed to have a biological weapons 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 is now rarely mentioned in either official or expert reviews. *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.[15] Finally, U.S. officials had long believed that both *Iraq* and *Libya* had biological weapons or programs, but inspections after the 2003 war in Iraq and the 2003 agreement with Libya showed that neither had an active program.

BIOTERRORISM. During 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 it 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 the United States in October 2001, someone sent letters containing anthrax to members of Congress and the media. The terrorist either did not realize that sophisticated dispersal mechanisms were required for mass casualties from anthrax or simply did not care. The letters killed five and infected eighteen others. The attack 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

Mass casualties require large amounts of chemical agents relative to either biological or nuclear weapons. Still, 5 metric tons 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.[16] 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 of warfare since World War I, despite (or perhaps because of) the substantial numbers of weapons that were 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 the spring of 2005, 168 countries were state parties to the CWC. Four countries—the United States, Russia, India, and South Korea—have declared their possession of chemical weapons stockpiles totaling more than 70,000 metric tons of agents. Russia's 40,000 metric tons is the largest declared stockpile,

Table 1.4. **Countries Suspected of Retaining Significant Chemical Weapons Programs**

China
Egypt
Iran
Israel
North Korea
Syria

and that nation's financial difficulties make complete elimination of its 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. Forty-nine of the 64 declared facilities were destroyed or converted, nearly 10,700 metric tons of chemical agents were destroyed, and one-fourth of the 8.6 million chemical weapons declared by the four possessor states was eliminated through treaty procedures between 1997 and February 2005.[17]

The most significant remaining suspected national programs are those of China, Egypt, Iran, Israel, North Korea, and Syria (table 1.4). The other countries sometimes suspected of conducting chemical weapons research include India, Pakistan, Sudan, and Taiwan, but there is no publicly available evidence of such activity.

SUSPECTED CHEMICAL WEAPONS STOCKPILES. U.S. intelligence assessments state that *North Korea* 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.[18]

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.[19] *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.[20] 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.

Iran's declaration at the May 1998 session of the CWC conference was the first time that nation had admitted to having had a chemical weapons program, apparently developed in response to Iraqi chemical warfare attacks during the Iran-Iraq War. U.S. 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.[21] Iranian officials deny these charges.

China has ratified the CWC and has declared that it does not possess an inventory of chemical agents. U.S. officials, however, believe that China has a moderate inventory of traditional agents, an advanced chemical warfare program and a wide variety of potential delivery systems.[22]

Libya gave up its offensive chemical weapons capability with the 2003 negotiations and has joined the CWC. *Iraq*'s chemical weapons program ended after the 1991 Gulf War, but it has not yet joined the CWC. *Albania* discovered and declared a small cache of chemical weapons in 2004, pledging to destroy them by 2006.

CHEMICAL WEAPON RESEARCH PROGRAMS. *Sudan* may have an active interest in acquiring the capability to produce chemical agents but is not believed to have done so. Sudan is a member of the CWC. *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. Though Pakistan has imported a number of dual-use chemicals, they are probably for the development of commercial chemical industrial activities and not for a dedicated warfare program. *India*'s declaration under the CWC in June 1997 was the first time that nation acknowledged it had a chemical warfare production program. Though it has pledged to destroy all agents and production facilities, India's activities and exports of dual-use equipment and chemical precursors cause some concern. *South Korea* ended its weapons 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 them: ballistic missiles (table 1.5). 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.

In comparison with the high point of deployments in the mid-1980s, there are now dramatically fewer long-range, intermediate-range, and medium-range ballistic missiles (see chapter 5, "Missile Proliferation"). Most nations that have missiles have only short-range, Scud-type missiles, and many of these arsenals are being retired as they age. The number of countries trying to develop long-range ballistic missiles has not changed greatly in 20 years and is somewhat smaller than in the past. The nations now attempting to do so are also smaller, poorer, and less technologically advanced than were those with missile programs 20 years ago.

Only China and Russia have the capability to hit the mainland of the United States with nuclear warheads on intercontinental land-based ballistic missiles. This has not changed since Russia and China deployed their first intercontinental

Table 1.5. **The Thirty Nations with Ballistic Missiles**

Nineteen countries possess only short-range ballistic missiles (that is, with ranges of less than 1,000 kilometers):		
Afghanistan Armenia Bahrain Belarus Egypt Greece Iraq	Kazakhstan Libya Slovakia South Korea Syria Taiwan Turkey	Turkmenistan Ukraine United Arab Emirates Vietnam Yemen
Seven countries possess medium-range ballistic missiles (with ranges of 1,000–3,000 kilometers):		
China India	Iran Israel	North Korea Pakistan Saudi Arabia
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 France	Russia	United Kingdom United States

ballistic missiles 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.

The greatest programs of concern are those developing medium-range missiles in India, Iran, Israel, North Korea, and Pakistan. None of these nations view their programs as threatening, but their neighbors take a decidedly different view. Though these programs are a cause for serious regional concern and could develop into potential international threats, overall the ballistic missile threat is limited and changing slowly.

A Global Nuclear Threat Assessment

On the basis of the proceeding information, it is reasonable to conclude that of all the potential threats, nuclear weapons pose the greatest risks. We can categorize these threats along four axes, though developments along one axis often influence developments along the others. These four categories of threat are nuclear terrorism, new nuclear weapon states and regional conflict, existing nuclear arsenals, and regime collapse. The greatest concerns are outlined here.

Nuclear Terrorism: The Most Serious Threat

Although *states* can be deterred from using nuclear weapons by fear of retaliation, *terrorists*, who do not have land, people, or national futures to protect, may not be deterrable. Terrorists' acquisition of nuclear weapons therefore poses the greatest single nuclear threat. The gravest danger arises from terrorists' access to state stockpiles of nuclear weapons and fissile materials, because acquiring a supply of nuclear material (as opposed to making the weapon itself) remains the most difficult challenge for a terrorist group. So-called outlaw states are not the most likely source. Their stockpiles, if any, are small and exceedingly precious, and hence well guarded. (Nor are these states likely to give away what they see as the jewels in their security crowns.) Rather, the most likely sources of nuclear weapons and materials for terrorists are storage areas in the former states of the Soviet Union and in Pakistan, and fissile material kept at dozens of civilian sites around the world.

Russia and other former Soviet states possess thousands of nuclear weapons and hundreds of tons of inadequately secured nuclear material. Terrorist organizations and radical fundamentalist groups operate within Pakistan's borders. National instability or a radical change in government could lead to the collapse of state control over nuclear weapons and materials and to the migration of nuclear scientists to the service of other nations or groups.

There is also a substantial risk of terrorist theft from the nuclear stockpiles in more than 40 countries around the world. Many of these caches of materials consist of highly enriched uranium that could be directly used in nuclear weapons or further enriched to weapons grade. There are also significant stockpiles of plutonium that could be used in a weapon, though with more difficulty.

New Nuclear Nations and Regional Conflicts

The danger posed by the acquisition of nuclear weapons by Iran or North Korea is not that either country would likely use these weapons to attack the United States, the nations of Europe, or other countries. States are and will continue to be deterred from such attacks by the certainty of swift and massive retaliation. The greater danger is the reactions of other states in the region. A nuclear chain reaction could ripple throughout a region and across the globe, triggering weapons decisions in several, perhaps many, other states. And along with these rapid developments and the collapse of existing norms could come increased regional tensions, possibly leading to regional wars and to nuclear catastrophe.[23]

New nuclear weapon states might also constrain the United States and others, weakening their ability to intervene to avoid conflict in dangerous regions—as well as, of course, emboldening Tehran, Pyongyang, or other new possessors.

Existing regional nuclear tensions already pose serious risks. The decades-long conflict between India and Pakistan has made South Asia for many years the region most likely to witness the first use of nuclear weapons since World War II. There is an active missile race under way between the two nations, even as China and India continue their rivalry. In Northeast Asia, North Korea's nuclear capabilities

remain shrouded in uncertainty but presumably continue to advance. Miscalculation or misunderstanding could bring nuclear war to the Korean peninsula.

In the Middle East, Iran's nuclear program, together with Israel's nuclear arsenal and the chemical weapons of other neighboring states, add grave volatility to an already conflict-prone region. If Iran were to acquire nuclear weapons, Egypt, Saudi Arabia, or others might initiate or revive their nuclear weapons programs. It is possible that the Middle East could go from a region with one nuclear weapon state to one with two, three, or five such states within a decade—with existing political and territorial disputes still unresolved.[24]

The Risk from Existing Arsenals

There are grave dangers inherent in the maintenance of thousands of nuclear weapons by the United States and Russia and the hundreds of weapons held by China, France, the United Kingdom, Israel, India, and Pakistan. Though each state regards its nuclear weapons as safe, secure, and essential to its security, each views others' arsenals with suspicion.

Though the Cold War has been over for more than a dozen years, Washington and Moscow maintain thousands of warheads on hair-trigger alert, ready to launch within fifteen minutes. This greatly increases the risk of an unauthorized launch. Because there is no time buffer built into each state's decision-making process, this extreme level of readiness also enhances the possibility that either country's president could prematurely order a nuclear strike based on flawed intelligence.[25]

Recent advocacy by some in the United States of new battlefield uses for nuclear weapons could lead to new nuclear tests. The five nuclear weapon states recognized by the NPT have not tested since the signing of the Comprehensive Test Ban Treaty (CTBT) in 1996, and no state has tested since India and Pakistan did so in May 1998. New U.S. tests would trigger tests by other nations and cause the collapse of the CTBT, which is widely regarded as a pillar of the nonproliferation regime.

To the extent that the leaders of a given state are contemplating acceding to U.S. or international nonproliferation demands, these leaders may feel a strong need for equity so that they can show their public that giving up nuclear aspirations is fair and in their interest. It is difficult, if not impossible, to demonstrate either positive outcome when immensely powerful nuclear weapon states reassert the importance of nuclear weapons to their own security.

The Risk of Regime Collapse

If U.S. and Russian nuclear arsenals remain at Cold War levels, many nations will conclude that the weapon states' promise to reduce and eventually eliminate these arsenals has been broken. Non-nuclear states may therefore feel released from their pledge not to acquire nuclear arms.

The NPT has already been severely threatened by the development in several states of facilities for enriching uranium and reprocessing plutonium. Although

each state has asserted that these facilities are for civilian use only, the resulting supplies of nuclear materials give each country a "virtual" nuclear weapons capability. This situation greatly erodes the confidence that states can have in a neighbor's non-nuclear pledge.

Additionally, there appears to be growing acceptance of the nuclear status of India and Pakistan, with each country accruing prestige and increased attention from leading nuclear weapon states, including the United States. Some now argue that a nuclear Iran or North Korea could also be absorbed into the international system without serious consequence.

If the number of states with nuclear weapons increases, the original nuclear weapon states fail to comply with their disarmament obligations, and states such as India gain status for having nuclear weapons, it is possible that Brazil, Japan, and other major non-nuclear nations will reconsider their nuclear choices. Most nations would continue to eschew nuclear weapons, if only for technological and economic reasons, but others would decide that nuclear weapons were necessary to improve their security or status. There is a real possibility, under these conditions, of a systemwide collapse.

Successes and Failures of the Nonproliferation Regime

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 have worried that proliferation could run out of control, creating a bleak, dangerous world with dozens of nations armed with nuclear 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 nuclear weapons, by the end of the decade 15 or 20 nations would have 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. Several European nations were already actively pursuing nuclear weapons 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, which ended nuclear tests in the atmosphere, under water, and in outer space.

U.S. diplomacy and international efforts to create legal and diplomatic barriers to the acquisition of nuclear weapons, which were codified in the NPT in 1968, dramatically stopped the rush toward nuclear weapons status. Twenty years after Kennedy's warning, only China (with Soviet help) had openly joined the ranks of the new nuclear nations, whereas 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, which 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."[26]

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

Since September 11, 2001, few have questioned 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 possible source of biological, chemical, and nuclear weapons, material and expertise."[27] 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 during 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.

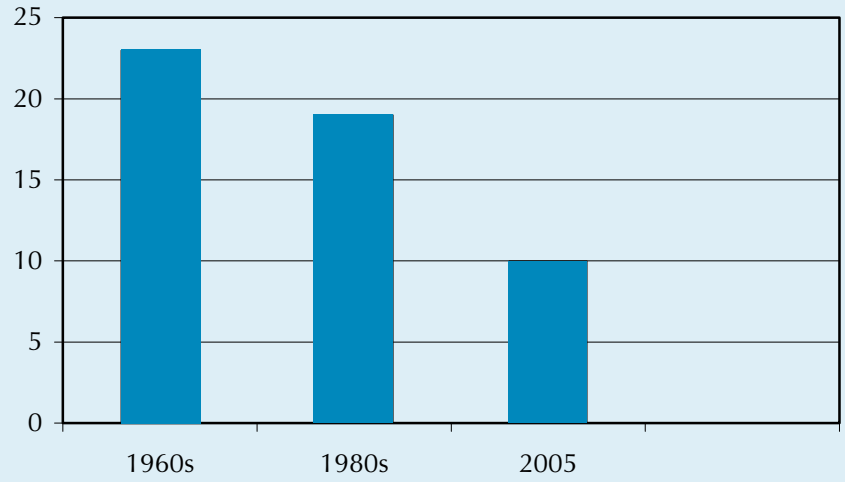
Since 1964, only four nations are known to have overcome the substantial diplomatic and technical barriers to manufacturing nuclear weapons. The proliferation of biological and chemical weapons is broader, but it is still mainly confined to two regions of the world: the Middle East and Northeast Asia.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

Even with all the serious challenges it has faced, the nonproliferation regime has still had a remarkable record of success (see figure 1.1). 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. Although the regime may have

Figure 1.1. **Countries with Nuclear Weapons or Programs (number of programs)**



NOTE

In the 1960s, 23 countries had weapons, were conducting weapons-related research, or were discussing the pursuit of weapons: Argentina, Australia, Brazil, Canada, China, Egypt, France, India, Israel, Italy, Japan, Norway, Romania, South Africa, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States, USSR, West Germany, and Yugoslavia.

In the 1980s, 19 countries had weapons or were conducting weapons-related research: Argentina, Brazil, Canada, China, France, India, Iran, Iraq, Israel, Libya, North Korea, Pakistan, South Africa, South Korea, Taiwan, United Kingdom, United States, USSR, and Yugoslavia.

In 2005, in addition to the 8 states with nuclear weapons, Iran and North Korea are suspected of having active nuclear weapons programs.

worked in the past, they doubt the holdouts can be convinced to adopt the same norms as those held by the regime founders. This inspection regime had failed to independently detect significant hidden programs in Iran, Iraq, and Libya. Many officials in the George W. Bush administration believe that the entire process of negotiating and implementing nonproliferation treaties is both unnecessary and harmful to U.S. national security interests. They argue that some of the treaties—such as the CTBT, 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 CWC and the BWC, promote a false sense of security as some nations sign, then cheat on, the agreements.

The Bush administration therefore has implemented a radically new nonproliferation approach. Previous presidents, as noted above, treated the weapons themselves as the problem and sought their elimination through treaties. President Bill Clinton, for example, warned in November 1998 of the threat "posed by *the proliferation of nuclear, biological, and chemical weapons and the means of delivering such weapons*" (italics added). President Bush framed the issue differently in his 2003 State of the Union address: "The gravest danger facing America

and the world is *outlaw regimes that seek and possess nuclear, chemical, and biological weapons*" (italics added). The Bush administration thus has changed the focus from "what" to "who." This corresponds to a strategy that seeks the elimination of regimes rather than weapons. This action-oriented approach has been detailed in two key documents—*The National Security Strategy of the United States of America* (September 2002) and *National Strategy to Combat Weapons of Mass Destruction* (December 2002)—in which the administration states its view that the threat from weapons of mass destruction emanates from a small number of outlaw states and from the nexus of these states, nuclear weapons and materials, and terrorists.[28]

The first direct application of this theory was the war with Iraq. There had been previous applications of military force to deal with proliferation threats, but this was the world's first nonproliferation war, a battle fought primarily over the claimed need to prevent the acquisition or transfer of nuclear, biological, and chemical weapons (see chapter 17, "Iraq").

Three major conclusions can be drawn from the war:

> In 2003, Iraq was not producing and did not have stockpiles of, nuclear, biological or chemical weapons or any Scud missiles or unmanned aerial vehicles designed to deliver such weapons. All active nuclear, chemical, and biological programs ended between 1991 and 1996.
>
> U.N. sanctions and inspections were more effective than most realized in disarming Iraq after the 1991 War. Inspectors in 2003 were finding what there was to find.
>
> In the year prior to the war, U.S. and British officials systematically misrepresented Iraq's weapon capabilities.[29]

This last finding is contested by officials in the U.S. and British administrations but is widely accepted outside these governments. Further, none of these conclusions appear to have diminished the enthusiasm of the proponents of the Iraq war for applying the Iraq model to other problem states. The new strategy, however, has not yet proved superior to the one it replaced.

Since 2000, proliferation problems have grown worse, not better (see table 1.6). Libya has been the only unqualified success, as that nation has abandoned decades of work on nuclear and chemical weapons and missile programs. But Iran has accelerated its program—whether peaceful or not—in the past few years. So has North Korea. That country ended the freeze on its plutonium program, claimed to have reprocessed the plutonium into weapons, withdrew from the NPT, and declared itself a nuclear weapon state. Globally, the threat from nuclear terrorism has grown as U.S. intelligence officials have concluded that the Iraq War made the terrorism problem worse and supplies of weapons and weapons materials remain dangerously insecure.[30] Though U.S. attention focused on the three "axis of evil" states, the nuclear black market of Pakistan's A. Q. Khan spread nuclear weapons technology and know-how around the world. It is not clear if this network has shut down or merely gone further underground.

Meanwhile, the United States and Russia have ended the process of negotiating reductions in their nuclear arsenals, and the reductions themselves are

Table 1.6. **The Fifteen Countries with Nuclear, Biological, or Chemical Weapons or Offensive 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?
North Korea	W?	W	W
Iran	R	R?	W?
Egypt		R?	W
Syria		R?	W
South Korea			W*
Libya			W*
Albania			W*

Key: W = has known weapons or agents; R = has known research program; ? = is suspected of having weapons or programs; and W* = possesses chemical weapons but has declared them under the Chemical Weapons Convention and is in the process of eliminating them.

proceeding at a slower pace than previous administrations planned. Programs to secure nuclear materials in the states of the former Soviet Union are also slowing down, though only half the materials have been secured. Finally, there is growing concern that the entire nonproliferation regime is in danger of a catastrophic collapse. (See the chapters on Iran, Libya, North Korea, Pakistan, Russia, and the United States for details.)

Elements of a New Nonproliferation Policy

Some believe that the strategy, or some modified variation, could still prove its worth. Many countries are cooperating in the Proliferation Security Initiative to interdict illegal trade in weapon components (see chapter 2 for more on this initiative). There is a much greater willingness internationally to enforce nonproliferation commitments. The right combination of force and diplomacy could yet result in negotiated solutions to the North Korean and Iranian programs. And prospects for peacefully resolving regional conflicts may have increased through the growing movement for democracy in the Middle East and Central Asia.

A combination of approaches may offer the best chance of success. There is the need for a new strategy that combines the best elements of the United States–centric, force-based approach with the traditional multilateral, treaty-based approach. For example, the European Union has crafted a joint nonproliferation strategy that includes tying all E.U. trade agreements to the observance of nonproliferation treaties and norms. This "soft power" approach could meld with the "hard power" of the United States to replicate the success of the United States and United Kingdom with Libya. The Libyan model could emerge from and prevail over the Iraq model: Change a regime's behavior rather than change the regime.

The theory and practical applications of a new approach have been detailed in a 2005 Carnegie Endowment report, *Universal Compliance: A Strategy for Nuclear Security*.[31] This report analyzes how to end the threat of nuclear terrorism by implementing comprehensive efforts to secure and eliminate nuclear materials worldwide and to stop the illegal transfer of nuclear technology. The strategy would prevent new nuclear weapon states by increasing penalties for withdrawal from the NPT, enforcing compliance with strengthened treaties, and radically reforming the nuclear fuel cycle to prevent states from acquiring dual-use technologies for uranium enrichment or plutonium reprocessing. The threat from existing arsenals would be reduced by shrinking global stockpiles, curtailing research on new nuclear weapons, and taking the weapons off hair-trigger-alert status. Finally, greater efforts would be devoted to resolving the regional conflicts that fuel proliferation imperatives and to bringing the three nuclear weapon states outside the NPT into conformance with a expanded set of global nonproliferation norms.

Tomorrow's solutions, like yesterday's, will not emerge in a diplomatic vacuum. As we struggle to develop new policies, it is worth remembering that the nonproliferation treaties were 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 weapons programs. The Soviet Union simply forced nonproliferation on its alliance system, whereas the United States was not adverse to using strong-arm tactics to compel South Korea and Taiwan, for example, to abandon nuclear weapons research.

Further thwarting proliferation, many developing nations found that their ambitions ran into formidable financial and technological obstacles to nuclear weapons development, missile engineering, and biological agent weaponization. This is still true today and should give pause to those who predict a smooth and rapid rise to nuclear weapon status for new nations.

These financial, technical, and alliance factors were not, however, sufficient barriers to proliferation. These factors were present in the 1960s and 1970s. But before the signing of the NPT, nuclear proliferation was on the rise; afterward, it was on the decline. The critical importance of the NPT and other treaties is that they provide the necessary international legal mechanism and establish the global norms that give nations a clear path to a non-nuclear future. These

historic lessons must be remembered anew, lest in our haste to construct new solutions we tear down the very structures we mean only to repair.

NOTES

1. For a comprehensive study of a new nonproliferation strategy, see George Perkovich, Jessica Mathews, Joseph Cirincione, Rose Gottemoeller, and Jon Wolfsthal, *Universal Compliance: A Strategy for Nuclear Security* (Washington, D.C.: Carnegie Endowment for International Peace, 2005); available at www.ProliferationNews.org.
2. President George Bush, "Remarks by the President to the Troops and Personnel," Norfolk Naval Air Station, Virginia, February 13, 2001.
3. For a brief discussion of the threat from conventional attacks on industrial and urban infrastructures, see the first edition of this book: Joseph Cirincione with Jon B. Wolfsthal and Miriam Rajkumar, *Deadly Arsenals: Tracking Weapons of Mass Destruction* (Washington, D.C.: Carnegie Endowment for International Peace, 2002), pp. 16–17.
4. Six nations abandoned indigenous nuclear weapon programs that were under way or under consideration in the 1960s: Egypt, Italy, Japan, Norway, Sweden, and West Germany. Since the late 1970s, Argentina, Australia, Belarus, Brazil, Canada, Iraq, Kazakhstan, Libya, Romania, South Africa, South Korea, Spain, Switzerland, Taiwan, Ukraine, and Yugoslavia have abandoned nuclear weapon programs or nuclear weapons (or both) on their territory. North Korea and Iran are the only two states that began acquiring nuclear weapon capabilities in this later period and have not ceased the effort.
5. In 1970, the year the NPT entered into force, there were about 38,000 nuclear weapons in global arsenals, mostly in the stockpiles of the United States and the Soviet Union; by 1986, the number of weapons had increased to a peak of 65,000 worldwide; in 2004, there were approximately 27,000.
6. National Council on Radiation Protection and Measurements, "Management of Terrorist Events Involving Radioactive Material," Bethesda, Md., October 24, 2001.
7. Milton Leitenberg, "Biological Weapons Arms Control," Center for International and Security Studies, University of Maryland, 1996, p. 20; available at www.ceip.org/files/projects/npp/pdf/leitenberg.pdf.
8. John Bolton, U.S. undersecretary of state for arms control and international security, "Remarks to the Fifth Biological Weapons Convention," Geneva, November 19, 2001.
9. Bolton, "Remarks to the Fifth Biological Weapons Convention."
10. John Bolton, U.S. undersecretary of state for arms control and international security, "Iran's Continuing Pursuit of Weapons of Mass Destruction," statement before the House International Relations Committee Subcommittee on the Middle-East and Central Asia, June 24, 2004.
11. Dany Shoham, "Chemical and Biological Weapons in Egypt," *Nonproliferation Review*, Spring–Summer 1998, pp. 48–58.
12. U.S. Arms Control and Disarmament Agency, "Annual Report to Congress," July 1996.
13. Shoham, "Chemical and Biological Weapons in Egypt," p. 55.
14. U.S. Department of Defense, *Proliferation: Threat and Response* (Washington, D.C.: U.S. Department of Defense, 2001), p. 45.
15. Ibid., pp. 24, 28.
16. Julian Perry Robinson, "Chemical Weapons Proliferation in the Middle East," in *Non-Conventional Weapons Proliferation in the Middle East*, edited by Efraim Karsh, Martin Navias, and Philip Sabin (Oxford: Clarendon Press, 1993), p. 80.
17. Organization for the Prohibition of Chemical Weapons, "Instant Briefing: Results," available at www.opcw.org/ib/.
18. U.S. Department of Defense, *Proliferation: Threat and Response*, p. 11.
19. E. J. Hogendoorn, "A Chemical Weapons Atlas," *Bulletin of the Atomic Scientists*, September/October 1997, p. 37.
20. Ibid., p. 37.
21. Ibid., p. 36.

22. Ibid., p. 15.
23. This is the danger President John Kennedy warned of in 1963: "I ask you to stop and think for a moment what it would mean to have nuclear weapons in so many hands, in the hands of countries large and small, stable and unstable, responsible and irresponsible, scattered throughout the world," he said. "There would be no rest for anyone then, no stability, no real security, and no chance of effective disarmament. There would only be the increased chance of accidental war, and an increased necessity for the great powers to involve themselves in what otherwise would be local conflicts." John F. Kennedy, "Radio and Television Address to the American People on the Nuclear Test Ban Treaty," July 26, 1963; available at www.jfklibrary.org/jfk_test_ban_speech.html.
24. Several countries in the Middle East are capable of pursuing nuclear weapon programs or otherwise acquiring nuclear weapons, including Saudi Arabia, Egypt, and Turkey. Saudi Arabia might seek to purchase nuclear weapons from Pakistan or invite Pakistan to station nuclear weapons on its territory. Other countries have at least the basic facilities and capabilities to mount a nuclear weapon program, albeit not without significant political and economic consequences. Egypt and Turkey could probably acquire enough nuclear material to produce a nuclear weapon within a decade of launching such an effort.
25. Former U.S. senator Sam Nunn argues, "The more time the United States and Russia build into our process for ordering a nuclear strike the more time is available to gather data, to exchange information, to gain perspective, to discover an error, to avoid an accidental or unauthorized launch." Speech to the Carnegie International Non-Proliferation Conference, June 21, 2004, available at www.ProliferationNews.org.
26. Leonard Spector, *Nuclear Proliferation Today* (New York: Vintage Books, 1984), pp. 3–4.
27. "President Announces Reduction in Nuclear Arsenal," press conference by President Bush and Russian president Vladimir Putin, November 13, 2001; available at www.whitehouse.gov/news/releases/2001/11/20011113-3.html.
28. National Security Council, *The National Security Strategy of the United States of America* (Washington, D.C.: White House, 2002); available at www.whitehouse.gov/nsc/nss.pdf. National Security Council, *National Strategy to Combat Weapons of Mass Destruction* (Washington, D.C.: White House, 2002), p. 1; available at www.whitehouse.gov/news/releases/2002/12/WMDStrategy.pdf.
29. For a detailed examination of these issues, see Joseph Cirincione, Jessica Mathews, and George Perkovich, *WMD in Iraq: Evidence and Implications* (Washington, D.C.: Carnegie Endowment for International Peace, 2004); available at www.ProliferationNews.org.
30. See testimony of Central Intelligence director Porter Goss and Defense Intelligence Agency director Admiral Lowell Jacoby before the Senate Intelligence Committee, February 16, 2005.
31. Perkovich et al., *Universal Compliance*.