THE BIOLOGICAL WEAPONS THREAT AND NONPROLIFERATION OPTIONS

A Survey of Senior U.S. Decision Makers and Policy Shapers

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Executive Summary

Among other events, the anthrax letter attacks of 2001 considerably escalated awareness of the threat of biological weapons. The absence of another headline-grabbing bioterrorist attack, the exposure of another government bioweapons program, or a major accident at a facility working with highly infectious pathogens in the past five years may have altered perceptions about the gravity of the biological weapons threat. One way to find out if that is the case is to survey the views of senior U.S. officials and legislators, former senior policymakers, and nongovernmental experts about the nature of the biological weapons threat. The first part of the survey described in this report does just that, while the second polls the same individuals about what steps, if any, should be taken to address the biological weapons threat and what priority should be placed on such endeavors.

The key findings of the survey are:

- Biological weapons are a major threat that is viewed as somewhat increasing, greater than chemical weapons threat and, by a slim majority, a threat greater than or equal to the threat of nuclear weapons.
- The top two reasons for an increasing bioweapons threat are the increasing availability of dual-use know-how, technology, and equipment and the revolution in the life sciences creating technologies and know-how that makes biological weapons acquisition easier.
- A major biological attack is somewhat unlikely within five years and somewhat likely or, according to over a quarter of those surveyed, very likely within a decade.
- The most likely bioweapons proliferation scenarios are: 1) small-scale, sporadic biological attacks by states or terrorists to undermine public confidence in government; and, 2) lone or deranged individuals who produce and use biological weapons.
- Survey participants almost universally backed requiring facilities that work with highly infectious pathogens to establish strong biosafety and biosecurity measures, oversee genetic engineering experiments, and certify their employees in biosafety and biosecurity.
- A pronounced majority supported the criminalization of bioweapons-related activities, professional codes for life scientists, a standard curriculum in ethics, biosafety, and biosecurity for life sciences students, and monitoring provisions for the biological and weapons ban.
- Seventy-one percent of those surveyed assessed the U.S. government's recent performance on biological weapons nonproliferation as either fair or poor.
- Most survey participants thought the U.S. government should devote some policy and spending priority to bioweapons nonproliferation, but forty-two percent argued this agenda should receive top policy priority.
- The policy options deemed most useful to bioweapons nonproliferation are biosecurity and biosafety measures and the criminalization of bioweapons-related activities.
- Seventy-two percent of the survey participants endorsed multilateral biological weapons nonproliferation measures, while twenty-one percent preferred a unilateral approach.

From 25 October to 15 November 2006, fifty-two senior U.S. government officials and legislators, former senior officials, and nongovernmental experts were polled.

Introduction

The anthrax letter attacks in the fall of 2001, which targeted U.S. politicians and reporters, killed five, and terrified countless people in the United States and elsewhere, considerably escalated awareness of the threat of biological weapons. Other events in the 1990s that raised concerns about biological weapons proliferation included revelations about the USSR's mammoth covert biological weapons program, the unmasking of Iraq's bioweapons program, and the failed attempts of the Japanese cult Aum Shinrikyo, which attacked Tokyo subway commuters in mid-March 1995 with the nerve agent sarin, to obtain and disperse biowarfare agents. Dire predictions of catastrophic acts of bioterrorism followed the 2001 anthrax attacks. Yet, terrorists have eschewed biological, radiological, and chemical weapons in favor of bombs and other conventional weapons.

The absence of another headline-grabbing bioterrorist attack, the exposure of another government bioweapons program, or a major accident at a facility working with highly infectious pathogens in the past five years may have altered perceptions about the gravity of the biological weapons threat. One way to find out if that is the case is to survey the views of senior U.S. officials and legislators, former senior policymakers, and nongovernmental experts about the nature of the biological weapons threat. The first part of the survey described in this report does just that, while the second polls the same three groups of individuals about what steps, if any, should be taken to address the biological weapons threat and what priority should be placed on such endeavors.

The remainder of this chapter provides background information about biological weapons, developments that may influence the bioweapons proliferation threat, existing nonproliferation tools, and several bioweapons nonproliferation policy options. This chapter concludes with a description of the survey methodology. Subsequent chapters of the report present the survey results related to the biological weapons threat, pertinent nonproliferation policy options, and the U.S. government's performance and future priorities related to biological weapons nonproliferation.

Background

Early in human history, adversaries began trying to harness disease for purposes of war but often encountered difficulties in wielding disease effectively as a weapon. Naturally occurring diseases that sicken and/or kill humans, animals, and plants are the starting point for biological weapons. Diseases come in the form of bacteria, viruses, fungi, rickettsiae, and toxins. Contagious and non-contagious diseases like plague and anthrax, respectively, can both be turned into weapons.[1]

In Medieval times, commanders attempted to harm their opponents by contaminating water supplies with cadavers of animals or humans that died from an infectious disease or

[1] For more on the characteristics of biological weapons, their manufacture, and delivery systems, see *Textbook of Military Medicine: Medical Aspects of Chemical and Biological Warfare, Part I: Warfare, Weaponry, and the Casualty*, ed. Frederick R. Sidell, Ernest J. Takafuji, and David R. Franz (Washington, DC: Surgeon General, U.S. Department of the Army, 1997); U.S. Congress, *Technologies Underlying Weapons of Mass Destruction*, OTA-BP-ICS-119 (Washington, DC: U.S. Government Printing Office, December 1993).

catapulting bodies over the walls of a besieged city.[2] In modern warfare, states have used disease sparingly. The most egregious case dates to World War II, when the Japanese Imperial Army unleashed plague, cholera, typhoid, and other diseases against Chinese civilians, killing an estimated 300,000.[3] To disperse biological agents today, missiles, aircraft bombs, artillery, or more rudimentary delivery systems (e.g., sprayers) can be used. The delivery of an aerosolized biological agent in ultra-fine particles that can be inhaled into the lungs poses the highest risk of mass casualties. Attacks on the human population can also be executed through deliberate contamination of the food supply because infection can occur through ingestion. Cuts or abrasions on the skin also present a route for exposure to a disease.[4]

The susceptibility of biological agents to meteorological conditions (e.g., ultraviolet rays) that can quickly kill the agent complicates the ability to execute an effective biological weapons attack. Agents can be hardened against some meteorological stresses, but a change in wind direction can still blow the agent off target.[5] Nonetheless, biological weapons can be used tactically and strategically. Tactically, a command post can be attacked with a non-contagious disease to take out an adversary's military leadership. A strategic attack might target large metropolitan areas with a contagious disease, instigating a pandemic that eventually fells so many civilian workers that combat troops can no longer be sustained because they are not being supplied with bullets, food, and other necessities. Deliberate targeting of civilians completely vitiates the 1949 Geneva Convention's principles of war, but the potentially devastating effects of a biological attack could be of several reasons that proliferators may find biological weapons attractive. Others might include the ability to offset an opponent's conventional or nuclear military advantage with biological weapons, the cheapness and technical ease with which biological weapons can be acquired in comparison to nuclear weapons, and the ability to create a biological weapons capability covertly. One of the survey questions broaches this aspect of the proliferation problem.

The possible integration of advanced technologies into biological weapons programs and the interest of sub-national actors in biological weapons could create qualitative and quantitative proliferation quandaries. The pace of discovery in the life sciences over the past few decades has been astonishing, from knowledge about the human genome and the pathogenesis of diseases to genetic engineering techniques that are being increasingly used to alter genetic material artificially and also to transfer it from one microorganism to another, including from one species to another. Genetic engineering can thus be used to make diseases resistant to vaccines and medical treatments and to make diseases more lethal or more contagious. With advanced

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[2] "Biological Weapons: Research, Development and Use from the Middle Ages to 1845," in *SIPRI Chemical and Biological Warfare Studies*, no. 18, ed. Erhard Geissler and John Ellis van Courtland Moon (Oxford: Oxford University Press, 1999).

[3] Sheldon H. Harris, *Factories of Death: Japanese Biological Warfare 1932-45 and the American Cover-up* (New York: Routledge, 1994).

[4] Op cit., *Technologies Underlying Weapons of Mass Destruction*; *Textbook of Military Medicine: Warfare, Weaponry, and the Casualty.*

[5] Biological agents can be dispersed in a wet slurry, which is more vulnerable to environmental stresses, or in dry form, where the agent is dried and microencapsulated with coatings that help stabilize and preserve the agent and also facilitate its spread from the original release point. *Health Aspects of Chemical and Biological Weapons* (Geneva: World Health Organization, 1970): 93-4; Technologies Underlying Weapons of Mass Destruction, 82, 94-6.

technologies, scientists can also fabricate diseases from segments of biologic material.[6] The revolution in the life sciences shows no signs of abatement. Many life-saving and quality-of-life enhancing innovations will emerge from life sciences laboratories in the decades ahead, but the potential misuse of new technologies, equipment, and know-how for malevolent purposes will be ever present.[7]

In the past couple of decades, two patterns in terrorist activities have raised the possibility that terrorists will turn to biological weapons as a preferred tool of attack. The first trend is the proven intent of some terrorist groups to cause the highest possible death tolls with ever more shocking attack methods, a dramatic change from the traditional terrorist practice of acts of violence calibrated to cultivate sympathy for a group's political objectives.[8] The second trend is the growth in the number of incidents wherein terrorists are plotting biological attacks, acquiring biological substances, and trying to produce and disperse biological agents.[9] To date, attacks that demonstrate a clear aptitude with biological weapons are atypical, with the 2001 anthrax letters being a prominent exception. At some point, perhaps taking advantage of advanced technologies, terrorists may be able to overcome routinely the technical obstacles to a mass casualty biological attack. At that juncture, the number of injuries and deaths from bioterrorist attacks, which are negligible in comparison to the huge casualties accumulating from suicide bombings, could skyrocket.[10] The survey included five questions designed to allow current and former senior policymakers and national security experts to characterize and assess the biological weapons proliferation threat.

Current Nonproliferation Mechanisms

Two major international accords were designed to contend with the threat of biological weapons at the nation-state level. The prospect of deliberate use of disease was so abhorrent that the international community outlawed its use in war in the 1925 Geneva Protocol, which also bans the use of poison gas. A total of 133 states are members of the Geneva Protocol.

The other component of the international biological weapons nonproliferation regime is the 1975 Biological and Toxin Weapons Convention (BWC), which prohibits the development, production, and stockpiling of germ weapons. This treaty has 155 members. Typical of arms control accords of 1970s vintage, the Convention does not include regular inspections or other

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[6] Ronald Jackson et al., "Expression of Mouse Interleukin-4 by a Recombinant Ectromelia Virus Suppresses Cytolytic Lymphocyte Responses and Overcomes Genetic Resistance to Mousepox," *Journal of Virology* 75, no. 3 (February 2001): 1205-10; Jeronimo Cello, Aniko V. Paul, Eckard Wimmer, "Chemical Synthesis of Poliovirus cDNA: Generation of Infectious Virus in the Absence of Natural Template," *Science* 297, no. 5583 (9 August 2002): 1016–8; Jeffrey K. Tautenberger et al., "Characterization of the 1918 influenza virus polymerase genes," *Nature* 437 (6 October 2005): 889-93.

[7] Malcolm Dando, *Biological Warfare in the 21st Century: Biotechnology and the Proliferation of Biological Weapons* (New York: Brassey's, 1994): 86-129.

[8] Walter Reich, ed. *Origins of Terrorism: Psychologies, Ideologies, Theologies, States of Mind* (Washington, DC: Woodrow Wilson Center Press, 1998).

[9] For databases that track terrorist activities, go to: www.mipt.org or to www.cns.miis.edu.

[10] On the technical hurdles facing terrorist acquisition and use of biological weapons and statistics of terrorist activities, Amy E. Smithson with Leslie-Anne Levy, Chapter 2, *Ataxia: The Chemical and Biological Terrorist Threat and US Response* (Washington, DC: Henry L. Stimson Center, 2000).

intrusive measures to monitor treaty compliance.[11] The United States, United Kingdom, France, and Canada renounced biological weapons and eliminated their offensive weapons programs before the BWC was activated.

In contrast, the Soviet Union ramped up its biological weapons program in the 1970s, hiding much of it within commercial facilities. In 1992, Russian President Boris Yeltsin admitted that the USSR had a secret offensive biological weapons program.[12] Defectors came forward to describe this program in considerable detail. The Soviets employed tens of thousands of scientists and technicians to weaponize over fifty diseases, including contagious diseases like smallpox, plague, and Marburg. Soviet scientists also engineered multiple diseases to nullify known vaccines and medical treatments.[13] Many of the facilities from this vast weapons program are now engaged in peaceful research with foreign collaborators and attempting to establish commercial activities, but Russia's refusal to allow outsiders into a handful of military sites perpetuates some concern that remnants of the old weapons program remain active.

In addition, U.S. intelligence assessments have highlighted biological weapons proliferation concerns about such nations as North Korea and Syria.[14] However, Iraq is the only other country confirmed in recent years to have had an offensive biological weapons program. Inspectors from United Nations Special Commission uncovered sufficient evidence of a covert bioweapons program to compel Iraq to admit in that it had produced and weaponized a few biological agents (e.g., anthrax, botulinum toxin).[15] Iraq was a BWC signatory. The Iraqi and Soviet programs went undetected for years, underscoring the problem of relying solely on national technical means to monitor compliance with the BWC.

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[11] Article 1 of this treaty stipulates that states cannot possess biological warfare agents in quantities and types that have no peaceful, prophylactic, or protective justification. Accordingly, this treaty does not impede the legitimate use of agents for research and development of medicines, vaccines, and defense capabilities (e.g., gas masks, decontamination). The line between legitimate and prohibited activities is often a blurry one, which makes determining compliance an inherently difficult task and opens avenues for hiding banned activities at commercial and defense facilities. Article VI of the treaty directs signatories to report suspected violations to the United Nations Security Council. However, the five permanent members of the Security Council have veto power that could be used to block an investigation of the possible violation.

[12] J. Dahlberg, "Russia Admits it Violated Pact on Biological Warfare," *Los Angeles Times*, 15 September 1992.

[13] See Ken Alibek with Stephen Handelman, *Biohazard* (New York: Random House, 1999); Anthony Rimmington, "From Military to Industrial Complex? The Conversion of Biological Weapons Facilities in the Russian Federation," *Contemporary Security Policy* 17 (April 1996): 81-112; David C. Kelly, "The Trilateral Agreement: Lessons for Biological Weapons Verification," *Verification Yearbook 2002* (London: Verification Research, Training and Information Centre, 2002).

[14] "Testimony of Carl W. Ford, Jr.," Senate Foreign Relations Committee Hearing on Reducing the Threat of Chemical and Biological Weapons, 19 March 2002; "Testimony of Gen. Thomas A. Schwartz," Senate Armed Services Committee, 5 March 2002; U.S. Arms Control and Disarmament Agency, *Adherence to and Compliance with Arms Control Agreements* (Washington, DC: U.S. Department of State, 1998).

[15] United Nations, *Report of the Secretary-General on the Status of the Implementation of the Special Commission's Plan for the Ongoing Monitoring and Verification of Iraq's Compliance with Relevant Parts of Section of Security Council Resolution 687 (1991)*, 11 October 1995) www.un.org/Depts/unscom/sres95-864.htm. Security Council Resolution 687 also called on Iraq to ratify the BWC, which it finally did in June 1991. See United Nations Security Council Resolution 687, 3 April 1991.

In the early 1990s, the international community convened a group of experts to examine what might be done to monitor the BWC.[16] The dual-use nature of biological materials and equipment and the difficulty in distinguishing permitted defense activities from prohibited offensive ones are among the challenges inherent in monitoring the Convention's prohibitions. Negotiations to create a legally binding monitoring protocol began in 1995, culminating in a draft agreement that the U.S. government rejected in July 2001, stating that the proposed protocol was insufficient to establish treaty compliance, could compromise sensitive defense information and proprietary business data, and could lead to the unraveling of export controls. Later that year, the U.S. government announced its opposition to further talks based on the proposed draft protocol, and the negotiations subsequently terminated.[17] Instead, the international community agreed to three weeks of talks in 2003, 2004, and 2005 to discuss: penal legislation related to biological weapons, national biosecurity regulations, the international response to biological weapons use and disease outbreaks, national disease surveillance mechanisms, and scientific codes of conduct.[18]

The passage of United Nations Resolution 1540 in 2004 helped to spur numerous governments to take steps to establish domestic controls to prevent the proliferation of weapons of mass destruction and their delivery systems. In Geneva technical discussions and to the 1540 committee at the United Nations, many states have provided some information about pertinent decisions, orders, resolutions, ordinances, decrees, control lists, draft legislation, regulations, executive orders, laws, and penal codes.[19] No comparative appraisal has been undertaken on any of the data provided to either the 1540 committee or the technical talks in Geneva.

Biological Weapons Nonproliferation Policy Options

In 1995, a U.S. citizen who publicly espoused racist views used false pretenses to acquire three vials of bubonic plague, an incident that prompted Congress to reexamine certain measures guiding research and commercial activities with highly infectious pathogens.[20] Biosecurity

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[16] For twenty-one separate monitoring measures, the Ad Hoc Group of Verification Experts considered what compliance-relevant information each measure could or could not provide; its ability to separate prohibited activities from legitimate ones; its ability to determine compliance; its financial, technical, and overall feasibility; and its impact on the industry and the protection of commercial proprietary information. United Nations, *Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint: Summary Report*, Document BWC/CONF.III/VERX/8 (Geneva: 24 September 1993).

[17] See John R. Bolton, under secretary for arms control and international security, "The U.S. Position on the Biological Weapons Convention: Combating the BW Threat" (Tokyo: 26 August 2002); "BWC: Review Conference Collapses," *Global Newswire*, 10 December 2001.

[18] The agenda for these talks derived largely from the proposals that the United States introduced in the fall of 2001 to substitute for a legally binding monitoring protocol. For detail on the U.S. proposals, see John R. Bolton, undersecretary for arms control and international security, "Remarks to the 5th Biological Weapons Convention RevCon Meeting" (Geneva: 19 November 2001). For an evaluation of these proposals, see *Compliance Through Science: U.S. Pharmaceutical Industry Experts on a Strengthened Bioweapons Nonproliferation Regime* (Washington, DC: Henry L. Stimson Center, May 2001).

[19] United Nations, *Meeting of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons: Report of the Meeting of Experts*, Document BWC/MSP.2003/MX/4, Part I (Geneva: 18-29 August 2003). For data available from the 1540 committee, go to: www.disarmament2.un.org/committee1540.

[20] Jim Woods and Jill Riepenhoff, "Plague Vials Found in Car," *Columbus Dispatch*, 13 May 1995; Jessica Eve Stern, "Larry Wayne Harris," in *Toxic Terror: Assessing the Terrorist Use of Chemical and Biological Weapons*, ed. Jonathan B. Tucker (Cambridge, Mass.: MIT Press, 2000): 228-46.

involves technologies, procedures, and protocols to secure the exchange of highly infectious pathogens and to control access to those pathogens within a defense, research, industrial, or storage facility. Biosecurity can include:

- licensing of facilities to work with highly infectious pathogens;
- physical protection barriers;
- procedures to ascertain personnel reliability;
- pre-transport approval for highly infectious pathogens and appropriate security during transport;
- measures to ensure accountability for highly infectious pathogens;
- proper oversight of scientific, defense, and commercial activities; and,
- appropriate security for information related to processes and techniques that could be useful in weaponization of the agent.

The institution of biosecurity precautions presupposes the determination of which pathogens would pose a significant risk to security and to public and environmental health if they were stolen or diverted. In 1996, the U.S. government created a select agent list for human pathogens. In 2002, the human pathogens select agent list was revised and similar control lists were created for animal and plant pathogens.[21]

Biosecurity is such a new field that in the United States and some other countries the benefits and costs of various biosecurity measures are still being evaluated. In September 2006, the World Health Organization published best practices in biosecurity that states could adopt voluntarily.[22] Some states provided data about the biosecurity measures they are contemplating or have enacted during meetings in Geneva in 2003 and also to the United Nations 1540 committee.

In contrast to biosecurity, many facilities that work with highly infectious pathogens have long had some form of biosafety measures in place to guide the safe handling of pathogens to prevent employee accidents and to reduce the scope of harm from accidents. The precondition for biosafety precautions is the specification of which pathogens would pose a low, moderate, serious, or severe risk to workers, the public, and the environment if accidental release were to occur. The major components of biosafety are:

- personnel training and implementation of proper laboratory practice and technique for those working with highly infectious pathogens (e.g., decontamination procedures, handling of sharp implements);
- use of protective equipment (e.g., personal protective gear, biological safety cabinets) to form a primary barrier to prevent personnel exposure to highly infectious pathogens;
- use of prophylactic vaccines, when available; and,

[21] For more on the evolution of biosecurity measures, see Julie E. Fischer, *Stewardship or Censorship: Balancing Biosecurity, the Public's Health, and the Benefits of Scientific Openness* (Washington, DC: Henry L. Stimson Center, 2006).
[22] *Biorisk Management: Laboratory Biosecurity Guidance*, WHO/CDS/EPR/2006.6 (Geneva: World Health Organization, September 2006).

- design, construction, and operation of secondary barriers (e.g., ventilation systems to direct airflow) to contain microbial agents within a defined area and ultimately preclude their escape from the facility.

Biosafety precautions are tailored to the type of pathogens at a facility, with biosafety level 1 used for low-risk pathogens and biosafety level 4 for the most lethal and contagious agents (e.g., smallpox, Ebola).

The principal U.S. biosafety guidelines are stated in the National Institutes of Health publication, *U.S. Biosafety in Microbiological and Biomedical Laboratories*. The World Health Organization has issued biosafety guidelines, the use of which is voluntary.[23] In recent years, facilities in the United States and elsewhere that have biosafety measures in place have reported laboratory-acquired infections.[24] The persistence of high rates of laboratory-acquired infections could point to a need to switch from a voluntary to a mandatory approach to biosafety, including the establishment of the type of automatic noncompliance penalties that are often included in regulatory standards.

Article VI of the BWC requires treaty members to pass penal legislation, but for decades many states neglected to do so. In addition to stipulating the punishment for engaging in prohibited activities, criminalization laws can strengthen the ability of law enforcement authorities to investigate suspicious activities prior to a biological weapons attack. The United States first passed legislation criminalizing activities in 1996, updating this legislation with the 2001 Patriot Act.[25] States have provided information on domestic criminalization and biosecurity measures. Comparative analysis of the utility of these various measures has yet to be performed.

The international community has joined to criminalize other heinous crimes. Among several criminalization treaties are those devoted to airline hijacking and sabotage (1970 and 1971), hostage taking (1979), theft of nuclear materials (1980), maritime piracy, sabotage (1988), terrorist bombings (1997), and financing of terrorism (1999).[26] Nongovernmental experts have prepared a draft treaty to criminalize activities related to biological weapons,[27] but

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[23] *Laboratory Biosafety Manual*, 3rd edition (Geneva: World Health Organization, 2006).

[24] Marilee P. Ogren, "An Accident Waiting to Happen?" *Scientist* (27 January 2003): 30-3; "China's Recent SARS Outbreak Raises Concerns About Biosafety," *Health and Medicine Week* (26 July 2004); "Laboratory-Acquired West Nile Infections: United States 2002," *Morbidity and Mortality Weekly Report* (20 December 2002); Pier Luigi Fiori et al., "Brucella Abortus Infection Acquired in Microbiology Laboratories," *Journal of Clinical Microbiology* 38, no. 5 (May 2000): 20005-6.

[25] See 18 USC, Sections 175-178 and 2332; 42 CFR 72; also *Antiterrorism and Effective Death Penalty Act*, Public Law 104-132, 24 April 1996. See also the *Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001*, known as the Patriot Act, signed into law on 26 October 2001, Public Law 107-56.

[26] For more information on these and other conventions against terrorist acts, go to: www.untreaty.un.org/English/Terrorism.asp.

[27] For more on the Draft Convention on the Prevention and Punishment of the Crime of Developing, Producing, Acquiring, Stockpiling, Retaining, Transferring, or Using Biological and Chemical Weapons, see Mathew Meselson and Julian-Perry Robinson, "A Draft Convention to Prohibit Chemical and Biological Weapons Under International Criminal Law," The Harvard-Sussex Program on CBW Armament and Arms Limitation, 1 November 2001. Available at: www.fas.harvard.edu/~/hsp/crim01.pdf.

to date no significant momentum has built among nations to institute a treaty criminalizing the various activities associated with acquisition and use of biological weapons.

Professional codes are well-established in some scientific disciplines, including the well-known physicians' Hippocratic oath, which embodies the principle of first, do no harm. Codes can come in the form of oaths, manifestoes, guidelines, and pledges and their function can be aspirational, educational, enforceable, or a combination of these functions. In some countries, professional societies in the life sciences disciplines have discussed and in some instances adopted codes.[28] One of the valued aspects of a professional code is its educational function, raising awareness among practitioners about the ethics and responsibilities of their profession. Other avenues to education professionals include establishing a standardized curriculum on scientific ethics, biosafety, and biosecurity in colleges and universities granting life sciences degrees and requiring facilities handling highly infectious pathogens to certify that their employees are well-trained in the requisite standards.

As the number of journal articles describing early recombinant DNA research multiplied, U.S. practitioners who recognized the potential benefits and quandaries of gene splicing gathered in the early 1970s to discuss and define an oversight process for genetic engineering research. *U.S. Guidelines for Research Involving Recombinant DNA Molecules*, another National Institutes of Health tome, resulted from this process. Even in the United States, application of these standards is not uniform and for some pertinent facilities is voluntary.[29]

In 2004, the U.S. National Academy of Sciences recommended pre-performance and pre-publication oversight of experiments that could:

- render a vaccine ineffective;
- confer resistance to therapeutically useful antibiotics or antivirals;
- enhance the virulence of a pathogen or render a nonpathogen virulent;
- increase transmissibility of a pathogen;
- change the natural host range of a pathogen (nonzoonotics to zoonotics);
- enable the evasion of diagnostics or detection; and,
- enable weaponization of a pathogen.[30]

In 2005, the U.S. National Science Advisory Board on Biosecurity first met to begin developing policies to reduce the potential for the results of biological research to be misused, including creating a national system of oversight for genetic engineering research.[31] Elsewhere, only a handful of countries worldwide have established partial or comprehensive oversight of genetic engineering research, which means that a considerable amount of genetic engineering research

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[28] See New Zealand Life Sciences Network, "Code of Conduct," available at: www.lifesciencesnetwork.org/pb/about/code/_ethics.asp; Australian Society for Microbiology, "Code of Ethics," available at: www.theasm.com.au/docs/ethics/default.asp.

[29] U.S. facilities that receive funding from the National Institutes of Health are required to have Institutional Biosafety Committees to provide oversight. Some other U.S. facilities have voluntarily created such committees.

[30] *Biotechnology Research in an Age of Terrorism*, Committee on Research Standards and Practices to Prevent the Destructive Application of Biotechnology (Washington, DC: National Research Council, 2004).

[31] For more on the activities of this board, see: www.biosecurityboard.gov.

will, for the time being, proceed ungoverned. A tiered oversight system would have primary oversight at the institutional level, buttressed, as necessary, by national and international oversight.[32]

The survey contains several questions formulated to poll participants as to whether various policy options should be pursued. The final segment of the survey asks participants to rate the U.S. government's recent performance on the biological weapons nonproliferation agenda, to stipulate what priority the government should give to bioweapons nonproliferation in the future, and to specify the preferred approach to implementation of the policy, unilateral or multilateral measures.

Survey Methodology

Beginning on 16 October 2006, three groups of individuals received invitations to participate in the survey, namely current senior officials, former senior officials, and nongovernmental experts. The first group consisted of senior members of the Executive Branch, from the deputy assistant level up to cabinet level in the Departments of State, Defense, and Commerce and within the intelligence community, military services, and National Security Council. The category of current senior officials also included senators and members of Congress serving in leadership posts and on committees that have jurisdiction on matters related to biological weapons proliferation, foreign policy, defense, and homeland security. Former senior executive branch officials and legislators were the second group asked to participate in the survey. Nongovernmental experts in nonproliferation, national and international security, and terrorism comprised the third survey group.

All individuals asked to take the survey received at least one follow-up call to confirm their receipt of the invitation and encourage participation. Table 1 details the number of individuals asked to participate in the survey in each category, as well as those that agreed to do so. The total number of individuals surveyed was fifty-two. A list of survey participants can be found in Annex I.

Table 1: Statistics of the Survey

Category of Participant	Number Invited To Participate in Survey	Number of Participants
Current Officials	186	8
Senior Administration Officials	41	3
Legislators	145	5
Former Senior Officials	73	19
Nongovernmental Experts	85	25
Total:	344	53

The majority of individuals who took the survey completed a written form or submitted their responses via a dedicated web site. Three individuals were interviewed either in person or on the telephone. The survey period ran from 25 October to 15 November 2006. Survey results were then aggregated for this report. The survey report presents the questions in a slightly different order than they were asked in the survey. Throughout the survey, added comments

[32] Op cit., *Compliance Through Science*, 56-7.

were invited. Most comments were given on a non-attribution basis, but a few survey participants did provide statements on the record.

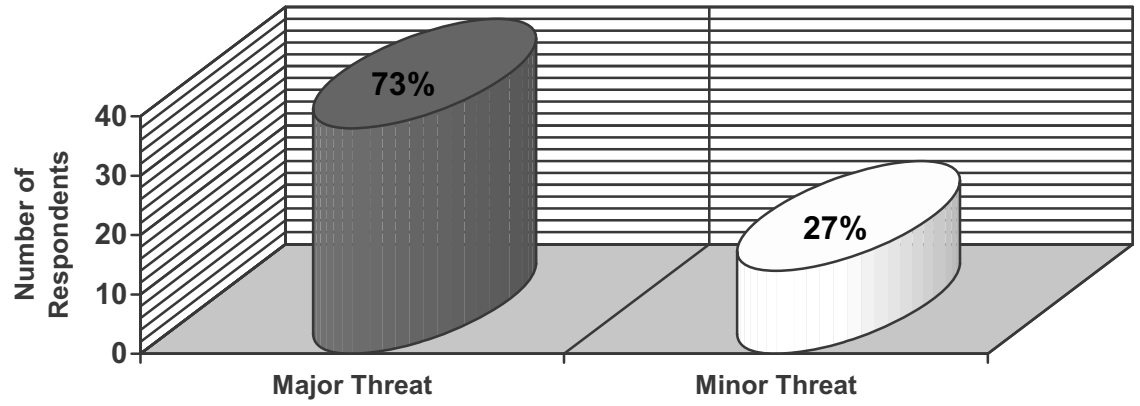
Amy E. Smithson, PhD, drafted the survey questions, administered the survey, and prepared the survey report. The Carnegie Corporation of New York and the Ploughshares Fund generously provided funding for this survey.

Survey Questions on the Biological Weapons Threat

Do you think that biological weapons present a major, minor, or no threat to the United States?

Among all three categories of survey participants, concern about the threat of biological weapons was pronounced. Almost three quarters, seventy-three percent, of those surveyed viewed biological weapons as a major threat, while the remainder deemed the threat of biological weapons to be minor. No survey participant chose the "no threat" option.

Graph 1: Evaluation of the Biological Weapons Threat*



*Survey participants were also offered the option of "No Opinion," but no one chose this option.

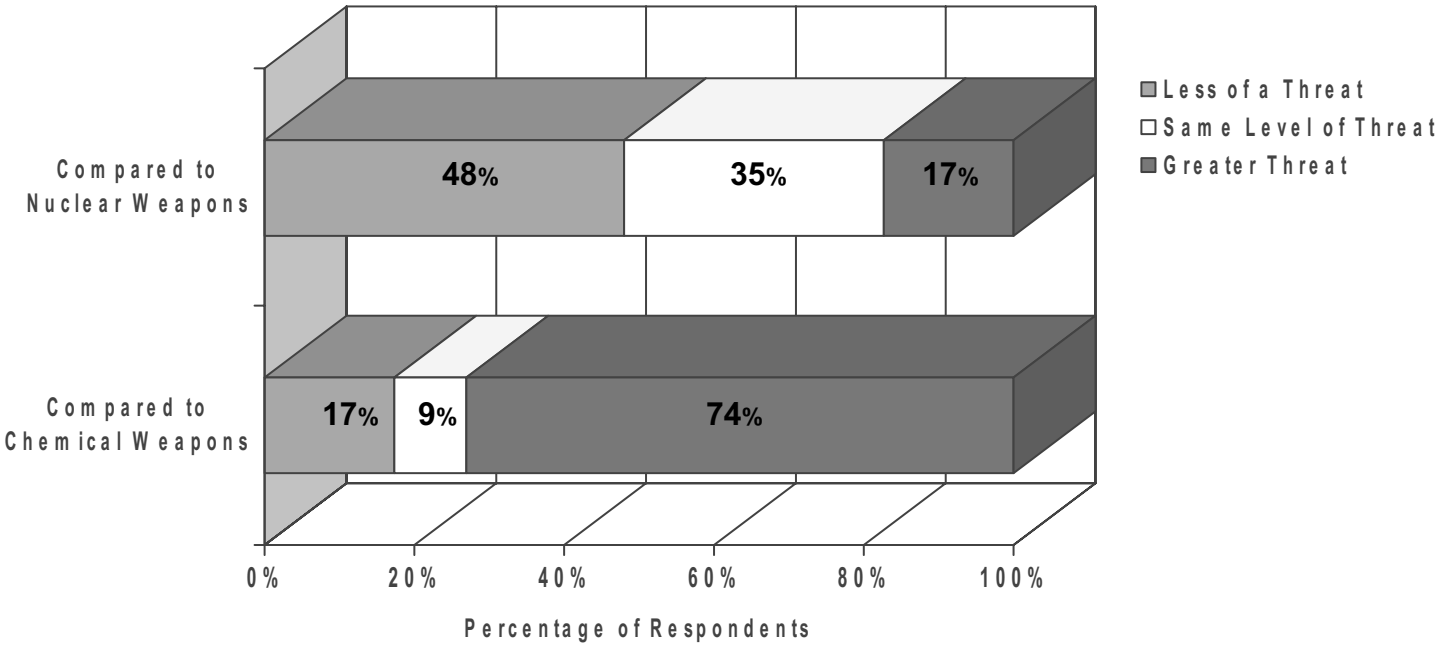
To begin with, some of the additional comments from the survey participants focused on the considerable difficulty of assessing the biological weapons threat. "We can't rely solely on national technical means, not for this threat. Our human intelligence assets have eroded over the years, and although they are trying to build them back up, we've got a long way to go and need to accelerate progress on an urgent basis." This former senior policymaker continued: "When it comes to these assessments, we don't have credibility any more. Nobody believes us when we say country 'X' has got weapon 'Y.' Another former senior policymaker provided a second take on the difficulty of evaluating the biological weapons threat. Deeming the bioweapons threat "overrated," this individual noted that not enough is known "to make sound judgments about their lethality and effectiveness, how and which ones of them can be 'weaponeered.'"

The weight of opinion was nonetheless that biological weapons constituted a major threat. One nongovernmental expert thought bioweapons were "a major threat in the hands of terrorists if we are talking about a contagious pathogen like smallpox." Echoing that line of thought, a former senior policymaker observed: "While I don't think the threat is extreme or acute, the consequences of a biological attack would be major. As we saw in 2001, the amount of panic that can be created just by sending something through the mail is considerable." On the opposite end of the scale, two survey participants commented on the practicality of using biological weapons, with a former senior policymaker surmising that "the likelihood of their use is low" and a nongovernmental expert doubting that "non-state actors will be able to weaponize

and disperse dangerous pathogens over a widespread area."

How does the biological weapons threat compare to the threats from other weapons of mass destruction?

Graph 2: Comparison of Biological, Nuclear, and Chemical Weapons Threats*



*Survey participants were also offered the option of "No Opinion," but no one chose this option.

When juxtaposed to other types of weapons of mass destruction, survey participants considered the biological weapons threat to be grave. A combined fifty-two percent of the survey participants saw the biological weapons threat as greater than or equal to the threat of nuclear weapons, while those remaining characterized bioweapons as less of a threat than nuclear weapons. Nongovernmental experts expressed mostly the latter view, while the prevalent opinion among former senior officials was that biological weapons presented the same level of threat as nuclear weapons. When measured against chemical weapons, the survey results were quite pronounced, with seventy-four percent seeing biological weapons as the greater threat.

Survey participants tendered a variety of observations about the nature of the threats that chemical, biological, and nuclear weapons present. In a three-way breakdown of the threats, one current senior policymaker described biological weapons as a "greater threat than chemical weapons" and "a greater threat than nuclear weapons, though not in terms of actual impact, but in terms of likelihood of use." A former senior policymaker offered something of a reverse comparison of biological and chemical weapons, noting that the threat of biological weapons was a "lower probability than chemical weapons, but a much greater impact."

Two current senior policymakers voiced concerns about the ability of biological weapons to cause equal or even greater harm than nuclear weapons. "Nuclear and biological threats are

very worrisome with regard to their potential for catastrophic consequences. If the right agent is used and dispersed properly, biological agents could result in the same level of devastation as nuclear weapons," said one current senior policymaker. Added another: "Biological attacks can be the same level of threat as nuclear with the appropriate agent and dispersal mechanism. . . . [T]he origin of the attack may be difficult to determine and, in some cases, human-to-human contact may facilitate the spread of the bio agent."

Continuing on the issue of comparative scope of harm, one expert stated that biological weapons posed "less of a threat than nuclear weapons," clarifying that answer "by the fact that massive human and property destruction is assured with a nuclear explosion and more uncertain with a biological weapon, though casualties would occur in both." A former senior policymaker who was also in the less of a threat than nuclear weapons camp also remarked that "there are many bio weapons and many variations in lethality, skill of dissemination, weather conditions, etc. There are far fewer such variables with nuclear weapons." Another former senior official noted that "the potential effect of biological weapons use is less than for nuclear weapons, but the probability of biological weapons acquisition and use is greater than it is for nuclear weapons."

Giving reason for selecting biological weapons as a greater threat than nuclear weapons, a former senior policymaker said bioweapons "are probably easier to acquire and develop," while an one expert noted that "biotechnology is advancing at a far greater pace than nuclear technology." Moving to the issue of the challenges of dispersing biological weapons effectively, another current senior policymaker gave the following comparison of chemical, biological, and nuclear weapons: "Bioweapons are more difficult to detect than chemical weapons, but must have ideal conditions to cause casualties approaching nukes." A former senior policymaker was also alert to the challenges of dispersing biological agents, observing that "[n]ukes can be adjusted for scope, biological weapons control is much more problematic."

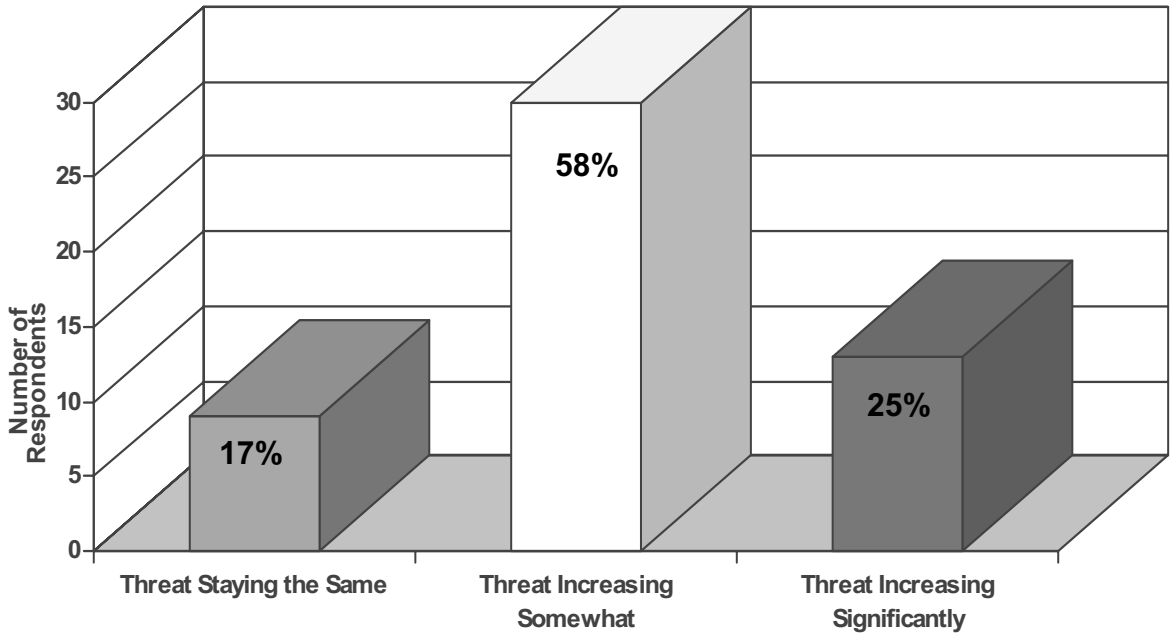
One survey participant articulated a clear ranking of threats between the different categories of weapons. "We need to separate the wheat from the chaff when it comes to the threat of different types of weapons of mass destruction," said a former senior policymaker. "A dirty bomb would probably not harm nearly as many people as a chemical attack, and the consequences of a biological attack would probably be the worst of those three threats. The biological threat is probably the most insidious, the most serious one because it is cheap, it comes from nature, and the release scenario can be as simple as the subway."

Would you say that the threat of biological weapons acquisition and use is relatively static, decreasing, or increasing?

According to the lion's share of survey participants, the threat of biological weapons acquisition and use is on the rise. Over half of the survey participants, fifty-eight percent, were of the opinion that the biological weapons threat is increasing somewhat, while twenty-five percent of those polled said that the threat was increasing significantly. Nine survey participants saw the threat as static. None of the survey participants assessed the biological weapons threat as decreasing, either somewhat or significantly.

Thus, survey participants fell into three schools of thought on this issue. The first consisted of those who viewed the threat as static. One current senior policymaker's assessment was that both the "low level bioterror threat and state-initiated bioweapons programs are decreasing" but nonetheless said the threat was staying level because of "the increased availability of capability to non-state parties, whether traditional terrorists or domestic insurrectionists." Having checked the option of "threat staying the same," a former senior policymaker stated that biological weapons were "still a major threat, but for one reason or another it doesn't seem to be considered as serious as nuclear."

Graph 3: Status of the Biological Weapons Threat*



*Survey participants were also given the options "Threat Decreasing Somewhat," "Threat Decreasing Significantly," and "No Opinion." No respondent chose these options.

Individuals who believed that the biological weapon threat was increasing somewhat gave several reasons for that view. A former senior policymaker said: "Again, no one really knows. The Soviet Union invested heavily in bioweapons R&D, but I'm not sure anyone is today." Another former senior policymaker said that the problem was not with state-level biological weapons programs. Rather, the former senior policymaker pointed to the growing "leakage to non-state actors" as reason for an increasing biological threat. Agreeing that the threat increase was related to non-state actors, an expert remarked: "Biotechnology is advancing at a far greater pace than nuclear technology and it is becoming easier for 'start-up firms' and small groups (including religious extremists) to experiment and develop new, potentially lethal pathogens." This sentiment about the increasing threat residing with subnational actors rang true with a third former senior official, who stated: "The threat seems to be increasing somewhat as more terrorists can receive education in biology over time."

The "increasing significantly" school of thought included two nongovernmental experts, one who attributed the increase to the "proliferation of dual-use biotechnologies" and another who concurred because "the biotechnology revolution is stretching to reach all corners of the globe. Research in some key countries is opaque, there are no unified international rules that must be conformed to, and the policy/regulation process is hopelessly behind the curve." A current senior policymaker viewed the increase in similar terms, also noting that "Al Qaeda has declared their intent to acquire and use biological weapons. In addition, the advances in science and technology and the proliferation of information on bioterrorism agents make synthesizing biological agents easier." This individual's last concern was: "Dual-use technologies pose an especially difficult challenge in that we must encourage the advancement of science while discouraging potential bioterrorists."

A final adherent to the significantly increasing school of thought called terrorism "something of a fad of this era" and predicted that copycats would follow the Islamic extremists who seek to use bioweapons. Said this former senior policymaker: "Everyone with a beef, every crackpot, anyone looking to score mass casualties will see biological weapons as an option. The number of people messing around with this stuff is simply on the rise."

This two-part question follows on the last question. If you believe that the biological weapons threat is increasing, what are the reason(s)?

Current senior policymakers and nongovernmental experts both selected the increasing availability of dual use know-how, technology, and equipment as their top reason for an increasing biological weapons threat, and both of these survey groups positioned the easier acquisition of biological weapons as a result of the life sciences revolution in their top three reasons. Former senior policymakers chose as their first reason for an increasing biological weapons threat the technical ease with which biological weapons can be acquired in comparison to nuclear weapons, a reason that nongovernmental experts placed third. Current policymakers ranked terrorist interest in acquisition and use second, but for the other two survey groups this reason fell into the second tier of reasons why they felt bioweapons proliferation was on the rise. Lack of strong nonproliferation tools and inadequate security at facilities handling biological weapons-grade materials were second-tier reasons for the nongovernmental experts but rated in the lowest tier for the current and former senior policymakers. As Table 2 shows, all three survey groups agreed in positioning two reasons for an increase in the biological weapons proliferation threat in the third tier, specifically the ability of biological weapons to offset asymmetrically an opponent's military advantage and the governmental transfer of biological weapons, weapons materials, or know-how to terrorists.

Two of the survey participants raised another reason for an increasing biological weapons proliferation threat. Observed a current senior policymaker: "The rapid increase in the number of labs focusing on biodefense may also be a contributing factor to the threat of a biological attack. The ability to obtain and make a bioagent is becoming more accessible." A nongovernmental expert had a slightly different take on this issue, saying, "I think the huge number of people working in biodefense in recent years creates increased possibilities for leakage of lethal biological weapons knowledge." In a variant of that statement, a current senior

policymaker stated that "the increasing availability of information about bio agents is also a contributing factor." Two survey participants said that some of the reasons listed (e.g., cheaper than nuclear weapons) pre-existed the September 11th attacks and therefore did not warrant consideration as a reason for the increased proliferation of biological weapons.

Table 2: Explanations for an Increasing Biological Weapons Threat*

Top Tier Reasons	
Increasing availability of dual-use know-how, technology, and equipment	**71%**
Revolution in the life sciences creating technologies and know-how that makes biological weapons acquisition easier	**67%**
Technically easier to acquire than nuclear weapons	**63%**
Terrorist interest in acquisition and use of biological weapons	**56%**
Second Tier Reasons	
Ability to acquire biological weapons covertly	**50%**
Ability to attack an opponent without firm attribution of the source of the attack	**46%**
Cheaper than nuclear weapons	**46%**
Lack of strong, interlocking biological weapons nonproliferation tools and programs	**40%**
Third Tier Reasons	
Inadequate security at facilities handling biological weapons-grade materials	**37%**
Ability to tailor the scale of a biological weapons attack by: targeting plants, animals, and/or people; using diseases that are contagious or non-contagious; using diseases that are lethal or just harmful	**31%**
Black market purchase of weapons materials and/or knowledge	**31%**
Ability of biological weapons to offset asymmetrically an opponent's military advantage	**25%**
Government transfer or sale of biological weapons, weapons materials, or know-how to terrorists	**10%**

***Survey participants were also given options of "Other," "All of the Above," and "No Opinion." No respondents selected the latter two options. Other reasons proposed for the increasing proliferation threat are described in text.**

A former senior policymaker suggested "the will of adversaries to use weapons of mass destruction" as another reason why the biological weapons proliferation threat was increasing. Seconding that opinion and adding other factors, a second former senior policymaker said that "the awareness of this as an option, the motivation to inflict widespread harm, and the availability of technology to facilitate getting biological weapons is all going in a direction indicative of an increase--a significant increase, of the bioweapons threat." Agreeing that "the threat is very real," a nongovernmental expert declared that "at the moment it seems that very few terror groups are actively pursuing large-scale bio capabilities" because most terrorist groups are using "violence in the pursuit of a political objective (e.g. separatism, insurgencies, etc.)."

Or, if you believe that the biological weapons threat is static or decreasing, what are the reason(s)?

The view that the biological weapons threat is static was far less prevalent than the opinion that this threat is on the rise. Among the nine individuals who assessed the bioweapons threat as remaining level in question number two, they saw the availability of other, more palatable options like conventional weapons as the prime reason the stagnant state of the threat, followed closely by the difficulty of achieving effective, precise use of biological weapons and technical obstacles to production and use of biological weapons. As Table 3 indicates, the possibility that an attacker would not be able to claim credit for a bioweapons attack, moral

objections to biological weapons, and the potential for an overwhelming punitive response to a biological weapons attack rounded out survey participants' second-tier choices. Only two respondents chose the existence of legal prohibitions as a reason for a leveling off of the biological weapons threat.

Table 3: Explanations for a Static Biological Weapons Threat*

Top Tier Reasons	
Availability of other, more palatable weapons (e.g., conventional bombs) that attackers have significant confidence will work as intended to intimidate, terrorize, and inflict harm, even if the scope of damage is not as widespread as that which can be achieved with biological weapons	**15%**
Effective, precise military or terrorist use of this weapon can be difficult to achieve because dispersed biological agents are susceptible to meteorological conditions (e.g., wind, heat)	**13%**
Technical obstacles to production and effective dispersal can stymie acquisition and use	**13%**
Second Tier Reasons	
Possibility of being unable to claim firm responsibility for a biological attack because of its delayed effects and/or confusion with a natural outbreak of disease	**10%**
Moral objections to the use of disease as a weapon	**8%**
Potential for an overwhelming punitive response from government(s) attacked with biological weapons	**8%**
Third Tier Reasons	
Increasing awareness of the possible catastrophic consequences that could result from the intentional release of a highly infectious pathogen	**6%**
Legal prohibitions against biological weapons: 1975 international treaty bans the development, production, stockpiling, transfer, and use of bioweapons; domestic criminalization laws in some nations	**4%**

***Survey participants were also given options of "Other," "All of the above," and "No opinion." No respondents selected the latter two options. One other reason suggested for the static level of the proliferation threat is described in text.**

A former senior official raised another issue that might contribute to a stationary biological weapons threat, that of a clarified deterrence policy. "When compared to nuclear weapons, where the concept of deterrence is clear, we don't have a clear concept of deterrence for biological weapons. For example, it is not clear that the United States would use nuclear weapons to respond to a biological weapons attack. We need to revisit our deterrence concepts because in some respects we're still thinking in Cold War terms. Yes," this former senior official continued, "we're also thinking about how to deter Iran and North Korea. But, in other respects, like for biological weapons, we need to update, clarify, and publicly state our deterrence policy. That will help in dealing with both responsible world leaders as well as irresponsible ones, like terrorists."

What is the likelihood, if any, of a biological weapons attack that inflicts major casualties in the next 5 years? In the next 10 years?

In the five-year timeframe, forty-six percent of the survey participants were of the opinion that an attack is somewhat unlikely, while the second most prevalent opinion was that an attack was somewhat likely. As for the remainder of the survey participants, four voted that a major attack was very likely and seven were on the opposite end of the spectrum, selecting the "very unlikely" option.

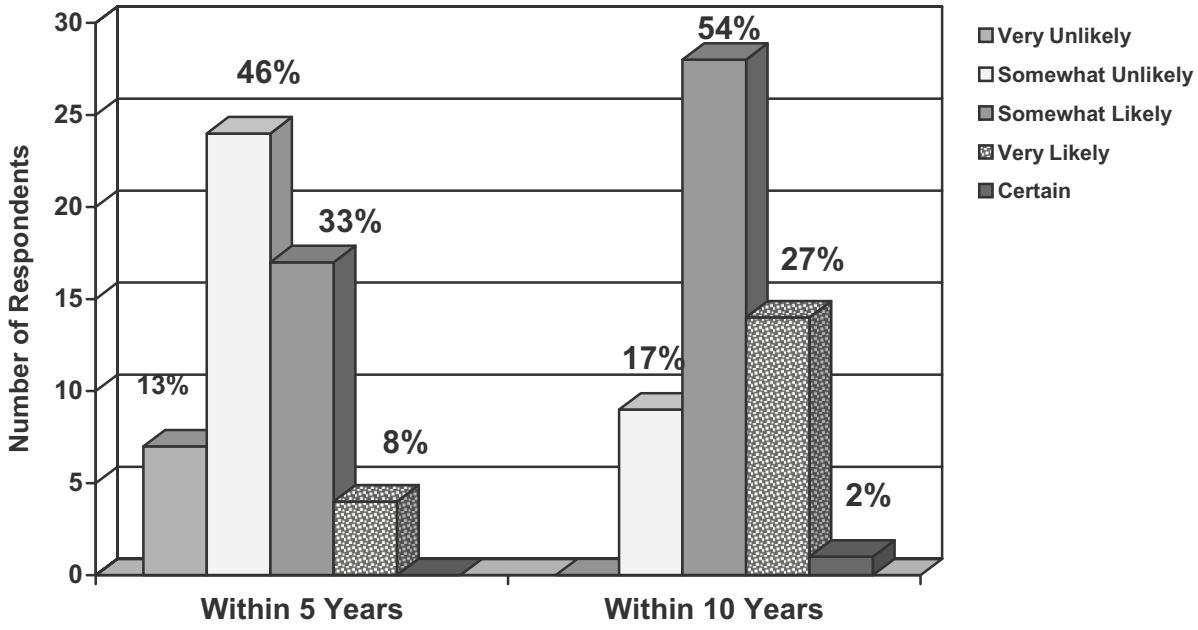
A nongovernmental expert thought the "chance of a natural pandemic such as flue is greater" than the likelihood of a biological weapons attack. More than one survey participant

remarked on the issue of a biological attack causing major casualties, with an expert commenting on the difficulty of pulling off a mass casualty attack and a current senior government official noting that while a biological attack was somewhat likely, it would not create major casualties. Similarly, a current senior official recognized that terrorists may struggle with the technical challenges associated with a mass casualty attack. "Although the 2001 anthrax attacks resulted in only five deaths, the impact was major, both nationally and internationally. Terrorist groups like al Qaeda certainly have expressed an interest in using bioterrorism, but to cause mass casualties they would need to acquire a lethal, transmissible agent that could be disseminated broadly." For that reason, this official concluded that "in the near term, the terrorist tool of choice will likely remain conventional explosives."

Another current senior policymaker also spotlighted the possibility that intent and capability to execute a major attack might not converge. Believing that the threat of a major attack would be somewhat likely over the coming decade, this individual said: "While terrorists certainly have the will to use biological agents as weapons of mass terror against the United States, it is unclear whether they currently have the ability to deliver biological weapons in a manner that would facilitate major casualties. They may acquire this ability in the next 5 to 10 years, however."

The survey participants shifted toward a higher likelihood of a major biological attack for the ten-year timeframe, with one respondent forecasting that a mass casualty bioweapons was certain to occur. The bulk of opinion, fifty-four percent, was that a major attack was somewhat likely. Twenty-seven percent of those surveyed viewed an attack as very likely. A nongovernmental expert thought that it "may take years before there is a successful attack, but that one successful attack will likely lead to several." In response to question number two, another nongovernmental expert also mentioned the potential for copycats of a biological attack to instigate a domino effect of sorts. One former senior official who checked the "somewhat likely" box described how determined adherence to an ideology will play a role in bioterrorism: "Attacks become more likely as young, convinced Islamists also have opportunities to engage in graduate studies in biology and microbiology, if their Islamist convictions remain intact in the face of disconfirming experience from graduate study. This seems to me to be the issue for the future. The motivation is there, the ability as yet limited." Continuing on the prospects of state cooperation with terrorists, this former senior official stated: "I do not think it is likely that states with bio capability would want to voluntarily undertake the risks of losing control by transferring it to terrorists. On the other hand, terrorists could penetrate government programs or corrupt government scientists with money or pressure."

Graph 4: Likelihood of a Biological Weapons Attack in the Next 5, 10 Years*



*Survey participants were also offered the option of "No Opinion," but no one chose this option.

A former senior policymaker concluded that the intervening preventative action or lack thereof would influence the likelihood of a biological attack. "Within five years, it is somewhat likely that there will be a major biological attack, and that increases to very likely in the ten-year timeframe if we don't do anything preventative in the interim. If we do something now to prevent these attacks, the forecast for the ten-year timeframe changes to somewhat unlikely that there will be a major attack. Our system, however, does not tend to do prevention measures well; rather, we respond after severe crises have already transpired." Continuing that line of thought, this individual said, "for instance, we should have gotten into World War II much sooner than we did. Everyone could see the problem, but it took the attack on Pearl Harbor to push us to action. I fear the same will be the case for biological weapons prevention tools. Unfortunately, something really bad will have to happen before we start putting meaningful prevention tools in place."

In keeping with the shift in opinion toward a higher likelihood of a major biological attack in the ten-year timeframe, a former senior policymaker opined: "Hard to predict but I believe it much more likely that bio threat will be real capability for terrorists in 5 years and within 10 years a near certainty that they will be used."

From the proliferation scenarios listed, please check the box(es) that describe any scenarios that you believe are likely.

The biological weapons proliferation scenarios that survey participants saw as most likely were not necessarily the ones that have received the most frequent play in the public. Those

survey viewed occasional small-scale attacks designed to make the public lose confidence in the ability of government to handle such events as the most likely scenario. Of the most popular scenario, one former policymaker referred to the 2001 anthrax attacks, saying that "a terrorist doesn't have to do much to practically put the government out of business. The panic, the interruption of business and normal activities due to just a few letters, was phenomenal." Among those polled, the second most likely scenario was deranged individuals acting alone to acquire and use biological weapons.

Some of the results for this question were in seeming contradiction to responses given to earlier questions. The government transfer or sale of biological weapons, weapons materials, or know-how to terrorists ranked as the least likely reason for an increase in the bioweapons threat in question three. Here, however, the same scenario received a higher rating and twenty-seven votes. In comments associated with the first question, some individuals said they felt the state-level threat was declining, but in this question, survey participants ranked state-level acquisition of classic biowarfare agents as the fourth most likely proliferation scenario.

Table 4: Most Likely Biological Weapons Proliferation Scenarios*

Top Tier Scenarios	
Small-scale, sporadic biological attacks by states or terrorists to undermine public confidence in local, state, and national governments	**75%**
So-called "lone wolf" actors or deranged individuals produce and use biological weapons	**71%**
Second Tier Scenarios	
Terrorist acquisition of biological weapons, working from scratch	**60%**
State-level acquisition of classic biological weapons (e.g., anthrax, botulinum toxin)	**58%**
Terrorist acquisition of biological weapons after obtaining state assistance with materials or know-how	**54%**
Third Tier Scenarios	
State or terrorist attacks on the civilian population to kill as many people as possible	**48%**
State or terrorist attacks on crops and/or livestock to cause severe economic damage	**42%**
State-level acquisition of novel biological agents using advanced technologies to make diseases resistant to existing medical treatments, more lethal, and/or more contagious	**38%**

***Survey participants were also given options of "Other scenarios," "None of the above," and "No opinion." No respondents selected the latter two options. One other proposed scenario is described in text.**

Finally, three of the proliferation scenarios that rated the lowest with survey participants are ones that have often received the most public attention, such as biological attacks intended to kill as many people as possible and attacks on the agricultural sector designed to cause economic havoc. A former senior policymaker explained why the agro-terrorism scenario did not rank highly with the survey group: "Security analysts see attacks against livestock and crops as a way to cause trouble, but it doesn't have the sex appeal of an attack on people. I don't think this type of an attack ranks high with terrorists." This individual continued by proposing another scenario as likely, "the AQ Khan variant, where one or more scientists from a state program has ideological sympathies with proliferators or becomes corrupt and for these reasons begins to peddle biological weapons materials, equipment, or know-how. The state itself doesn't approve of this below-the-table assistance, but it occurs nonetheless." Ranking dead last among the

scenarios presented was the development of novel biological agents that are more lethal, more transmissible, and/or able to defeat existing medical treatments.

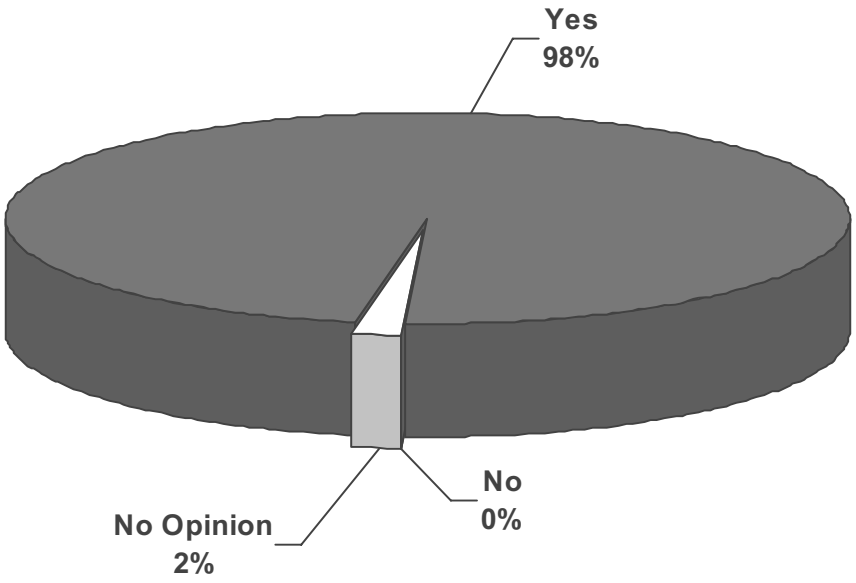
A current senior policymaker stated that terrorists were much more likely perpetrators of biological attacks than governments: "State use of bioweapons that cause casualties is very unlikely. More likely is an attempt by terrorists to cause local disruptions." Likewise, a nongovernmental expert did "not see states doing it," adding that terrorists were more likely to be bad actors in this instance. This expert suggested that "theft of harmful pathogens from poorly stored supplies or insecure repositories" was another likely scenario worthy of consideration. A former senior policymaker agreed that terrorists are the more likely perpetrators of biological attacks, but did not rule out the possibility of misbehavior by states. "Terrorists are now using the most advanced technological, financial, and communications tools; so yes, they're sophisticated enough to make biological weapons on their own. Both rogue states and terrorists will consider these weapons because they are cheap."

One nongovernmental expert placed all of these scenarios in perspective to other more likely threats to human health and well-being, such as automobile accidents and hurricanes, by putting some numerical definition on the term "likely." This individual stated "I don't believe any of these are more than a 50% shot, that is, that they are 'more likely than not' to happen. But I think several of them□probably all of them□pose enough risk, considered as low probability but high consequence, to be worth worrying about and worth actively trying to prevent."

Survey Questions on the Biological Weapons Nonproliferation Policy Options

Should individual governments require facilities engaged in the research, handling, storage, and exchange of highly infectious pathogens to adopt rigorous biosecurity measures to prevent the theft or diversion of these pathogens?

Graph 5: Support for Rigorous Biosecurity Measures

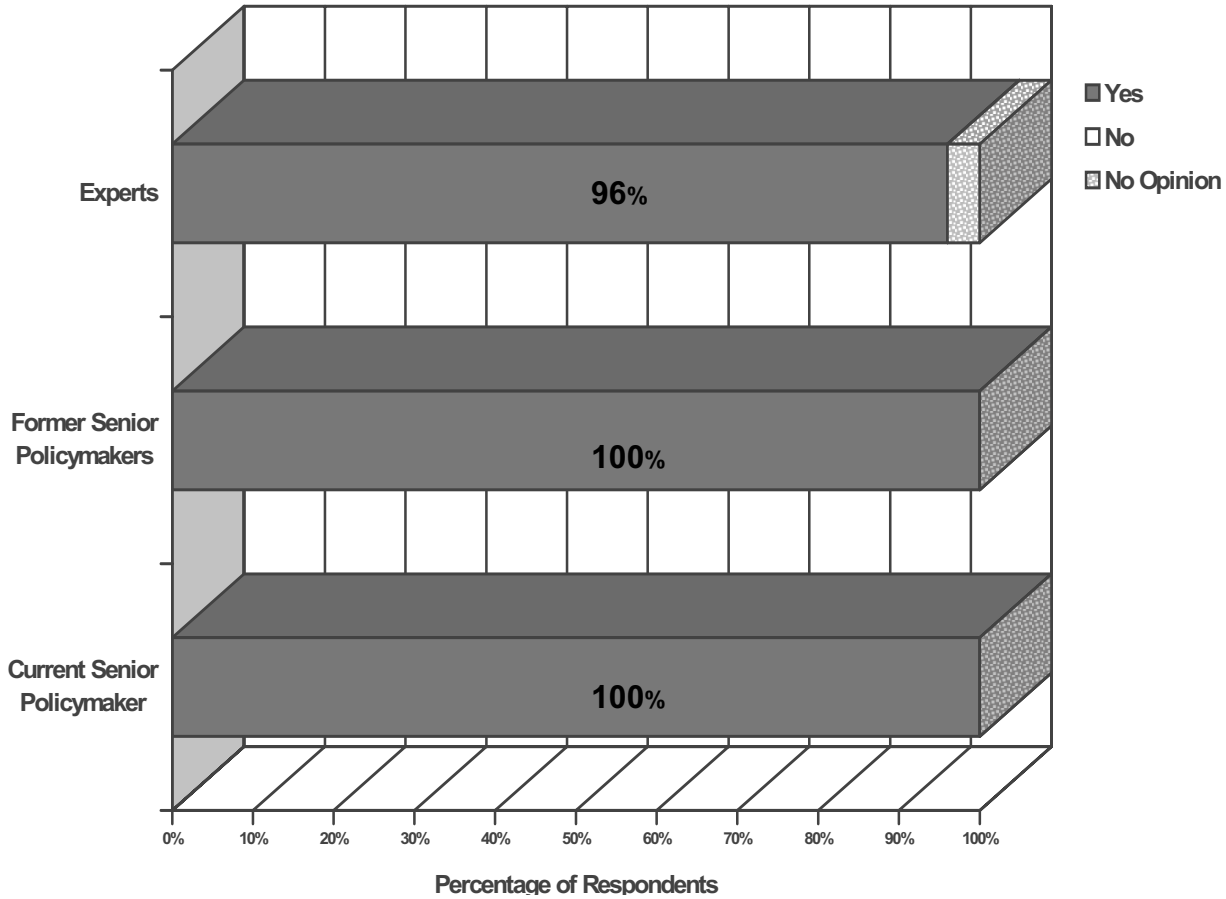


With the exception of one "no opinion" vote, the survey participants almost universally agreed that governments should require facilities working with highly infectious pathogens to establish rigorous biosecurity measures. In short, ninety-eight percent gave their support to this policy option. Mincing no words, one former senior policymaker said this seemed "like a 'no-brainer,'" and another said simply, "Tighten up yesterday!" Such regulations should be well-designed and balanced, concluded a former senior policymaker. "These biosecurity measures, as well as ones for biosafety and oversight of genetic engineering research, must not be stupidly burdensome. They must be thoroughly crafted by experts with the appropriate technical knowledge to accomplish the needed objectives in a reasonable manner."

Of the present state of affairs, a current senior policymaker said: "The CDC Select Agent Program is a step in the right direction, but we must encourage similar programs to be adopted internationally." Reiterating this point, one former senior policymaker said that although the United States was "far ahead" in biosecurity, action was still needed "in most of the world. We must give leadership in this important area." Exhibiting pessimism that many states would institute such regulations, another former senior policymaker stated, "yes, but I suspect there will be little progress toward this goal."

Should individual governments require facilities involved in the legitimate research and handling of highly infectious pathogens to enact strong biosafety measures to reduce the risks of this activity to workers and the public?

Graph 6: Support for Strong Biosafety Measures



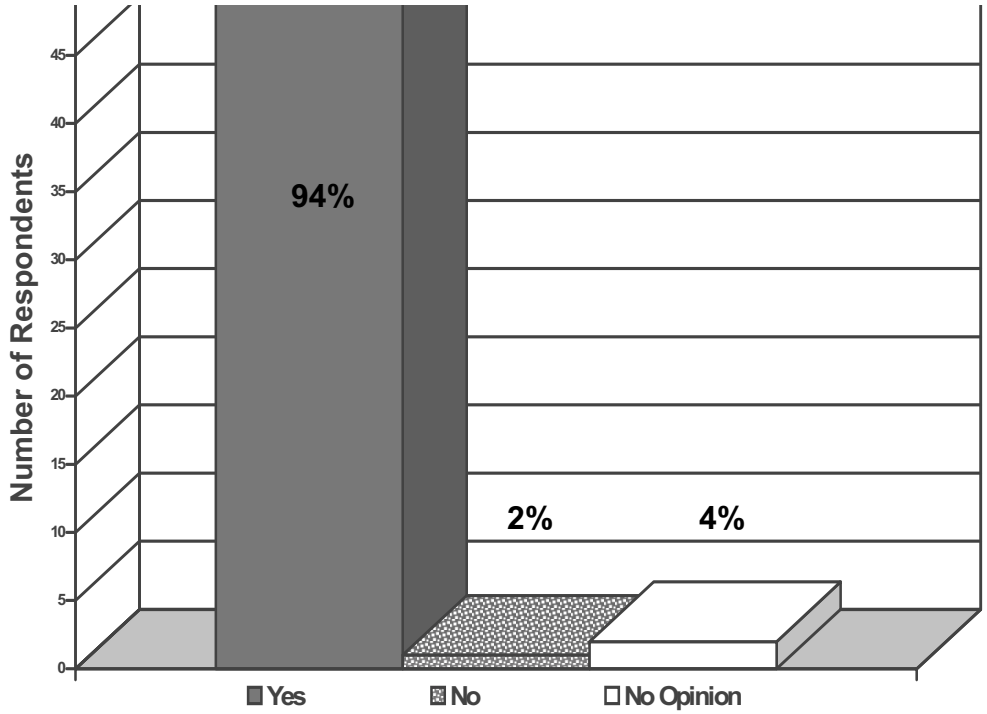
Those polled overwhelmingly deemed it worthwhile that governments should establish strong biosafety measures at facilities working with highly infectious pathogens, with ninety-nine percent of the total survey participants sanctioning this policy option. In their supplementary comments, two survey participants honed in on the need to craft such regulations with care. Said a current senior policymaker: "Traditional biosafety and biosecurity programs need to be flexible enough as well as tailored to ever changing and rapid information." Similarly, a former senior policymaker stated that "discretion needs to be at the laboratory end. Remote bureaucracies will not understand the dynamic relationship changes."

Among those who resoundingly supported the institution of biosafety measures, the same former senior policymaker who used the term "no-brainer" with regard to biosecurity policy option simply said "ditto" for biosafety. Although also a supporter of biosafety, doubt about the

potential for progress in biosafety permeated the remarks of one former senior policymaker, who said: "Individual states should do this and may know their own circumstances best, but the fact of the matter is that states won't take the initiative to do this."

Should individual governments require facilities to institute oversight of experiments that involve genetic engineering of highly infectious pathogens?

Graph 7: Support for Oversight of Genetic Engineering Experiments Involving Highly Infectious Pathogens



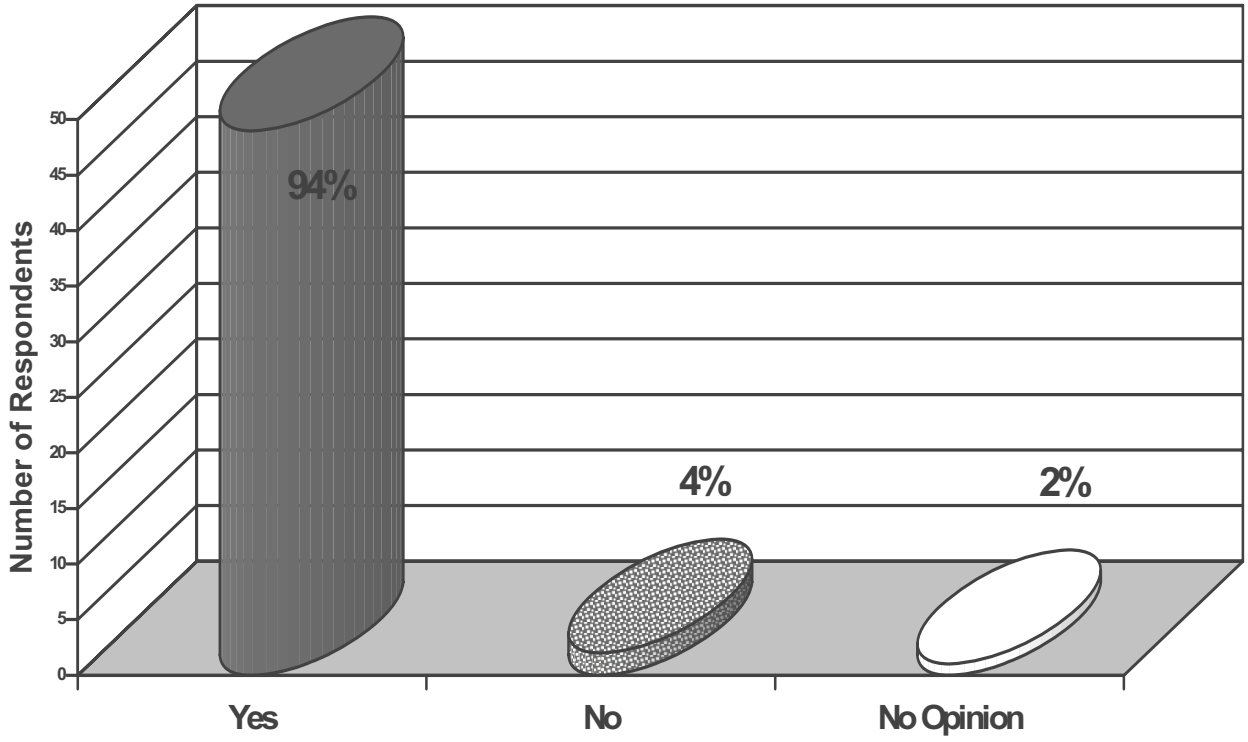
By a ninety-four percent margin, survey participants unambiguously supported establishing oversight of experiments that involve genetic engineering of highly infectious pathogens, although one individual voted against this policy option and two checked the "no opinion" box. Explaining the sole "no" vote, a current senior policymaker stated that: "The range of genetic engineering experiments is so wide it could constitute an overbearing and unsustainable burden for oversight, and would likely drive some legitimate scientific inquiry underground."

Among those who agreed that governments should bring about oversight of genetic engineering, three survey participants remarked on the delicate balance that such regulations must achieve. A nongovernmental expert said that "regulations and oversight need much discussion to optimize protection and minimize constraints on beneficial research." Noting that "there are already protocols to guide R&D," a former senior policymaker wondered if "across-the-board regulations would be sufficiently flexible" to allow those involved in legitimate research to "pursue an honest path." Finally, a current senior policymaker stated:

"There must be some mechanism of oversight, to a reasonable extent, but not so much as to impede scientific and technological advances. The U.S. has initiated a good model involving the participation of informed members of the scientific and medical community in reviewing experiments that fall into seven classes as identified in the National Academy of Sciences' Fink Committee Report."

Should individual governments pass legislation to criminalize the development, production, acquisition, stockpiling, retention, transfer, and use of biological weapons?

Graph 8: Support for the Criminalization of Biological Weapons-Related Activities



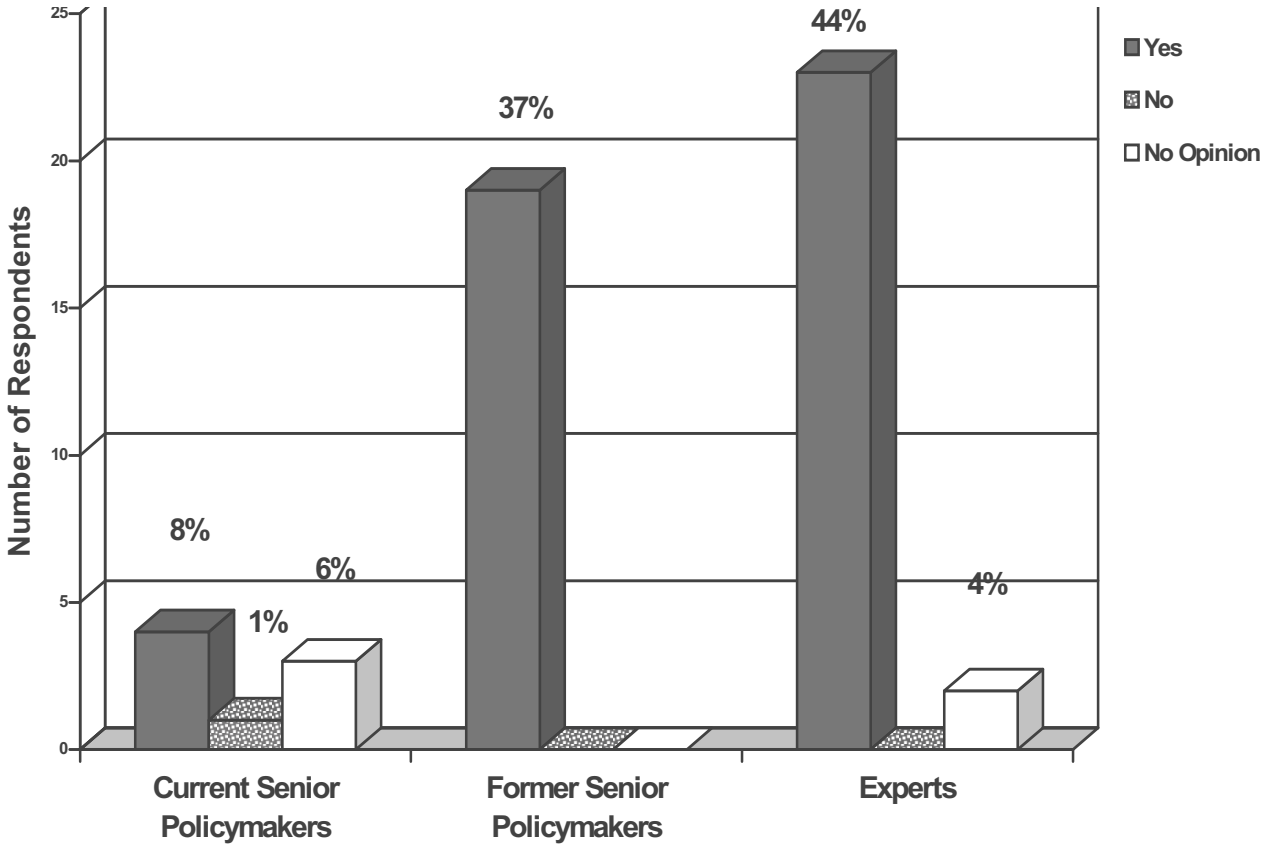
A pronounced majority, ninety-four percent, of survey participants viewed the passage of criminalization laws as a constructive tool of biological weapons nonproliferation, with only two dissenting opinions, one no opinion vote. The current senior policymaker who cast one of two votes against criminalization of bioweapons-related activities said that it "would criminalize legitimate research into countermeasures." This individual said their answer would change to a "yes" if a specific exemption were added for research.

One former senior policymaker who supported criminalization laws nonetheless doubted "if they would be effective." No one else expressed that sentiment, but two experts commented that United Nations Security Council Resolution 1540 directed that all states should pursue criminalization laws. One expert argued that this step "should be considered mandatory under 1540 and the Biological and Toxin Weapons Convention."

Two current senior policymakers observed that the United States already has criminalization legislation in place, specifically in U.S. Code 175, as amended by the Patriot Act. One of these individuals stated that "it is important to encourage other nations to adopt similar legislation because the biothreat does not stop at our borders." A current senior policymaker added: "U.S. legislation will only protect us to a certain extent. An international approach is needed in which we encourage other nations to adopt similar legislation criminalizing bioweapons as the U.S. The Department of State recently initiated a biocriminalization project with Interpol to encourage other nations to adopt such legislation." Along those lines, a nongovernmental expert suggested that criminalization laws "should be harmonized among countries and tied to international conventions."

Should individuals engaged in the life sciences and related fields (e.g., microbiology, biochemistry) adopt a professional code that highlights the dual-purpose use of scientific knowledge, condemns biological warfare, and specifically encourages or requires ethical conduct to inhibit the deliberate malevolent use of highly infectious pathogens?

Graph 9: Support for Professional Codes for Life Scientists



The concept of having scientists in the life sciences disciplines adopt a professional code had considerable appeal to the survey participants, with eighty-nine percent voting in favor of this option. Only one survey participant, a current senior policymaker, objected to this policy option. This individual acknowledged the ability of codes to raise awareness but asked whether

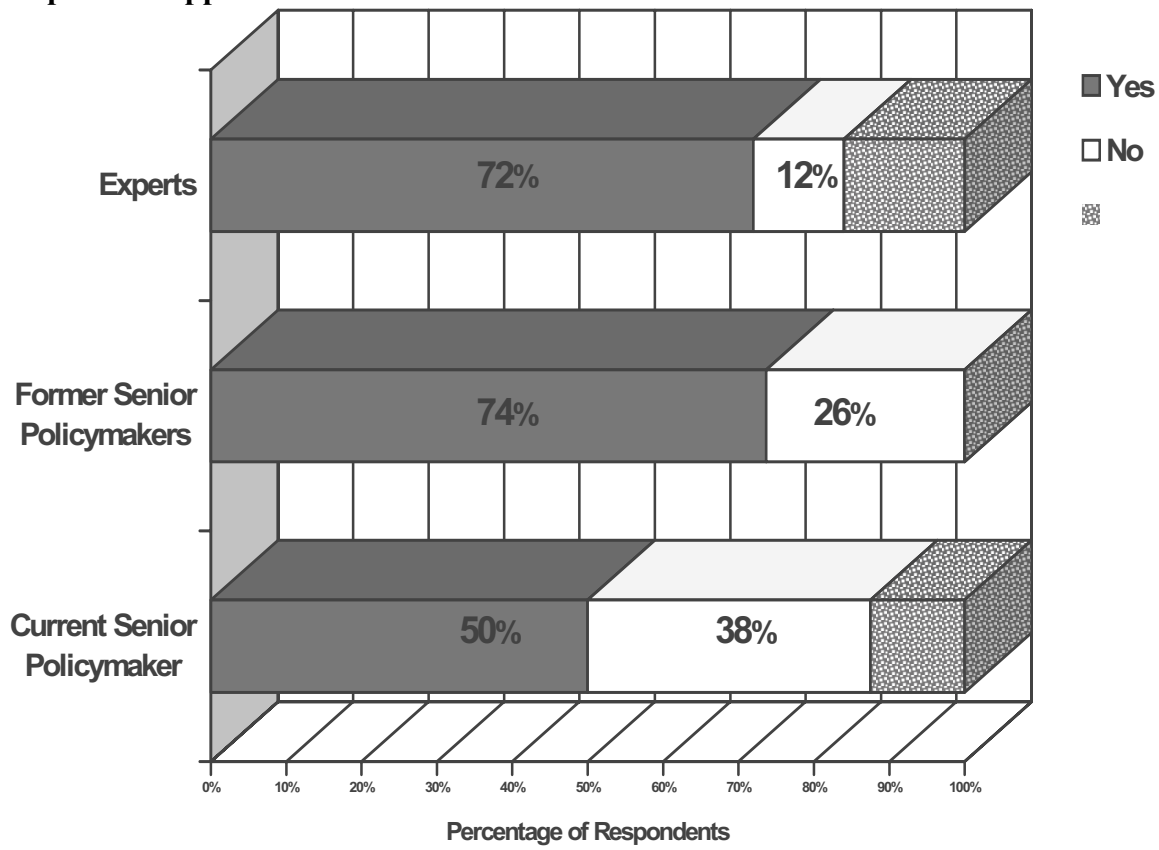
individuals in the life sciences whose work was not dual-use need be involved. To that end, this individual wondered, "how broad does it need to be?"

Five survey participants did not have an opinion on whether professional codes should be instituted. One "no opinion" voter, a current senior policymaker, said he did not "know if this adds any value." Another senior policymaker, who supported this policy option, noted that multiple codes would be needed to adapt "to different circumstances and conditions."

For all of its appeal, some of those who backed this policy seemed to recognize its limitations with their comments. One expert said that "codes educate but cannot prevent deliberate misuse," while a former senior policymaker observed that codes "will not take the place of" multilateral treaties and standards. One current senior policymaker portrayed a code as "somewhat helpful in raising awareness of the dual-use issue," but questioned "who would be subject to the code (those only in life science or also in related fields such as engineering and mathematics) and how effective that code would be."

Should individual governments require universities and colleges awarding undergraduate and advanced degrees in the life sciences require degree candidates to take a standardized curriculum of substantial instruction in the ethics of science and in biosafety and biosecurity practices?

Graph 10: Support for a Standardized Curriculum for Life Sciences Students

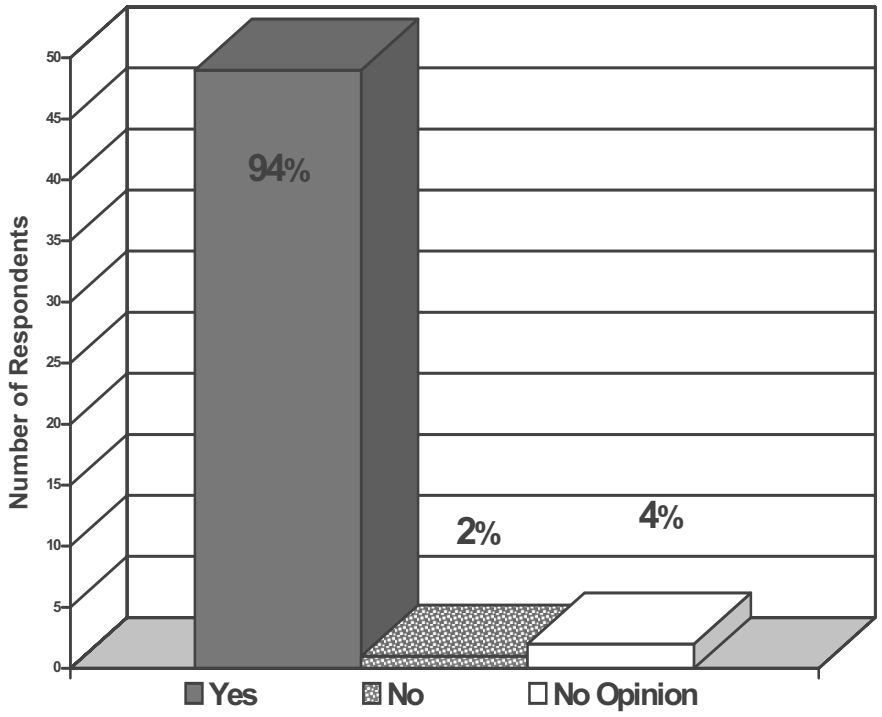


The policy option of requiring universities and colleges to administer a standardized curriculum in the ethics of science and in biosecurity and biosafety practices to students in the life sciences received strong support from the survey participants, with sixty-nine percent of the total survey participants approving of this option. Twenty-two percent disagreed with a standardized curriculum, while nine percent of those polled had no opinion on this matter.

The common theme among the comments provided on this policy option related to the amount of education that should be required. One expert noted that "a short course may be sufficient," while another said there would be "a lot of push-back on this one because students don't like more and more required courses." This individual suggested integrating the instruction "into the existing curriculum somehow" and that perhaps "a couple of lectures highlighting the issue at the undergraduate level" would be sufficient. A current senior policymaker agreed that "education and training is definitely a key component of biosecurity," but noted that "'substantial' instruction for undergraduates in the life sciences may not be the best, most effective use of limited resources. A more targeted approach may prove more fruitful." Picking up where that individual left off, another current senior policymaker stated that "for advanced degree candidates in the life sciences who work or will work with pathogens, implementing a standardized curriculum in ethics and in biosafety and biosecurity practices is a sound idea," but that those who do not plan a career in research should not be required to take "substantial" instruction.

Should individual governments mandate that facilities handling highly infectious pathogens require that their employees to be certified in basic biosafety and biosecurity procedures and receive refresher training and recertification on a regular basis?

Graph 11: Support for Facility Certification of Employees in Biosafety and Biosecurity Procedures



Survey participants gave a ringing endorsement to having individual governments require facilities involved with highly infectious pathogens to certify their employees are knowledgeable in biosafety and biosecurity rules and regularly provide refresher training and recertification. Of those polled, ninety-four percent supported this policy. The single no vote on this policy option was from a former senior policymaker, who said that facilities should not handle this responsibility, but "accrediting agencies should, however." Another former policymaker applauded the notion of "oversight, oversight, oversight!" while a third former senior policymaker agreed that "the goal is right" but doubted that "an internationally regarded standard is plausible because countries will want the flexibility to adapt to local norms."

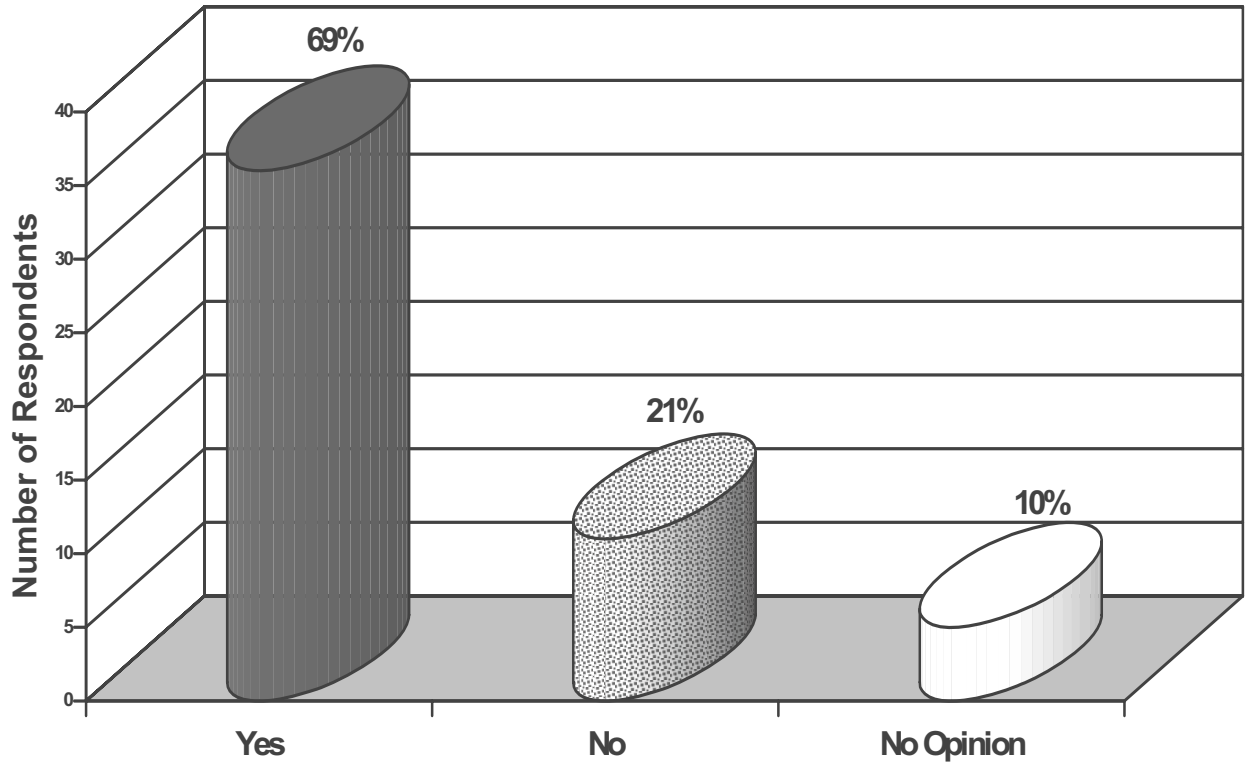
The 1975 Biological and Toxin Weapons Convention, which bans the development, production, stockpiling, and transfer of germ weapons, lacks provisions to monitor treaty compliance. Should the international community convene negotiations to design on-site inspections and other monitoring procedures to strengthen the ability to monitor adherence to this treaty?

A sixty-nine percent majority of the survey participants thought that negotiations to add a monitoring provisions to the Biological and Toxin Weapons Convention should be resumed. Nine individuals, however, balked at the suggestion of negotiating monitoring provisions for this treaty. A current senior policymaker articulated a few reasons for not supporting negotiations. Concluding that this policy would be "bound to fail," this individual stated: "The existing mandate for such negotiations, from the 1994 Special Conference, contains inherent dichotomy between opposing objectives of a negotiation. Achieving a mandate to even attempt an effective monitoring regime would be impossible. If such a mandate existed, achieving effective measures is also very improbable."

Explaining one of four "no opinion" votes, a former senior policymaker said "this goal is too ambitious. A more plausible set of near-term steps has more promise." The remarks of a nongovernmental expert were similar: "There needs to be exploration of alternative mechanisms." This individual described the treaty as "increasingly irrelevant in today's fast advancing biological environment." A current senior policymaker said that "given the dual-use nature of biological agents, their precursors, and laboratory equipment, it is incredibly challenging to decipher whether a facility is conducting legitimate research or creating a weapon, rendering on-sight inspection of little value."

The challenge of negotiating a monitoring protocol did not daunt others who provided commentary on this issue. One expert stipulated that a monitoring protocol be centered on "clarification and challenge visits, not routine." A former senior policymaker called for U.S. leadership: "Since this treaty does not have monitoring provisions, there ought to be a major U.S. initiative to inspire them. We should be at the negotiating table on this, leading the way." With the gravity of the threat warranting U.S. action, this individual continued, saying that "in the minds of almost anybody talking about the subject of nonproliferation, this term refers strictly to nuclear weapons. Well, the definition has got to be expanded to include biological weapons, which are a particularly insidious threat." A former senior official took strong issue

Graph 12: Support for Adding Monitoring Provisions to the Bioweapons Ban



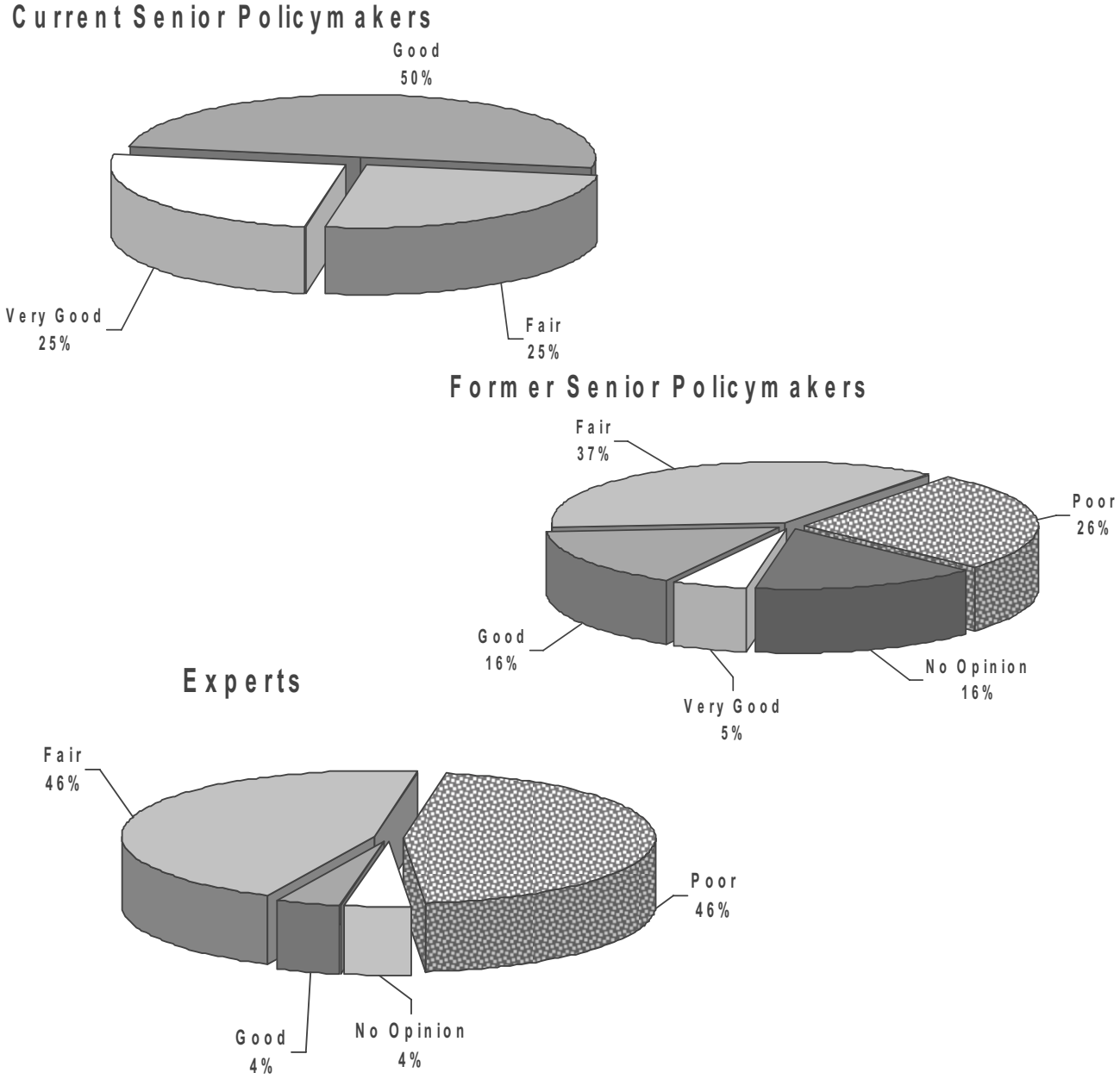
with the U.S. government's failure to press ahead with negotiation of monitoring provisions: "It is unacceptable to claim, as the U.S. has, that a weapon made by human hands cannot be controlled by human hands and unacceptable to indicate that the U.S., being ahead in this field, would rather retain its advantages than risk their loss through security leaks."

Two experts, however, expressed strong misgivings that the current U.S. administration would not pursue this policy option. Said one of them, "this ain't gonna happen until the United States changes its position. Even then, a number of other states would probably have to change their views as well to have a strong package. It's not worth pursuing hard until there's a reasonable chance of success."

Survey Questions on the U.S. Government's Performance and Future Priorities Related to Biological Weapons Nonproliferation

This two-part question addresses the U.S. government's recent past performance and its future priorities. How would you rate the U.S. government's performance in pursuing bioweapons nonproliferation and accident prevention measures in the last five years?

Graph 13: Evaluation of the U.S. Governments Performance in the Last 5 Years



Relatively few of those surveyed saw the U.S. government's recent past performance in bioweapons nonproliferation in a positive light. No one rated the performance as excellent, and only four "very good" votes were cast, three from current senior policymakers. A current and a former senior policymaker respectively attributed their "very good" ratings to the "nonproliferation and counter proliferation departments being actively engaged worldwide" and "great awareness of the dangers." Two former senior policymakers credited their assessments of "good" U.S. government performance on the bioweapons nonproliferation agenda to "oversight" and "uncoordinated R&D and detection tools."

A current senior policymaker characterized this as "a challenging area in which success comes slowly" and listed some positive aspects of the U.S. government's performance. Overseas, this individual highlighted "U.S./Russian cooperation in avian flu surveillance, increased access to and reconfiguration of former Soviet bioweapon production facilities, and redirecting former bioweaponeers to peaceful pursuits." At home, this current senior policymaker said that "implementation of the Select Agent Program has increased our biosecurity posture."

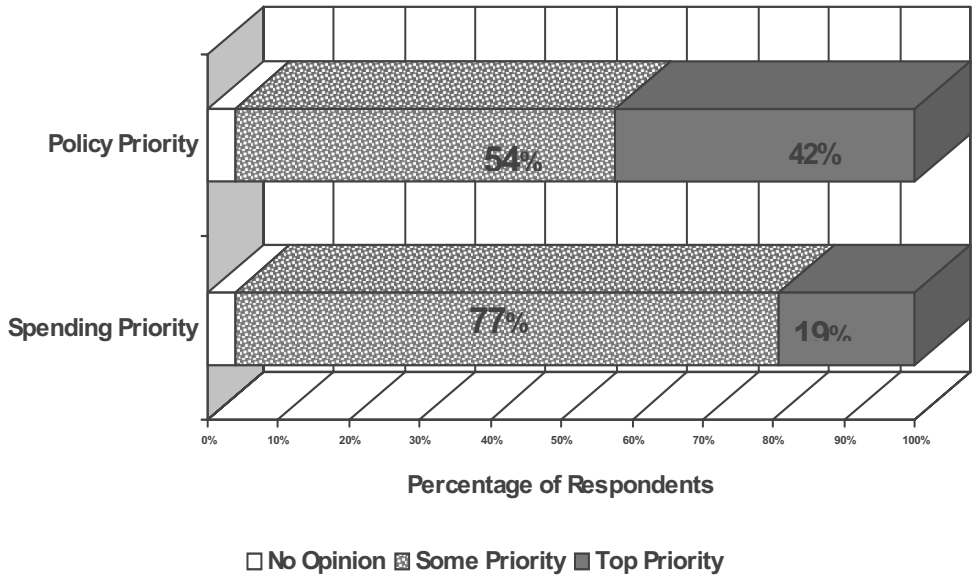
Most survey participants saw the performance as either fair (forty percent) or poor (thirty-one percent), a combined seventy-one percent. Survey participants provided a laundry list of reasons for the U.S. government's mediocre performance in recent years. A nongovernmental expert who rated the U.S. government's performance as fair provided a corresponding laundry listed "lack of adequate funding to incentivize the lock up of pathogens in Russia and the former Soviet Union; no pursuit of harmonized global biosecurity norms; lack of adequate balance between preparedness for biological attack and the need to prevent it; almost total disregard in key policy making institutions, particularly the Congress, for the security implications of advances of the technology." Adding to this list, two nongovernmental experts suggested as reasons for the government's run-of-the-mill performance, "lots of money spent, not much consideration and thought" and "seems disorganized and rather weak, with no penalties (or forced compliance)." Lengthening the list yet again, a former senior official nominated "neglect of the multilateral dimension reduces effectiveness." One former senior policymaker who gave the U.S. government a grade of "C minus" remarked that "the intention of the U.S. government on this agenda has been good, but not necessarily the execution." Another former senior policymaker said the reason for the fair performance was simple: "We have not made this a priority."

Two survey participants, one a nongovernmental expert, credited their poor ratings to the absence of U.S. leadership on this agenda internationally. The other, a former senior policymaker assigned blame to "the lack of interest by the administration and their antipathy to treaties." Two other nongovernmental experts combined these viewpoints, one commenting that the U.S. government had "no focus on this issue" and another pointing to the U.S. "rejection of binding multilateral agreements" as a handicap on international progress in biological weapons nonproliferation.

Expressing a sense of urgency about the government's pedestrian performance on the biological weapons nonproliferation agenda, one former senior policymaker commented, "there is much more to do and perhaps little time!" Former Defense Secretary Frank C. Carlucci, who felt the U.S. government's performance on this agenda was undistinguished, stated that the survey "suggested a number of helpful measures" and pointedly asked: "Why has the USG not advocated them?"

How much policy and spending priority do you think the U.S. government should place on biological weapons nonproliferation policies and programs in the future?

Graph 14: Recommended Level of Policy, Spending Priority



Most of the survey participants took the middle of the road in responding to this question about policy and spending priority. Fifty-four percent of all of those polled said that bioweapons nonproliferation should command some policy priority from the U.S. government, whereas forty-two percent argued that this agenda should receive top policy priority. As for spending priority, a sturdy seventy-seven percent of the survey participants believed that biological weapons nonproliferation deserved some spending priority, while nineteen percent thought this agenda merited top spending priority. Two survey participants did not offer opinions on policy or spending priorities.

A former senior policymaker who categorized biological weapons nonproliferation as a top policy priority said, with considerable emphasis, "when the average American thinks of WMD, he or she thinks nuclear. Biological is a subject that needs for more attention and awareness! It's a major killer!" An expert who also believed bioweapons nonproliferation should top the U.S. government's list of priorities described biological warfare agents as "the most serious threats to U.S. security. Nuclear scenarios are unlikely and chemical attacks are

self limiting. Communicable biological agents are self propagating and have potential calamitous results. We should make the control of such agents a top priority."

A nongovernmental expert who made bioweapons nonproliferation a top policy priority and said the U.S. government should give it some spending priority argued that "the private sector must also make this a priority and provide resources to supplement what the government is able to provide." A former senior official depicted the U.S. government's spending track record as follows: "We are spending a lot of money now with questionable effect." Another expert would have the U.S. government place top policy and spending priority on bioweapons nonproliferation. Spotlighting the meager spending in this area, this individual observed that "homeland security, which is essentially a responsive effort, is $42 billion. Bio proliferation prevention is under $200 million."

In order of their potential to reduce the threat of biological weapons proliferation or accidental release of a highly infectious pathogen, please rank the utility of the following policy options.

Table 5: Assessing the Utility of Nonproliferation Policy Options*

Policy Option	Very Useful	Useful	Not Very Useful	Not Useful	No Opinion
Obligate facilities working with highly infectious pathogens to institute rigorous biosecurity measures	71%	25%	0	0	4%
Compel facilities working with highly infectious pathogens to institute robust biosafety measures	69%	21%	4%	0	6%
Require facilities engaged in genetic engineering research with highly infectious pathogens to institutionalize an oversight system	46%	44%	4%	0	6%
Criminalize activities associated with the acquisition and use of biological weapons	63%	21%	12%	2%	2%
Encourage relevant scientific associations to adopt professional codes	31%	56%	10%	0	3%
Require standardized ethics, biosafety, and biosecurity education for individuals seeking life sciences degrees	25%	50%	13%	4%	8%
Mandate that facilities handling highly infectious pathogens to ensure that their employees have appropriate biosafety and biosecurity training	60%	37%	0	0	3%
Add inspections and other monitoring procedures to the Biological and Toxin Weapons Convention	48%	25%	11%	8%	8%

***Survey participants were also given the choice of "Other option," but no respondents selected this choice.**

The policy option that survey participants voted to as be very useful was the policy of instituting strong biosecurity for facilities handling highly infectious pathogens, followed by robust biosafety, criminalization of bioweapons-related activities, biosafety and biosecurity certification of employees at facilities working with highly infectious pathogens, adding monitoring provisions to the bioweapons ban, and establishing tiered oversight of genetic engineering research. Professional codes for those working in the life sciences disciplines received the most support for being useful, followed closely by a standardized curriculum in scientific ethics and biosecurity and biosafety for those earning life sciences degrees and oversight of genetic engineering research. Ruminating on the policy options, a senior former

policymaker described them all as "useful in the abstract. Practically," this individual stated, "there are problems with imposing them as binding obligations."

Seven survey participants viewed a standardized curriculum as being not very useful, with adding monitoring measures to the Biological and Toxin Weapons Convention and criminalization laws both getting the next highest vote tally in this category. The policy option of professional codes rated third in the "not very useful" category. Strengthening the bioweapons treaty rated four "not useful" votes from survey participants. Those polled had "no opinion" on all policy options, with the most votes of this type for adding monitoring measures to the bioweapons treaty and a standardized curriculum in universities.

Around the world, the measures in place in some nations and in some biological facilities to prevent proliferation, contain the scope of accidents, and otherwise govern activities with highly infectious pathogens range from nonexistent to quite strong to ad hoc and widely variable. From the list of approaches, please select those that you think would provide the <u>strongest barrier(s)</u> to proliferation of biological weapons and to accidental release of highly infectious pathogens.

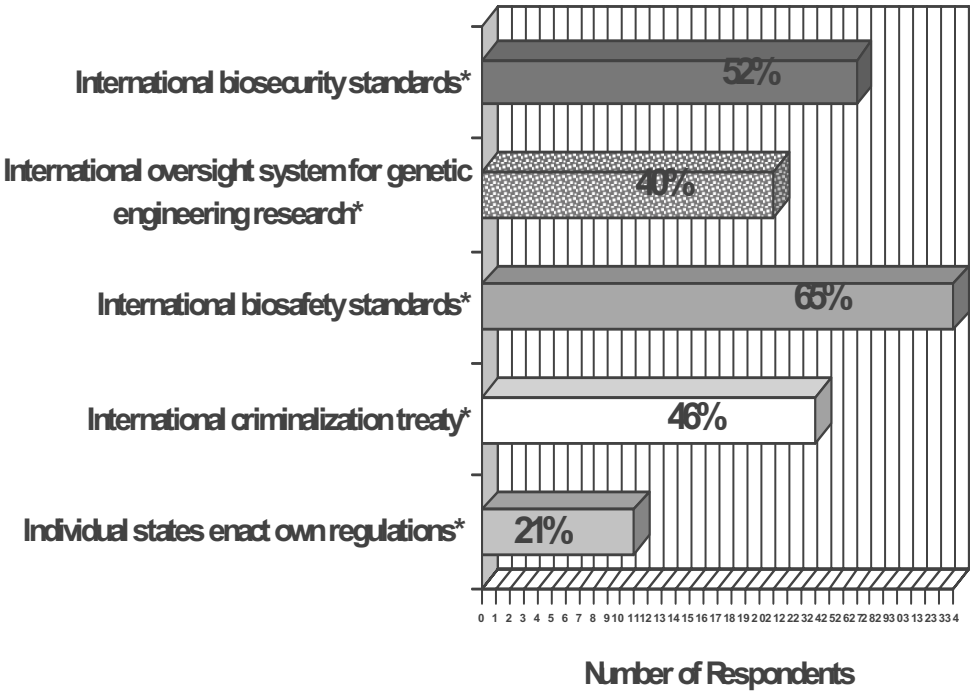
This question offered survey participants a choice between unilateral or multilateral approaches to implementing several bioweapons nonproliferation policy options. Of those surveyed, twenty-one percent backed a unilateral approach to biological weapons nonproliferation measures, whereby states, if they opt to do so, would establish their own laws and regulations. One of the individuals who supported a unilateral approach, a former senior policymaker, stated: "I'm not confident that multilateral measures will be effective."

The multilateral policy options received far stronger backing than the unilateral approach, with seventy-two percent of those surveyed endorsing some form of a multilateral measure. Tough international biosafety standards received votes from sixty-six percent of the survey participants, biosecurity standards from fifty-two percent, an international biocriminalization treaty forty-six percent, and an international system of genetic engineering oversight garnered votes from forty percent of those polled. In addition, a current senior policymaker suggested a multilateral combination approach, namely an "international set of biosurety standards that also encourages states to adopt national legislation." Biosurety is blend of biosafety and biosecurity measures. Likewise, a second current senior policymaker advocated international biosecurity standards in tandem with national criminalization legislation.

One expert viewed the policy options that included automatic noncompliance penalties as "unachievable," noting that arms control treaties do not include automatic punishments for noncompliance. This individual asked, "how do you convince states to accept such penalties up front?" Regulatory regimes do, however, frequently incorporate noncompliance penalties as an incentive for companies and individuals to take the responsibility of implementing the regulations seriously. In keeping with this formula, a current senior policymaker said that "states with strong regulatory regimes will need to apply those regimes internationally, perhaps by denying intellectual property benefits (patents, etc) to noncompliant firms." Another current senior policymaker warned against formulating biosecurity, biosafety, or oversight of genetic engineering standards in such a way that they would create an "international registry of both

institutions and individuals who are operating in secure environments" that would be "available to both governments and commercial firms," which could serve as a "'shopping list' of potential collaborators/researchers for dangerous pathogen activity."

Graph 15: Support for Unilateral Versus Multilateral Policy Options



Key to Policy Options:
*****A robust, international set of standards for biosecurity with automatic penalties for noncompliance (e.g., hefty fines for individuals and facility operators)
*****A solid, tiered system of institutional, national, and international oversight of genetic engineering research with automatic penalties for noncompliance (e.g., loss of job)
*****A tough, international set of standards for biosafety with automatic penalties for noncompliance (e.g., loss of accreditation and/or license)
***** An international treaty that criminalizes development, production, acquisition, stockpiling, retention, transfer, and use of biological weapons, requiring anyone who commits the prohibited acts to be prosecuted or extradited for prosecution
*****Based on their knowledge of domestic circumstances, individual states are best suited to prepare and implement, if they choose to do so, their own laws and regulations to impede biological weapons proliferation and accidental release

Arguing for the multilateral approach, one former senior policymaker stated:

> International standards should be set for biosecurity, for biosafety, and for oversight of genetic engineering research. All states should know and adhere to the rules. The International Atomic Energy Agency, though it has had some problems on occasion, has on the whole done a very good job of being a nuclear watchdog. We should have the equivalent of the IAEA for biosecurity, biosafety, and oversight of genetic engineering research. We keep on tearing down, criticizing the United Nations' system. Instead, we ought to be doing what we can to make it work in these and other areas. Counting on individual governments to set these types of biological standards on their own is not enough. A collaborative effort by responsible nations is needed. This is yet another chance for the United States to exercise international leadership by promoting international standards and mechanisms in this area. Absent a major biological crisis, I doubt we'll do it.

This individual was not alone in worrying that the United States would be complacent about pursing biological weapons nonproliferation measures.

Three survey participants asked some of that their remarks go on the record. Former Vice Chairman of the Joint Chiefs of Staff General Joseph W. Ralston observed:

> My concern is that, as important as this issue is, and as many things that need to be done about it, it is unlikely that the U.S. government will do anything significant until a biological catastrophe occurs. To illustrate my point, in 1997 the Unified Command Plan tried to stand up a small task force to study the terrorist threat to the United States. This concept to study the terrorist threat caused an uproar both inside and outside of the government. We could see it coming and we tried to make a relatively modest effort to study the problem, but even that was rejected. Five years later, of course, come the 9/11 attack. The same factors will be in play with the biological weapons threat. That's just the way our system works.

General Ralston's remarks were also eerily similar to an observation made by another former senior policymaker in response to the question about the likelihood of a major bioweapons attack within the next decade.

Also in the camp supporting a multilateral approach to biological weapons nonproliferation, Jonathan B. Tucker, PhD, a nongovernmental expert in chemical and biological weapons issues, provided the following comment for the record:

> The ongoing revolution in molecular biology is likely to increase significantly the future threat of biological and biochemical warfare. If the international community is to manage this threat, both national biosecurity measures and binding international agreements to strengthen the BWC (e.g. mandatory

declarations of dual-use facilities and clarification or challenge visits to address compliance concerns, but not routine visits) will be essential.

Former U.S. Ambassador Jonathan Dean pointed to a lack of political will as the culprit for the current status of international bioweapons nonproliferation efforts: "I believe one of the largest problems here is the willingness of the U.S. government agencies to rely more on their own capabilities than to risk possible loss of secrecy through multilateral cooperation in protecting against biological weapons." Finally, former Secretary of Defense Frank C. Carlucci stated: "This is a serious threat which has not received sufficient attention. This survey indicates that a number of steps can be taken to reduce it but not eliminate this threat. We need to raise the priority of this issue."

Annex I
List of Participants

Stewart Baker
Assistant Secretary for Policy, U.S. Department of Homeland Security

Hans Binnendijk
Theodore Roosevelt Chair in National Security Policy and Director, Center for Technology and National Security Policy, National Defense University

Harold Brown
Trustee & Counselor, Center for Strategic and International Studies, and former Secretary of Defense

Matthew Bunn
Senior Research Associate, Belfer Center for Science and International Affairs at the Harvard University John F. Kennedy School of Government

MajGen. William F. Burns (U.S. Army, Ret.)
Distinguished Fellow, U.S. Army War College, and former Director, Arms Control and Disarmament Agency

Daniel Byman
Director, Center for Peace and Security Studies, Georgetown University

Frank C. Carlucci
Counselor, Center for Strategic and International Studies, and former Secretary of Defense

Ashton Carter
Ford Foundation Professor of Science and International Affairs, John F. Kennedy School of Government, Harvard University, and former Assistant Secretary of Defense for International Security Policy

LtGen. James R. Clapper (U.S. Air Force, Ret.)
Senior Vice-President and COO, DFI International, and former Director, Defense Intelligence Agency

William S. Cohen
Chairman & CEO of the Cohen Group, and former Secretary of Defense

Jonathan Dean
Adviser on Global Security Issues, Union of Concerned Scientists, and former Ambassador to the NATO-Warsaw Pact Force Reduction Talks

Robert Einhorn
Senior Adviser, Center for Strategic and International Studies, and former Assistant Secretary of State for Nonproliferation

Clark Kent Ervin
Director of the Homeland Security Initiative, Aspen Institute

Charles Ferguson
Fellow for Science and Technology, Council on Foreign Relations

James Forest
Director of Terrorism Studies, U.S. Military Academy, West Point

James Goodby
Nonresident Senior Fellow, Brookings Institution, former Ambassador for Nuclear Security and Dismantlement and Deputy Assistant Secretary of State for European Affairs and for Political-Military Affairs

John Hamre
President & CEO, Center for Strategic and International Studies, and former Deputy Secretary of Defense

Siegfried Hecker
Visiting Professor, Center for International Security and Cooperation, Stanford University, and Director Emeritus of Los Alamos National Laboratory

Laura Holgate
Vice President for Russia & NIS Programs, Nuclear Threat Initiative

Adm. David E. Jeremiah (U.S. Navy, Ret.)
President of Technology Strategies & Alliances Corporation, and former Vice Chairman, Joint Chiefs of Staff

Juliette Kayyem
Lecturer in Public Policy, Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University

Gen. P.X. Kelley (U.S. Marine Corps, Ret.)
Former Marine Corps Commandant

Congressman Peter T. King
Chairman, House Committee on Homeland Security, Member, House Committee on International Relations

Lawrence Korb
Senior Fellow, Center for American Progress

Franklin D. Kramer
Distinguished Research Fellow, Center for Technology and National Security Policy, National Defense University

Michael Krepon
President Emeritus, Henry L. Stimson Center

Melvin R. Laird
Former Secretary of Defense

Anthony Lake
Distinguished Professor in the Practice of Diplomacy, Edmund A. Walsh School of Foreign Service, Georgetown University, and former National Security Advisor

Congressman John Linder
Chairman, House Subcommittee on the Prevention of a Nuclear and Biological Attack

Robert Litwak
Director of International Security Studies, Woodrow Wilson International Center for Scholars

Senator Richard G. Lugar
Chairman, Senate Committee on Foreign Relations

Kenneth N. Luongo
Executive Director, Russian-American Nuclear Security Advisory Council

Ambassador Donald A. Mahley
Special Negotiator for Chemical and Biological Arms Control Issues, Department of State

Norman P. Neureiter
Director, Center for Science, Technology and Security Policy at the American Association for the Advancement of Science

Thomas W. O'Connell
Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict

Gen. William E. Odom (U.S. Army, Ret.)
Senior Fellow, Hudson Institute, and former Director of the National Intelligence Agency

Charles V. Peña
Senior Fellow, The Independent Institute

William Potter
Institute Professor and Director, Center for Nonproliferation Studies, Monterey Institute

Gen. Joseph W. Ralston (U.S. Air Force, Ret.)
Former Vice Chairman, Joint Chiefs of Staff, and Supreme Allied Commander Europe, NATO

Gen. Dennis Reimer (U.S. Army, Ret.)
President, DFI International, and former U.S. Army Chief of Staff

Marc Sageman
Senior Associate, Center for Strategic and International Studies

Michael F. Scheuer
Adjunct Professor of Security Studies, Edmund A. Walsh School of Foreign Service, Georgetown University

Congressman Christopher Shays
Chairman, House Subcommittee on National Security, Emerging Threats and International Relations; Member, House Committee on Homeland Security

Walter B. Slocombe
Former Under Secretary of Defense for Policy

James Steinberg
Dean, Lyndon Baines Johnson School of Public Affairs, University of Texas

Congressman Bennie G. Thompson
Ranking Member, House Committee on Homeland Security

Jonathan B. Tucker
Guest Researcher, Stiftung Wissenschaft und Politik

Adm. Stansfield Turner (U.S. Navy, Ret.)
Former Director of the Central Intelligence Agency

Adm. James Watkins (U.S. Navy, Ret.)
Former Chief of Naval Operations and former Secretary of Energy

Gen. Larry Welch (U.S. Air Force, Ret.)
Former Air Force Chief of Staff

Jon Wolfsthal
Fellow, Center for Strategic and International Studies

Raymond Zilinskas
Director, Chemical and Biological Weapons Nonproliferation Program, Center for Nonproliferation Studies, Monterey Institute