

**Director's Series: Science, Technology and Policy: Biological
Weapons and Nuclear Use**

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FOREIGN AFFAIRS

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Why America Must Lead Again

Rescuing U.S. Foreign Policy After Trump

Joseph R. Biden, Jr.

“As I said in 2017, I believe that the sole purpose of the U.S. nuclear arsenal should be deterring—and, if necessary, retaliating against—a nuclear attack. As president, I will work to put that belief into practice, in consultation with the U.S. military and U.S. allies.” (p. 75)

U.S. Nuclear Weapons Policies: A Conversation with Michèle Flournoy

INTERVIEWS

July/August 2017

Interviewed by Kingston Reif and Maggie Tennis



I think if you have nuclear use by one nuclear power against another, the risk of full-scale escalation is there. The case that has, in recent years, stopped presidents from fully embracing [a] no-first-use [policy] has been the potential for catastrophic weapons of mass destruction [WMD] attacks of a different nature—for example, a successful, massive bio-attack that would have consequences on the order of a nuclear attack in terms of people killed and so forth. It's that exceptional case that has kept people from making the full statement.

117TH CONGRESS
1ST SESSION

Calendar No. 144

H. R. 4350

IN THE SENATE OF THE UNITED STATES

OCTOBER 18, 2021

Received; read twice and placed on the calendar

POLITICO

Pentagon may not present Biden with nuclear options he wants

By ALEXANDER WARD and QUINT FORGEY | 11/05/2021 04:43 PM EDT

10 SEC. 1633. SENSE OF CONGRESS REGARDING NUCLEAR
11 POSTURE REVIEW.
12 It is the sense of Congress that the nuclear posture
13 review initiated in 2021 should address the following:
14 (1) An assessment of the current and projected
15 nuclear capabilities of Russia and China;
16 (2) the role of nuclear forces in United States
17 military strategy, planning, and programming;
18 (3) the relationship between deterrence, tar-
19 geting, and arms control;
20 (4) the role of missile defenses, convention-
21 strike forces, and other capabilities play in de-
termining the role and size of nuclear forces;
the levels and composition of nuclear

“Sole Purpose” vs. “No First Use”

No First Use:

The United States will not be the first to use nuclear weapons, no matter the circumstances

“Supporters of the current policy argue that removing the threat of nuclear escalation could embolden countries like North Korea, China, or Russia, who might believe that they could overwhelm U.S. allies in their regions and take advantage of local or regional conventional advantages before the United States or its allies could respond. In such a scenario, some argue, the “no first use” pledge would not only undermine deterrence, but could also increase the risk that a conventional war could escalate and involve nuclear weapons use.”

[and therefore proliferation consequences And China]

Amy Woolf, CRS, October 13, 2021

“Sole Purpose” vs. “No First Use”

Sole Purpose:

Sole Purpose 1: *The sole purpose of the U.S. nuclear arsenal is to deter — and, if necessary, to retaliate against — a nuclear attack against the United States and its allies.*

Sole Purpose 2: *The sole purpose of the U.S. nuclear arsenal is to deter nuclear attacks against the United States and its allies.*

Sole Purpose 3: *The sole purpose of the U.S. nuclear arsenal is to deter significant strategic attacks, including nuclear attacks, against the United States and its allies.*

And the “sole purpose car to the emergency room” analogy

(Ankit Panda and Vipin Narang, *War on the Rocks*, Feb. 22, 2021)

Obama 2010 NPR

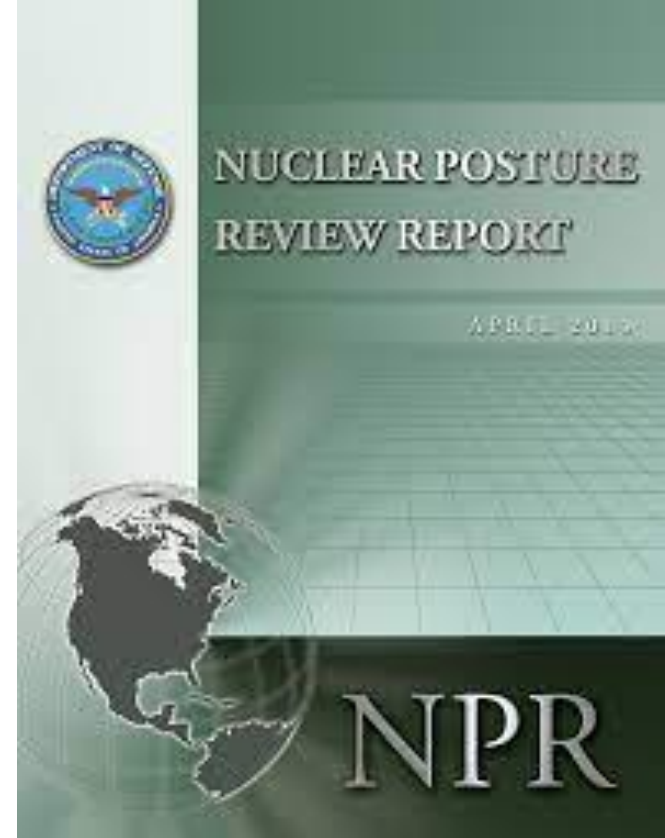
REDUCING THE ROLE OF U.S. NUCLEAR WEAPONS

The fundamental role of U.S. nuclear weapons, which will continue as long as nuclear weapons exist, is to deter nuclear attack on the United States, our allies, and partners.

....

To that end, the United States is now prepared to strengthen its long-standing “negative security assurance” by declaring that the United States will not use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the Nuclear Non-Proliferation Treaty (NPT) and in compliance with their nuclear non-proliferation obligations.

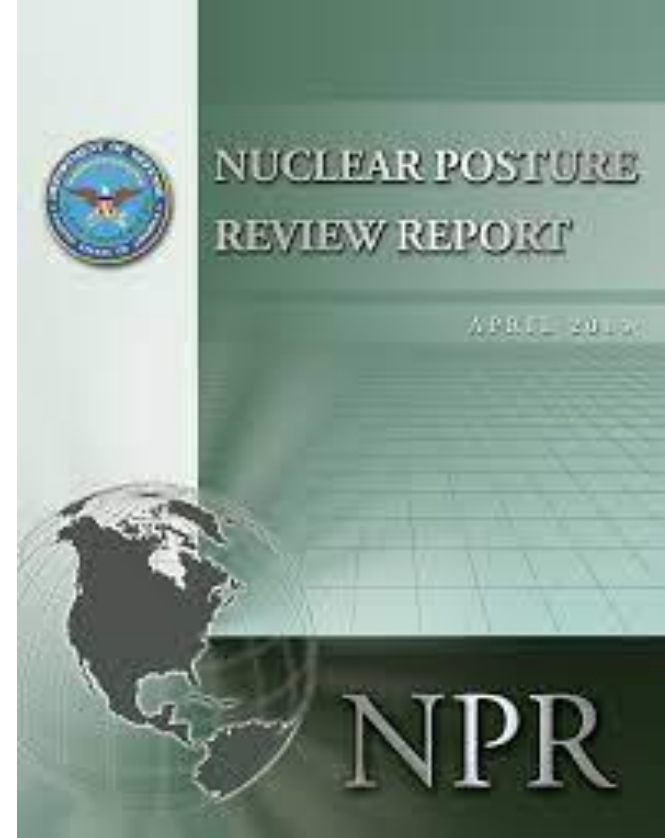
....



pp. 15-16

The BW carve-out:

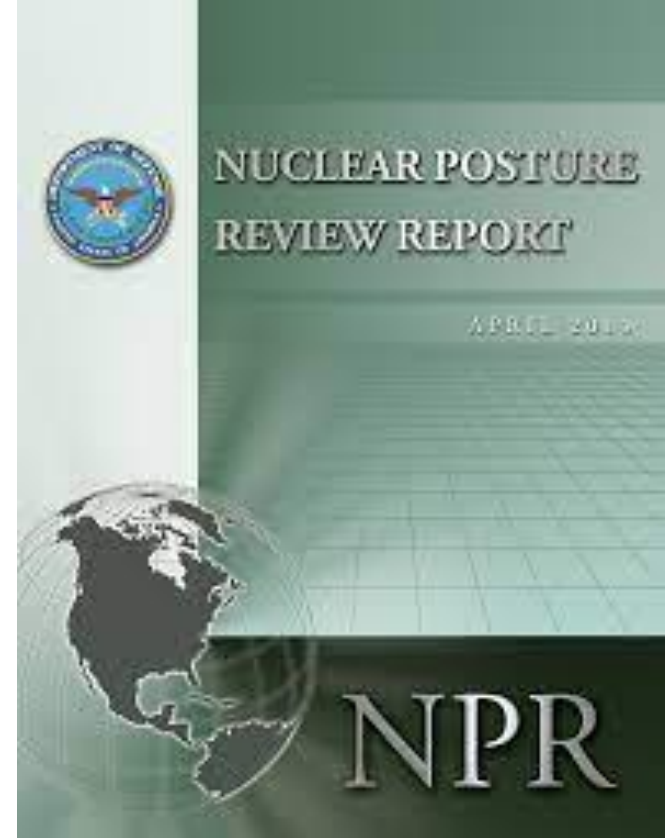
Given the catastrophic potential of biological weapons and the rapid pace of bio-technology development, the United States reserves the right to make any adjustment in the assurance that may be warranted by the evolution and proliferation of the biological weapons threat and U.S. capacities to counter that threat.



pp. 15-16

REDUCING THE ROLE OF U.S. NUCLEAR WEAPONS

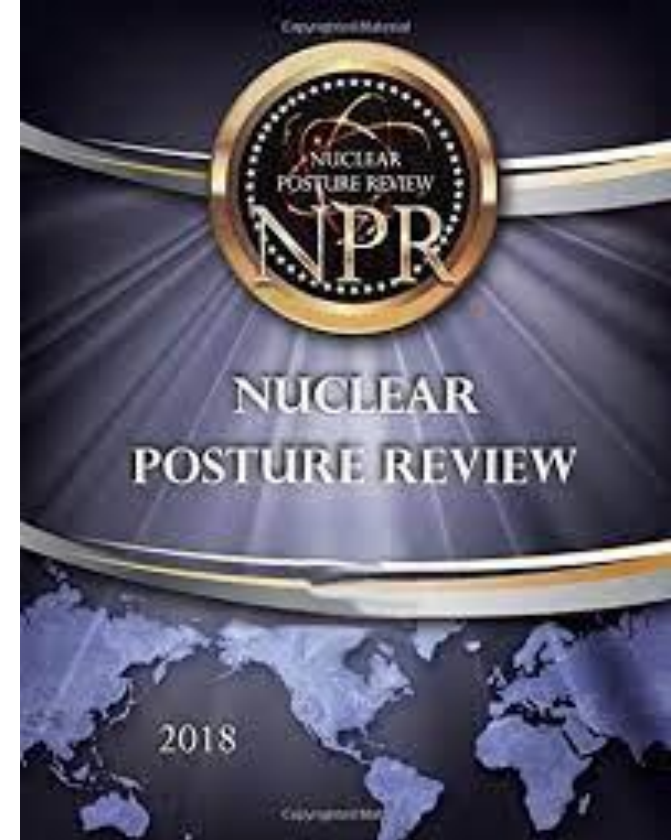
In the case of countries not covered by this assurance – states that possess nuclear weapons and states not in compliance with their nuclear non-proliferation obligations – **there remains a narrow range of contingencies in which U.S. nuclear weapons may still play a role in deterring a conventional or CBW attack against the United States or its allies and partners. The United States is therefore not prepared at the present time to adopt a universal policy that the “sole purpose” of U.S. nuclear weapons is to deter nuclear attack on the United States and our allies and partners, but will work to establish conditions under which such a policy could be safely adopted.**



pp. 15-16

Trump 2018 NPR

(p. 21)



The United States will not use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the NPT and in compliance with their nuclear non-proliferation obligations.

Given the potential of significant non-nuclear strategic attacks, the United States reserves the right to make any adjustment in the assurance that may be warranted by the evolution and proliferation of non-nuclear strategic attack technologies and U.S. capabilities to counter that threat.

A “survey” inspired by Flournoy’s remarks . . .

Trump Administration Official directly involved in NPR:*

“The potential threat of biological and chemical weapons attacks was an important factor in our decision not to adopt a no-first-use policy. There was no disagreement on this point within the US government, which was well represented in the Working Group.

As you know, the US does not have a biological weapons capability that can respond to adversary use. There is a concern, however unlikely, that an adversary may think it could use such an attack or threat of an attack to coerce the United States. By maintaining the possibility of a nuclear response to biological weapons attack, we hope that this might contribute to deterring such attacks in the first place.”

Obama Administration Official directly involved in NPR:*

“...we looked at both the assessed threat (intelligence based) and the potential threat (technology based) including how BW might be used in general and how the current and future leadership of each of the relevant actors might view potential BW threat and use.”

*Email interviews with CFC, October & November 2021

Winter 2009 NSC meeting:

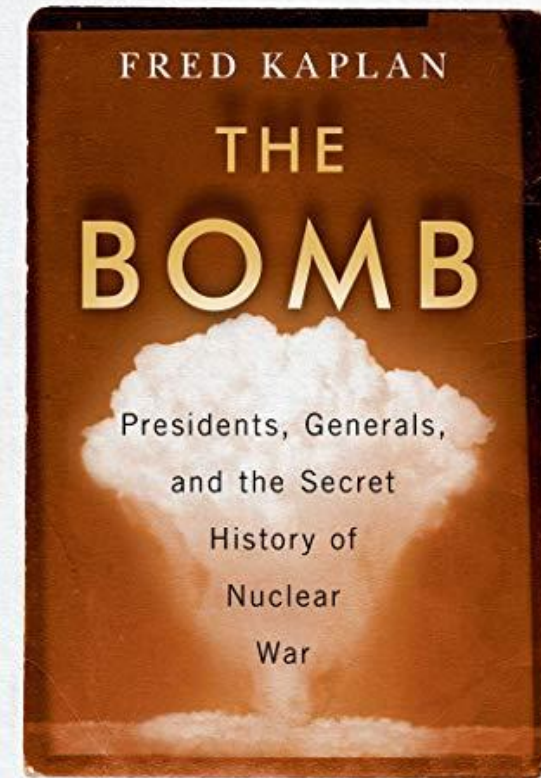
“[Secretary of Defense] Gates raised three points...

First, he wondered why the United States would want to box
Itself in unilaterally . . .

Second, he warned that the allies would view no-first-use as
an abandonment of America’s prime security guarantee...

[and third] was that North Korea and a few other hostile
countries [including Russia] possessed biological weapons . . . a
large-scale biological attack could kill hundreds of thousands,
even millions, of Americans. The United States had given up
bioweapons long ago, so it couldn’t “retaliate in kind.” . . .
Certainly any President would at least want to consider
responding to such a hideous attack with nuclear weapons . . .
to deter them”

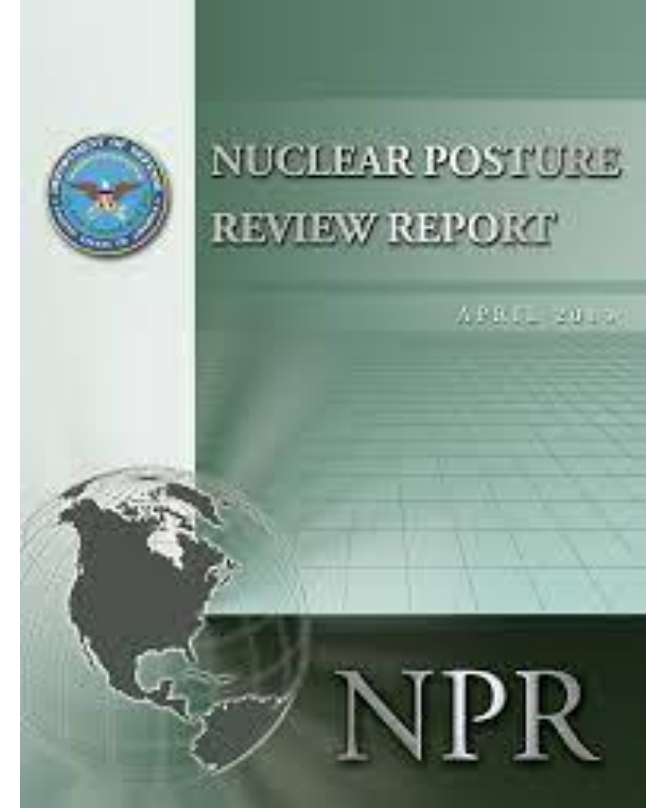
“Rich and surprisingly entertaining.” —*The New York Times Book Review*



(p. 229)

REDUCING THE ROLE OF U.S. NUCLEAR WEAPONS

In the case of countries not covered by this assurance – states that possess nuclear weapons and states not in compliance with their nuclear non-proliferation obligations – there remains a narrow range of contingencies in which U.S. nuclear weapons may still play a role in deterring a conventional or CBW attack against the United States or its allies and partners. The United States is therefore not prepared at the present time to adopt a universal policy that the “sole purpose” of U.S. nuclear weapons is to deter nuclear attack on the United States and our allies and partners, but will work to establish conditions under which such a policy could be safely adopted.



pp. 15-16

January 12, 2017

Remarks by the Vice President on Nuclear Security

Remarks by the Vice President on Nuclear Security

Washington, DC

Wednesday, January 11, 2017

In our 2010 Nuclear Posture Review—we made a commitment to create the conditions by which the sole purpose of nuclear weapons would be to deter others from launching a nuclear attack.

President Obama and I are confident we can deter—and defend ourselves and our Allies against—non-nuclear threats through other means.

The next administration will put forward its own policies.

But, seven years after the Nuclear Posture Review charge—the President and I strongly believe we have made enough progress that deterring—and if necessary, retaliating against—a nuclear attack should be the sole purpose of the U.S. nuclear arsenal.



James N. Miller

No to no first use—for now

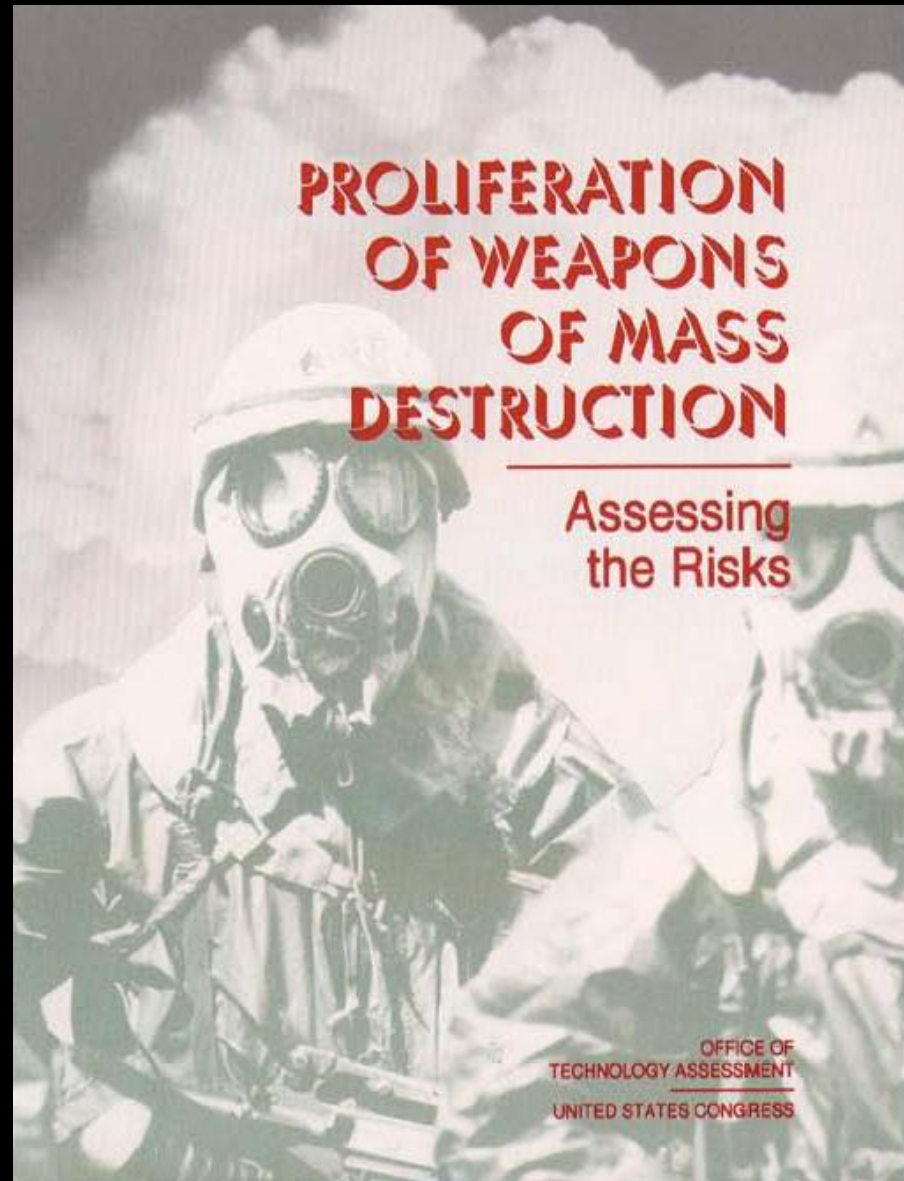
By James N. Miller, January 1, 2020

“The potential for biological weapons to kill on a massive scale comparable to nuclear weapons, concerns that some potential adversaries may have or acquire biological weapons, the rapid advancement of biotechnology that makes a covert program even more feasible, and the reality that the United States has foresworn biological weapons all led the Obama administration in its 2010 Nuclear Posture Review to reserve the right for the United States to re-visit its negative security assurance if necessary....**Since 2010, the rationale behind the Obama administration’s reservation has not been reversed either by reductions in the biological weapons threat or by significant advances in US defensive capabilities.**”

Summary of BW Arguments Against Adopting “Sole Purpose” or “No First Use” Posture

1. BW can cause casualties on a scale comparable to NW;
2. Some adversaries may still have BW, or may get them;
3. Advances in biotechnology make things even worse in terms of covert programs and novel (possibly contagious) agents;
4. U.S. has foresworn biological weapons so cannot retaliate in kind—the U.S. can’t deter BW with BW;
5. Some forms of conventional deterrence may now be more difficult;
6. *Therefore* the Obama 2010 NPR conditions for adopting “sole purpose” have not been established because
 - (a) the BW threat of our adversaries persists (and because of biotech might be even worse); and
 - (b) we have not made sufficiently significant advances in our biodefense capabilities

OTA: It is credible that a biological attack could cause fatalities comparable to a nuclear attack, at various scales.



(August 1993)

Anthrax spores, 30 kg,

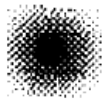


10 km²



30,000 - 100,000

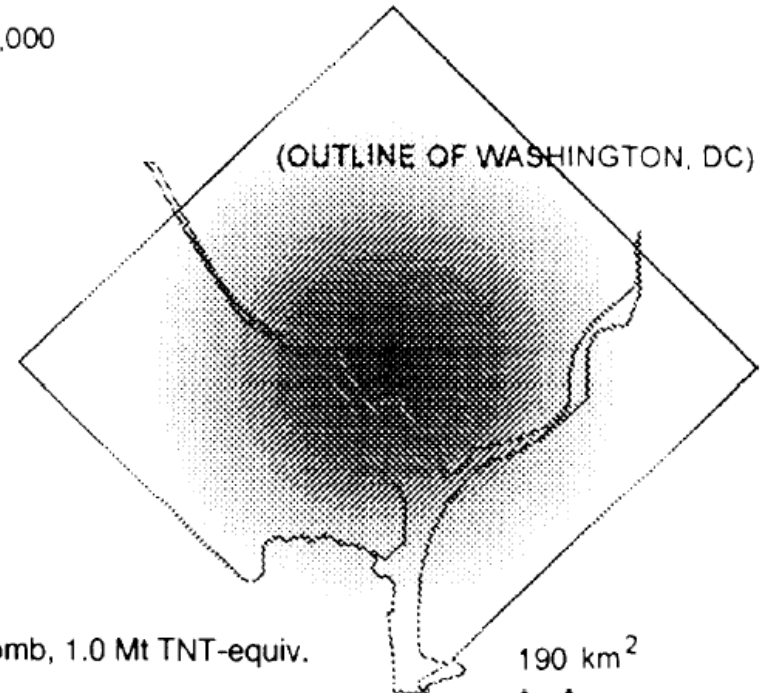
Atomic bomb, 125 kt TNT-equiv (Hiroshima-size), area
of 5 lb/in overpressure



78 k m²



23,000-80,000



Hydrogen bomb, 1.0 Mt TNT-equiv.

190 km²



570,000-1,900,00

Figure 2-2-Comparing Lethal Areas of Chemical and Biological Weapons:
Delivery by Aircraft as Aerosol Line Source

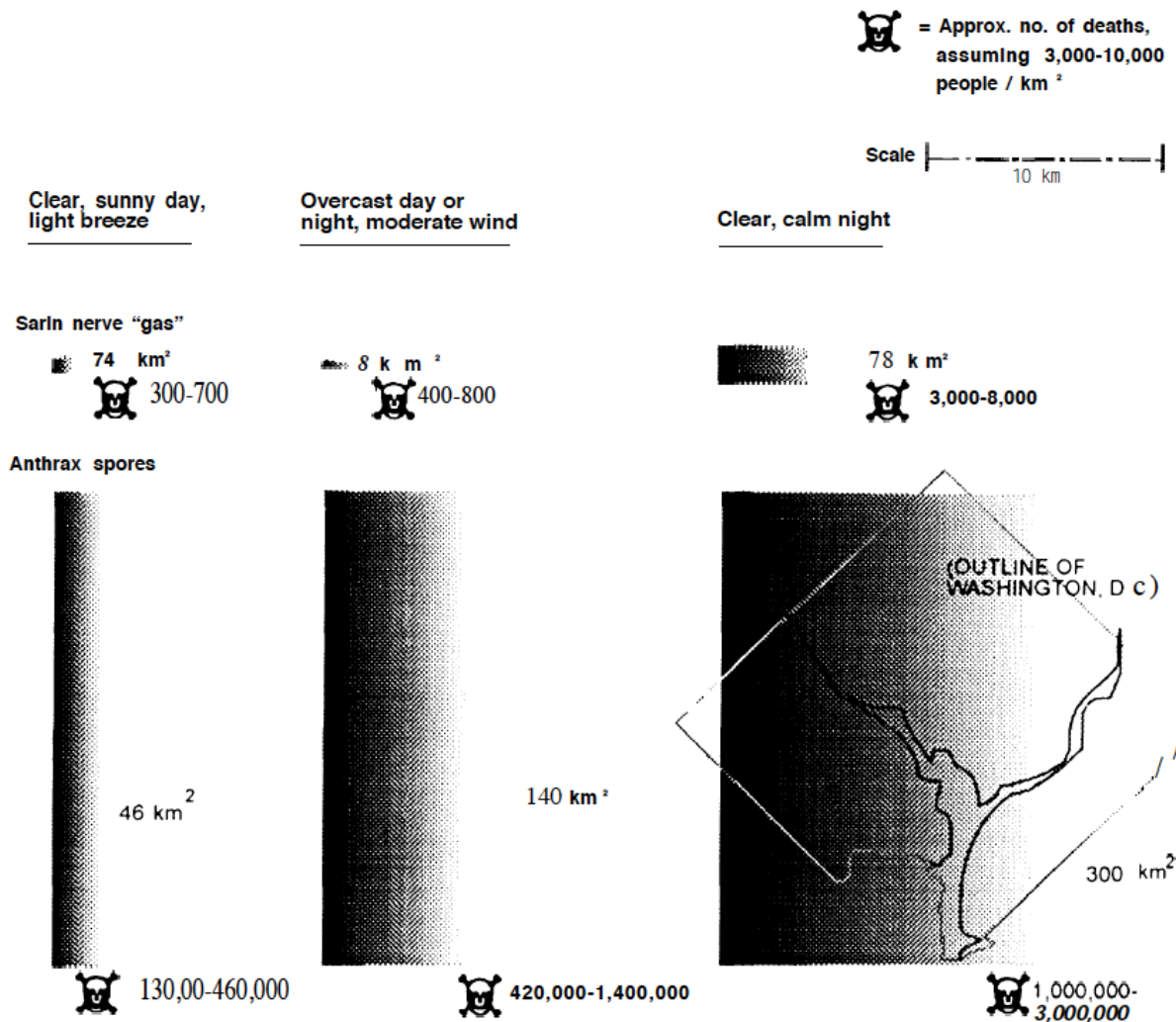


Figure shows the lethal areas of single airplane-loads of chemical and biological weapons, assuming a highly efficient, line-source delivery of the killing agents. The figure also assumes that the aircraft has a greater payload than the missile in figure 2-1, delivering 1,000 kg of sarin nerve agent or 100 kg of anthrax spores. (More anthrax would be inefficient in a city attack.) Given these two factors, a single airplane delivering chemical or biological weapons can be considerably more lethal than a single missile. For an anthrax attack, the diagram shows how fatalities could vary greatly under three different weather scenarios. In one case, that of an overcast day or night with moderate wind, maximizing the lethal area would require distributing the agent in a 4.5 km by 34 km area, which would not be appropriate for most cities; therefore, the figure assumes a more rectangular distribution, which would still generate a comparable number of casualties.

SOURCE: Office of Technology Assessment, 1993.

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Let's examine each of these arguments—but acknowledge that we've had this debate before, prior to 9/11:

D. Gompert, K Watman, D. Wilkening (1995). "Nuclear First Use Revisited," *Survival* 37, 27-44.

G. Bunn (1996). "Expanding Nuclear Options: Is the U.S. Negating Its Non-Use Pledges?" *Arms Control Today* 26, 7-10.

V. A. Utgoff (1997). "Nuclear Weapons and the Deterrence of Biological and Chemical Warfare," Henry A. Stimson Center, Occasional Paper No. 36

G. H. Quester (2000). "The Response to Renegade Use of Weapons of Mass Destruction," in V. Utgoff, ed., *The Coming Crisis* (MIT Press), pp. 227-244.

B. Roberts (2000). "Rethinking How Wars Must End: NBC War Termination Issues in the Post-Cold War Era," in V. Utgoff, ed., *The Coming Crisis* (MIT Press), pp. 245-278.

S. D. Sagan (2000). "The Commitment Trap: Why the U.S. Should Not Use Nuclear Threats to Deter Biological and Chemical Weapons Attacks," *International Security* 24, 85-115.

1990s Shocks Regarding BW State Programs: Soviet Union

- Defectors from Soviet program reveal tens of thousands of employees, perhaps thousands with critical knowledge
- Concern about former (?) Soviet bioweaponers



Biopreparat State Research [now: Scientific] Center for Applied Microbiology in Obolensk—center for work on Bonfire's objectives: Anthrax, Plague, Tularemia, etc.



Anthrax prophylaxis by antibiotic resistant strain STI-AR in combination with urgent antibiotic therapy

A. P. POMERANTSEV, YU. V. MOCKOV, L. I. MARININ, A. V. STEPANOV and L. G. PODUNOVA

State Scientific Centre of Applied Microbiology, Obolensk, Moscow Region, 142279, Russia

The incompatibility of live vaccines with antibiotics on simultaneously administration gave rise to the idea of developing a vaccine strain, resistant to antibiotics, that would allow simultaneous prophylaxis and immunization in an emergency. The strain to be used should be resistant to various groups of antibiotics, especially to penicillins and to tetracyclines. These antibiotics are intensively applied in prophylaxis of anthrax infections in Russia.

We have managed to derive a variant of STI-1 strain, STI-AR, resistant to ampicillin (MIC 512 µg/ml), rifampicin (MIC 128 µg/ml), doxycycline (MIC 64 µg/ml), chloramphenicol (MIC 64 µg/ml), macrolides and lincomycin (MIC 128 µg/ml). MIC estimations were carried as follows: each antibiotic was diluted and incorporated into solid media to create a series of plates ranging from 512 µg to 2 µg per ml in two-fold dilutions. The plates were incubated at 37°C overnight and the MICs read as the lowest dilution which showed no bacterial growth.

The resistance to penicillins was induced by means of derepression of *B. anthracis* STI-1 penicillinase gene and a constitutive isolate from this population was characterized. Rifampicin resistant spontaneous mutant strain STI-PR was selected from among the pen^R-population of *B. anthracis* cells and its constitutive resistance to rifampicin was characterized also. Resistance to the remaining antibiotics was obtained by means of insertions of *tet*, *cat*, *ermC* genes of different plasmids into the host genome of *B. anthracis* STI-PR strain. Resistance to

tetracyclines was only found following induction by the respective antibiotic.

The strain STI-AR retained the normal morphological properties and spore-forming features of the parent STI-1 strain. Resistances to all antibiotics were stable during growth of the STI-AR strain in nutrient media without antibiotic pressure and *in vivo* as well. The experiments on animals (hamsters and rabbits) showed that the STI-AR strain does not differ from its parent strain in residual virulence, safety and immunogenicity. The protective properties of the strain were also studied against challenge with a virulent culture of *B. anthracis* using concurrent doxycycline therapy (Table).

Table: Immunogenicity of STI-AR strain on the background of infection and special prophylactic treatment with doxycyclin

Animals groups	Survival, %	
	After primary infection and treatment	After second infection
Infection+STI-AR+doxycycline	100	80
Infection+STI-1+doxycycline	100	0
Infection+STI-AR	10	-
Infection+STI-1	10	-
Infection+doxycycline	100	0
Infection (control)	0	0

Biopreparat “Bonfire”* Program’s five objectives:

1. Develop multi-antibiotic-resistant pathogenic bacteria (aimed for resistance to 10 antibiotics)
2. Develop bacteria and viruses with modified antigenic structures [to be unrecognized by diagnostics, vaccines, and immune systems]
3. Genetically engineer pathogens with “wholly new and unexpected properties”
4. Methods to increase the hardiness of BW microorganisms
5. Develop and implement safety requirements for R&D

THE SOVIET BIOLOGICAL WEAPONS PROGRAM



A HISTORY

MILTON LEITENBERG

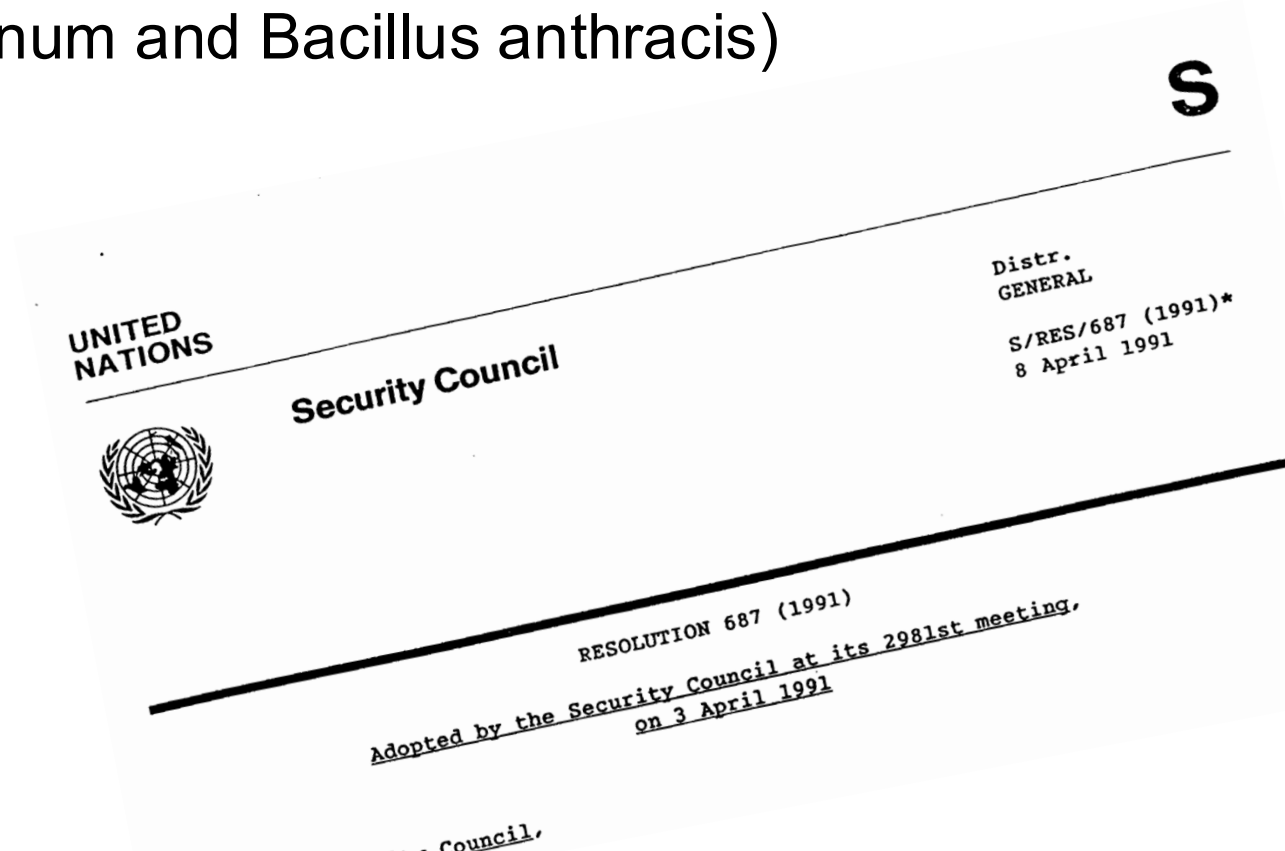
RAYMOND A. ZILINSKAS

(2012)

“Kostyor”; Biopreparat: dozens of facilities, ~30,000 people

1990s Shocks Regarding BW State Programs: Iraq

- Gulf War cease-fire in 1991: UNSCR 687 requires Iraq to declare BW weapons and accept inspections; in 1995 admits to major program (Rolf Ekeus: “large quantities” of *Clostridium botulinum* and *Bacillus anthracis*)



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1. BW can cause casualties on a scale comparable to NW; ✓
2. Some adversaries *may still have BW*, or may get them;
3. Advances in biotechnology make things even worse in terms of covert programs and novel (possibly contagious) agents;
4. U.S. has foresworn biological weapons so cannot retaliate in kind—the U.S. can’t deter BW with BW;
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6. *Therefore* the Obama 2010 NPR conditions for adopting “sole purpose” have not been established because
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April 2019, Assistant Secretary of State Christopher Ford speech at the National Defense University:

“Unfortunately, the Russians show no sign of ever having gotten rid of their biological weapons program. Indeed, far from demonstrating its elimination of this program as required by the Biological and Toxin Weapons Convention (BTWC), Russia has refused to properly declare the termination of the program under the BTWC.”

Bruce W. Bennett (RAND), “The Challenge of North Korean Biological Weapons,” testimony to the House Armed Services Committee, October 11, 2013)

BW Agent	Type of Agent	NK BW Source ¹⁹
Anthrax	Bacteria	KRIS, USFK, Alibek, WP
Botulinum	Toxin	USFK
Brucellosis	Bacteria	KRIS
Cholera	Bacteria	KRIS, USFK
Dengue fever	Virus	—
Diphtheria	Bacteria	KRIS
Dysentery	Bacteria	KRIS
E. coli	Bacteria	—
Hemorrhagic fever (HFRS)	Virus	KRIS, USFK, Alibek, WP
Hepatitis	Virus	KRIS
Japan. Encep.	Virus	—
Malaria	Parasite	—
Pertussis	Bacteria ^b	—
Pnm. plague	Bacteria ^b	KRIS, USFK, Alibek, WP
Q Fever	Bacteria	—
Smallpox	Virus ^b	USFK, Alibek, WP
Tuberculosis	Bacteria ^b	KRIS
Tularemia	Bacteria	KRIS, WP
Typhoid fever	Bacteria	KRIS, USFK

Sources: USFK = General Leon J. LaPorte, “Statement before the Senate Armed Services Committee,” April 1, 2004; Alibek = “Interview—Dr. Ken Alibek,” Homeland Defense, September 28, 2000; WP = The Republic of Korea Ministry of National Defense, 2012 Defense White Paper, p. 36.

Summary of BW Arguments Against Adopting “Sole Purpose” or “No First Use” Posture

1. BW can cause casualties on a scale comparable to NW; ✓
2. Some adversaries may still have BW; ✓ (probably)
3. Advances in biotechnology make things even worse in terms of covert programs and novel (possibly contagious) agents;
4. U.S. has foresworn biological weapons so cannot retaliate in kind — the U.S. can't deter BW with BW;
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Summary of BW Arguments Against Adopting “Sole Purpose” or “No First Use” Posture

1. BW can cause casualties on a scale comparable to NW; ✓
2. Some adversaries, including some especially gnarly ones, may still have BW; ✓ (probably)
3. Advances in biotechnology make things even worse in terms of covert programs and novel (possibly contagious) agents;
4. U.S. has foresworn biological weapons so cannot retaliate in kind—the U.S. can’t deter BW with BW;
5. Some forms of conventional deterrence may now be more difficult;
6. *Therefore* the Obama 2010 NPR conditions for adopting “sole purpose” have not been established because
 - (a) the BW threat of our adversaries persists (and because of biotech might be even worse); and
 - (b) we have not made sufficiently significant advances in our biodefense capabilities—as Covid-19 demonstrates

Expression of Mouse Interleukin-4 by a Recombinant Ectromelia Virus Suppresses Cytolytic Lymphocyte Responses and Overcomes Genetic Resistance to Mousepox

RONALD J. JACKSON,^{1,2*} ALISTAIR J. RAMSAY,^{2,†} CARINA D. CHRISTENSEN,² SANDRA BEATON,¹
DIANA F. HALL,^{1,‡} AND IAN A. RAMSHAW²

Pest Animal Control Cooperative Research Centre, CSIRO Sustainable Ecosystems,¹ and Division of Immunology and Cell Biology, John Curtin School of Medical Research, Australian National University,² Canberra, Australia

Received 25 July 2000/Accepted 13 November 2000

Genetic resistance to clinical mousepox (ectromelia virus) varies among inbred laboratory mice and is characterized by an effective natural killer (NK) response and the early onset of a strong CD8⁺ cytotoxic T-lymphocyte (CTL) response in resistant mice. We have investigated the influence of virus-expressed mouse interleukin-4 (IL-4) on the cell-mediated response during infection. It was observed that expression of IL-4 by a thymidine kinase-positive ectromelia virus suppressed cytolytic responses of NK and CTL and the expression of gamma interferon by the latter. **Genetically resistant mice infected with the IL-4-expressing virus developed symptoms of acute mousepox accompanied by high mortality, similar to the disease seen when genetically sensitive mice are infected with the virulent Moscow strain. Strikingly, infection of recently immunized genetically resistant mice with the virus expressing IL-4 also resulted in significant mortality due to fulminant mousepox.** These data therefore suggest that virus-encoded IL-4 not only suppresses primary antiviral cell-mediated immune responses but also can inhibit the expression of immune memory responses.

Ectromelia virus (ECTV; family *Poxviridae*, genus *Orthopoxvirus*) is a natural pathogen of laboratory mice that causes a generalized disease termed mousepox (13). All mice are equally susceptible to infection by footpad inoculation; however, development of clinical mousepox among inbred mouse strains differs greatly (44). In mousepox-sensitive (e.g., BALB/c) mice, the disease is an acute systemic infection with high viral

regulatory activities of IL-12 and IL-4, factors that play key roles in directing the development of the Th1 and Th2 subsets, respectively, is well characterized (40). Both in vitro and in vivo, the presence of IL-4 at the time of stimulation has been shown to inhibit IL-12 expression by antigen-presenting cells (macrophages and dendritic cells), with Th2 cells dominantly expanded in the acquired response (7, 8, 25). In addition to its

cDNA Clones

- > TrueORF cDNA Clones (H/M/R)
- > Viral ORF Clones
- > Destination Vector
- > TrueClone (Human)
- > TrueClone (Mouse)
- > Organelle Marker Plasmids
- > MicroRNA Tools
- > Mutant and Variant Clones
- > Plasmid Purification Kits
- > Transfection Reagents
- > Gene Synthesis Service

Related Products

- > Purified Human Protein
- > shRNA
- > TrueMAB Antibody
- > Over-Expression Lysate
- > Antitag Antibodies
- > 2014 CRISPR Landmark Papers

CellPress Selections

CRISPR/Cas9 Genome Editing

> [Click to view the details of CRISPR/CAS9](#)

**Genome-editing
Knockout Kit**

CRISPR/Cas
Vectors

gRNA Cloning and
Donor Construction

AAVS1
Transgene
Insertion

New!

CRISPR/Cas
Starter Kit

Features

- Complete kit for gene knockout via CRISPR (targeted sites around the 5' end of the ORF)
- 2 guide RNA vectors in [pCas-Guide](#) to ensure an efficient cleavage
- Donor vector with predesigned homologous arms
- Knockin GFP-Puro for selection
- [pCas-Guide-scramble](#) is also provided as a negative control

Applications

- Knock-in GFP reporter for promoter study
- Knock-out genes at chromosomal level

[CRISPR Manual](#) 

[Knockout Kit Validation](#) 

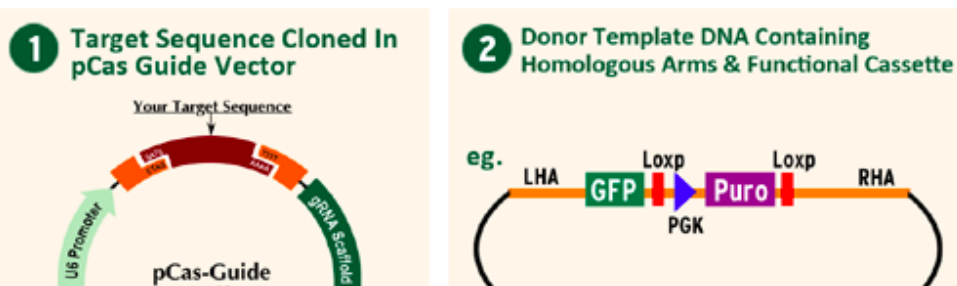
Knockout Kit Finder

Search by gene symbol or keyword.

CAS9 Antibody

> [Cas9 antibodies](#)

Scheme of Genome-editing knockout kit using CRISPR



EXECUTIVE OFFICE OF THE PRESIDENT
PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY
WASHINGTON, D.C. 20502

November 2016

Dear Mr. President,

Advanced biotechnology offers the promise of transforming the way the world produces food and portable fuels, protects the environment, and treats disease.¹ The power of biotechnology has been growing at an exponential rate over the past several decades, driven by intense efforts in academia and the private sector aimed at both fundamental research and commercial applications.² The United States is the clear world leader, but biotechnological knowledge and skills are broadly distributed across many developed and developing nations.

While the ongoing growth of biotechnology is a great boon for society, it also holds serious potential for destructive use by both states and technically-competent individuals with access to modern laboratory facilities.³ As the security challenges evolve rapidly with technological advances, it is important that the Federal Government's own thinking about how to protect the Nation keeps pace.

Since 2001, the U.S. Government has spent billions of dollars annually to protect the Nation against both intentional biological attacks and emerging infectious diseases, and much has been accomplished.⁴ But, molecular biologists, microbiologists, and virologists can look ahead and anticipate that the nature of biological threats will change substantially over the coming years—in ways both predictable and unpredictable. The U.S. Government's past ways of thinking and organizing to meet biological threats need to change to reflect and address this rapidly-developing landscape.

RECOMMENDATION 4. The White House should set the following ambitious ten-year goals with appropriate funding (of at least \$250 million per year) for medical countermeasures preparedness. The Secretary of Health and Human Services and the Secretary of Defense should report annually to the White House about progress and impediments to reaching these goals:

- a. For infectious organisms for which there exist effective approaches to creating vaccines, the United States should have the ability to accomplish, within a six-month period, the complete development, manufacture, clinical testing, and licensure of a vaccine. For pandemic influenza, the goal should be 3 to 4 months to vaccine deployment.

RECOMMENDATION 6. The Departments of Defense, Health and Human Services, and other government agencies should promote vigorous basic and applied research efforts in academic, industrial and government laboratories with the goal of developing new types of countermeasures. These countermeasures should be rapidly and easily modified to target, safely and effectively, specific human-made and naturally-occurring pathogens. The delivery of approved countermeasures should be within days after the an agent’s detection and characterization.

HHS and DoD should receive new funding of \$75M per year for four years to lay the foundation of this initiative. Funding for relevant agencies within HHS and DoD should then ramp up to a steady-state of at least \$250M per year.

American Pandemic Preparedness: Transforming Our Capabilities

September 2021

A blue ink signature of Eric S. Lander, written in a cursive style.

Eric S. Lander
Assistant to the President for
Science and Technology

A blue ink signature of Jacob J. Sullivan, written in a cursive style.

Jacob J. Sullivan
Assistant to the President for
National Security Affairs

- As the technologies of modern biology become more powerful, affordable, and accessible, there is also the disturbing possibility that a malign actor could develop and use a biological weapon, including one that is highly contagious, in violation of the Biological Weapons Convention and UN Security Council Resolution 1540.

Conclusion: There will be an increasing frequency of natural — and possibly human-made — biological threats in the years ahead.

Summary of BW Arguments Against Adopting “Sole Purpose” or “No First Use” Posture

1. BW can cause casualties on a scale comparable to NW; ✓
2. Some adversaries may still have BW; ✓ (probably)
3. Advances in biotechnology make things even worse in terms of covert programs and novel (possibly contagious) agents; ✓
4. U.S. has foresworn biological weapons so cannot retaliate in kind—the U.S. can’t deter BW with BW;
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U.S. cannot “retaliate in kind” because it no longer has BW?

Let's remember that the context here is attacks that rise to level of consideration of a nuclear response, so context must be mass-casualty biological attack.

Is the claim that if we did have BW, we would deter such an attack with the threat of a proportionate biological attack of our own?

But U.S. gave up BW before BWC in part because of lack of battlefield utility (Tucker, *International Security*, 2002). Proportionate response using BW would have to mean a mass-casualty attack of our own.

U.S. cannot “retaliate in kind” not because it no longer has BW, but because it would not retaliate in kind. Consider:

Obama Administration’s *Report on Nuclear Employment Strategy*:

“Guidance for Nuclear Employment” includes (pp. 4-5):

The new guidance makes clear that all plans must also be consistent with the fundamental principles of the Law of Armed Conflict. Accordingly, plans will, for example, apply the principles of distinction and proportionality and seek to minimize collateral damage to civilian populations and civilian objects. The United States will not intentionally target civilian populations or civilian objects.”

My conclusion: The U.S. could not deter (mass casualty) BW with BW even if it *had* BW. Having BW would not give the U.S. an option it does not now have. The fact that U.S. does not have BW is not relevant.

Report on the Nuclear Employment Strategy of the United States – 2020

Specified in Section 491(a) of Title 10 U.S.C.

U.S. nuclear planning and targeting adhere to the laws of armed conflict. The United States has for decades rejected a deterrence strategy based on purposely threatening civilian populations, and the United States will not intentionally target civilian populations.

...

U.S. nuclear weapons employment guidance directs minimizing civilian damage to the extent possible consistent with achieving U.S. objectives and restoring deterrence.

...

Should a crisis escalate into a large-scale nuclear attack on the United States or its allies or partners, the United States retains the option to pursue multiple objectives, from preventing further nuclear employment to inflicting intolerable costs on the adversary.

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Quester, 2000: “I argue that unconditional surrender is the appropriate objective if a country such as Iraq or North Korea uses nuclear weapons.”

Idea of regime change as the appropriate response likely seems less appealing and less credible:

- After twenty years' experience in Afghanistan and Iraq; and
- The DPRK now has a nuclear arsenal of its own; and
- The U.S. must worry even more about Russia or China acting as protectors of allies that use biological weapons

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U.S. statement to the ad hoc group of states parties to the Biological Weapons Convention, July 2001 meeting [rejecting further negotiation of a BWC compliance protocol]:

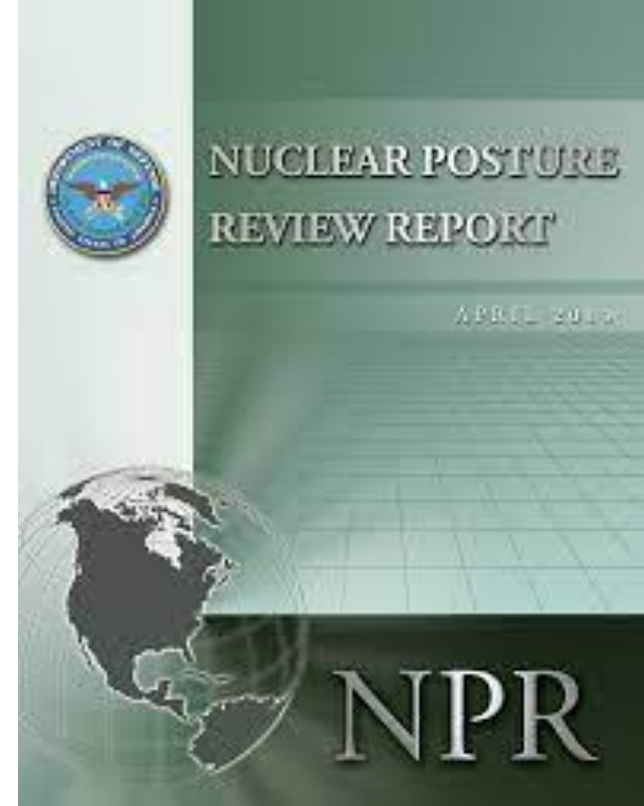
In the draft Protocol, there is an inherent dilemma associated with the question of on-site activities. The provisions for on-site activity do not offer great promise of providing useful, accurate, and complete information to the international community. However, when we examined the prospects of the most intrusive and extensive on-site activities physically possible—which we believed were likely not acceptable to most other countries—we discovered that the results of such intrusiveness would still not provide useful, accurate, or complete information.

One objective is to agree on a declaration base that would provide reasonable inventories of activity in a country relevant to the underlying Biological Weapons Convention. Our assessment of the range of facilities potentially relevant to the Convention indicates that they number, at least in the case of the United States, in the thousands, if not tens of thousands. In addition, their number and locations change on an irregular but frequent basis. Thus, we had no hope that any attempt at a comprehensive declaration inventory would be accurate, timely, or enduringly comprehensive.

REDUCING THE ROLE OF U.S. NUCLEAR WEAPONS

The United States is therefore not prepared at the present time to adopt a universal policy that the “sole purpose” of U.S. nuclear weapons is to deter nuclear attack on the United States and our allies and partners, **but will work to establish conditions under which such a policy could be safely adopted.**

This statement could only mean that sole purpose must await a world in which we are sure that none of our adversaries has a BW program if it were said cynically. It must therefore mean something else.



pp. 15-16

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OPCAST Ad Hoc Pandemic Response Group

We are a subgroup of former members of President Obama's Council of Advisors on Science and Technology ("OPCAST").

Members are: John P. Holdren, Christine Cassel, Christopher Chyba, Susan L. Graham, Eric S. Lander, Richard C. Levin, Ed Penhoet, William Press, Maxine Savitz, and Harold Varmus.

The members of the subgroup serve as individuals working on their own time, not as representatives of their institutions. The effort has no sponsors and no budget.

Our reports and recommendations regarding the coronavirus pandemic are posted here as they become available.

[COMPENDIUM of Reports 1-6 below](#) (posted 12/31/2020) (PDF, 116 pp.)

This single document assembles all six reports below in full, preceded by a set of brief summaries. Four of the reports are followed by short updates taking account of developments since the reports first came out.

Earlier posts of individual reports:

1. [Recommendations for the National Strategic Pandemic-Response Stockpile](#) (Report, 5/20/2020) (PDF)
["We need to replenish our stockpile of PPE immediately"](#) (Letter, *The Washington Post*, 7/16/2020) (PDF)
2. [The Role of Contact Tracing in the Control of Microbial Epidemics, Including COVID-19](#) (Report, 6/18/2020) (PDF)
["Contact tracing is essential to preventing another spike in coronavirus infections"](#) (Op-Ed, *The Boston Globe*, 7/13/2020) (PDF)
3. [Strengthening the Public Health Infrastructure: The Role of Data in Controlling the Spread of COVID-19](#) (Report, 7/28/2020) (PDF)
["It shouldn't be so hard to get the data needed to protect public health"](#) (Guest Expert Comment, *Modern Healthcare*, 8/31/2020) (PDF)
4. [Testing for the Pathogen During the COVID-19 Pandemic and Future Ones](#) (Report, 8/18/2020) (PDF)
["It Has Come to This: Ignore the C.D.C."](#) (Op-Ed, *The New York Times*, 8/31/2020) (PDF)
5. [Recommendations for the Coming COVID-19 Commission](#) (Report, 9/21/2020) (PDF)
6. [Epidemiological Modeling Needs New, Coherent, Federal Support for the Post-COVID-19 Era](#) (Report, 9/28/2020) (PDF)
["Modeling, post COVID-19"](#) (Editorial, *Science*, 11/27/2020) (PDF)

[SUMMARIES OF FINDINGS AND RECOMMENDATIONS OF REPORTS 1-6 ABOVE](#) (11/28/2020) (PDF)

Create a COVID-19 commission

We need a definitive public reference for the history of events

By **Christopher F. Chyba¹, Christine K. Cassel², Susan L. Graham³, John P. Holdren⁴, Ed Penhoet⁵, William H. Press⁶, Maxine Savitz⁷, Harold Varmus⁸**

The 2019 Global Health Security Index concluded that although “no country is fully prepared for epidemics or pandemics,” the United States scored highest among all countries in pandemic preparedness (1). Yet in the COVID-19 outbreak as of October 2021, measured in deaths per 100,000 popula-

tion, the United States did worse than 30 of the 35 countries defined by the International Monetary Fund as having “advanced economies,” and worse than all but 18 of 185 countries ranked (2). Many have now called for a US COVID-19 Commission to provide a definitive reference for the history of the events, to enlarge the public’s understanding of them, and to prescribe strategies that might prevent, or at least mitigate, future pandemics. Drawing on our experience as members of the President’s Council of Advisors on Science and Technology (PCAST)

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 - (b) we have not made sufficiently significant advances in our biodefense capabilities ✓ (given Covid-19 experience)

January 12, 2017

Remarks by the Vice President on Nuclear Security

Remarks by the Vice President on Nuclear Security

Washington, DC

Wednesday, January 11, 2017

The next administration will put forward its own policies.

But, seven years after the Nuclear Posture Review charge—the President and I strongly believe we have made enough progress that deterring—and if necessary, retaliating against—a nuclear attack should be the sole purpose of the U.S. nuclear arsenal.

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The next administration, the United States did worse than 30 of the 35 countries defined by the International Monetary Fund as having “advanced economies,” and worse than all but 18 of 185 countries ranked (2). Many have now called for progress that deterring—and if a nuclear attack should be the sole purpose of the U.S. nuclear arsenal.

But, seven years ago, the President and I were charged with the review charge—the President and I strongly believe in the policies of the United States did worse than 30 of the 35 countries defined by the International Monetary Fund as having “advanced economies,” and worse than all but 18 of 185 countries ranked (2). Many have now called for progress that deterring—and if a nuclear attack should be the sole purpose of the U.S. nuclear arsenal.

American Pandemic Preparedness: Transforming Our Capabilities

September 2021

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- As the technologies of modern biology become more powerful, affordable, and accessible, there is also the disturbing possibility that a malign actor could develop and use a biological weapon, including one that is highly contagious, in violation of the Biological Weapons Convention and UN Security Council Resolution 1540.

Conclusion: There will be an increasing frequency of natural — and possibly human-made — biological threats in the years ahead.

Summary of Goals

This list provides a brief summary of the goals above.

I. Transform our Medical Defenses

1. Vaccines: Rapidly make effective vaccines against any human virus family

- Design, test, and review by 100 days after pandemic threat appears (for COVID-19 = May 2020)
- Produce enough vaccine for the U.S. by 130 days and entire world by 200 days
- Simplify vaccine distribution (e.g., eliminate need for cold storage)
- Simplify vaccine administration (e.g., replace sterile injection, with skin patches and nasal sprays)

2. Therapeutics: Life-saving medicines suitable for any virus family

- Develop medicines to block key virus functions (as done for HIV)
- Enable rapid production of neutralizing antibodies (currently too slow)
- Develop medicines to prevent severe immune over-reactions (useful in public health)

3. Diagnostics: Simple, inexpensive, accurate tests for any virus available within weeks

- Develop technologies to meet sustained demand, including daily home testing for all, if required
- Use new diagnostics in routine care, to serve public health, drive down costs, and expand capacity

II. Ensure Situational Awareness

4. Early-Warning Systems: Rapidly detect new viral outbreaks with pandemic potential

- Detect new threats by genome sequencing of patients with unexplained fevers in U.S. and abroad
- Detect new viral threats by wastewater sampling
- Create early-warning networks to aggregate and analyze global data

5. Real-time Monitoring: Follow existing viral outbreaks for spread and evolution

- Improve tracking by combining diagnostic, epidemiological, sequencing, and environmental data
- Improve analysis and forecasting

III. Strengthen Public Health Systems

6. U.S. Public Health. Modernize infrastructure to prevent and contain biological threats

- Strengthen the public health work force
- Invest in public health laboratories and public health digital infrastructure
- Prioritize vulnerable communities

7. Global Health. Establish international infrastructure and financing for pandemic preparedness

- Create local capacity and international systems
- Catalyze sustainable international financing

IV. Build Core Capabilities

8. Personal Protective Equipment. Increase effectiveness, comfort, affordability, and manufacturability

9. Stockpiles and Supply Chains. Ensure U.S. ability to produce vital supplies

10. Prevent Catastrophic Biological Events. Accelerate biosafety, biosecurity, and deterrence

11. Regulatory Improvement. Ensure regulatory capacity for vaccines, therapeutics, and diagnostics

V. Manage the Mission

12. Mission Control. Manage this national responsibility with the seriousness of purpose, commitment, and accountability of an Apollo Program and coordinate work with international scientific community

\$65 billion
over 7-10 years



**Director's Series: Science, Technology and Policy: Biological
Weapons and Nuclear Use**

Christopher Chyba
Professor of Astrophysical Sciences & International Affairs
Princeton University

November 8, 2021

“Sole purpose” options:

1. Biological weapons can cause mass casualties, biotech makes things worse, and it will always be entirely possible that awful regimes will have them, until eventually there is a major transformation of international relations. Until then, we cannot adopt “sole purpose,” much less NFU. The aspirational language in the 2010 NPR was never really attainable.

“Sole purpose” options:

2. Biological weapons can cause mass casualties, biotech makes things worse, and it will always be entirely possible that awful regimes will have them. *But we always understood that.* We can adopt “sole purpose” once our defenses are at the necessary level. We previously had objective reasons to think we were there (e.g. *GHSI*, 2019), but the Covid-19 pandemic revealed that we were not. But we have been identifying and fixing the problems in our Covid-19 response, and we have laid out a path to protect ourselves against future threats in the OSTP/NSC pandemic preparedness plan and other forthcoming initiatives. We will continually assess milestones and adopt “sole purpose” when we have made sufficient progress, measured by these.

“Sole purpose” options:

3. Biological weapons can cause mass casualties, biotech makes things worse, and it will always be entirely possible that awful regimes will have them. *But we always understood that.* We have assessed the failures of the U.S. response to the Covid-19 pandemic, and are putting in place the steps needed to address those failures. In the meantime we have a robust strategy in place for the most obvious BW agents (such as anthrax and smallpox) and are putting into place aggressive strategies (e.g. the OSTP/NSC plan, but more to come) that will allow us to counter future threats, including bio-engineered ones. We therefore feel able to adopt “sole purpose” now (relying as well on conventional deterrence in the interim) and will continue to aggressively pursue a transformation in biological security for the U.S., its allies, and the world.



**Director's Series: Science, Technology and Policy: Biological
Weapons and Nuclear Use**

Christopher Chyba
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November 8, 2021

U.S. Nuclear Weapons Policies: A Conversation with Michèle Flournoy

INTERVIEWS

July/August 2017

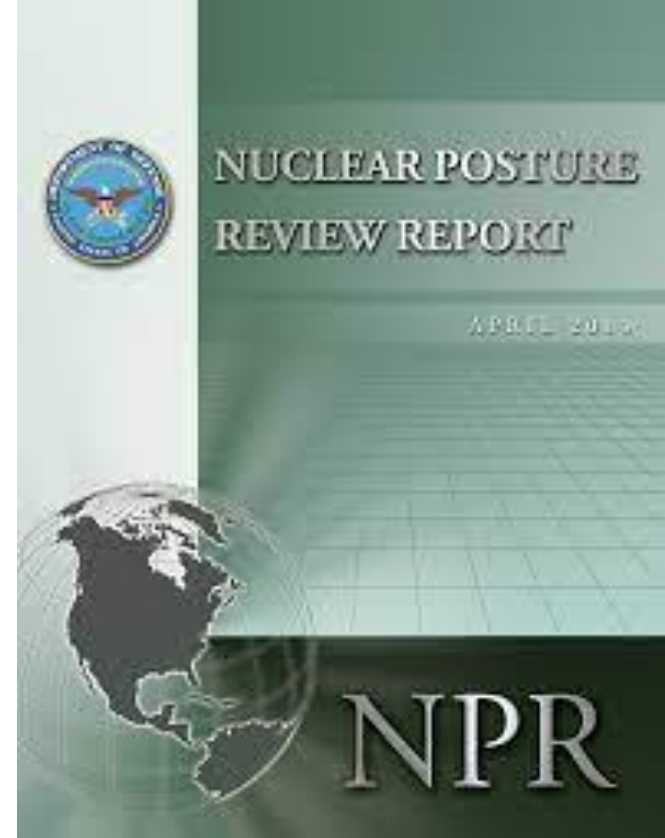
Interviewed by Kingston Reif and Maggie Tennis



I personally believe that we should emphatically state that the purpose of nuclear weapons is to deter the use of other nuclear weapons. Period. In a real world instance, if a president felt that there was an exceptional case where he had no other option to respond to a catastrophic WMD attack that was non-nuclear, okay, then that's a presidential decision at that point. But I think there's benefit to declare that we don't believe these weapons are for war-fighting and that we stand in opposition and in contrast to countries like Russia who talk in a very cavalier manner about escalating to nuclear use in order to try to stop conventional war, which is incredibly irresponsible and incredibly dangerous. I think there's room to strengthen U.S. declaratory policy in this area.

REDUCING THE ROLE OF U.S. NUCLEAR WEAPONS

In making this strengthened assurance, the United States affirms that any state eligible for the assurance that uses CBW against the United States or its allies and partners would face the prospect of a devastating conventional military response—and that any individuals responsible for the attack, whether national leaders or military commanders, would be held fully accountable.



pp. 15-16

Table 1. Two Conventional Wisdoms.

	Deterrence Hawks	Nonproliferation Doves
Deterrence Effects	Nuclear threats are effective—indeed sometimes necessary—to deter chemical and biological weapons.	Nuclear threats are both ineffective and unnecessary to deter chemical and biological weapons.
Nuclear Proliferation Effects	U.S. nuclear threats do not encourage proliferation, because states proliferate in response to regional security concerns, not U.S. declaratory policy.	U.S. nuclear threats encourage proliferation by legitimizing nuclear weapons and suggesting that other states need nuclear weapons to deter chemical and biological weapons.

Sagan, "The Commitment Trap," *International Security* (2000)

“Sole purpose” options:

1. Biological weapons can cause mass casualties, biotech makes it worse, and it will always be entirely possible that awful regimes will have them, until we come to the land where horses talk. Until then, we cannot adopt “sole purpose,” much less NFU. The aspirational language in the 2010 NPR was never really attainable.
2. Biological weapons can cause mass casualties, biotech makes it worse, and it will always be entirely possible that awful regimes will have them. But we always understood that. We can adopt “sole purpose” once our defenses are at the necessary level. There were objective reasons to think we were there (e.g. GHSI, 2019), but Covid-19 pandemic reveals that we were not. But we have laid out a path to get there in the OSTP/NSC pandemic preparedness plan and other forthcoming initiatives, and we will assess milestones and fully intent to adopt “sole purpose” when we have made sufficient progress.
3. Biological weapons can cause mass casualties, biotech makes it worse, and it will always be entirely possible that awful regimes will have them. But we always understood that. We can adopt “sole purpose” once our defenses are at the necessary level. There were objective reasons to think we were there (e.g. GHSI, 2019), but Covid-19 pandemic reveals that we were not.

Succession of arguments (2):

3. BW can kill on a massive scale; we need NW threat to deter this. This is really the key Point.

Disaggregate threat:

- a. Terrorists: obviously not talking about them. Deterrence not useful and probably
- b. counterproductive
- c. Saddam Hussein-like states. Can use conventional threats; regime-ending, prosecution, etc. Like Quester wanted, though presumably well short of occupation.
- c. Superpower protected states otherwise like this (Syria with biological weapons?)
- d. DPRK like states with a nuclear deterrent of their own, or other significant deterrent DPRK artillery aimed at Seoul, e.g.
- e. Major power such as Russia or China

D and e: really? Going to initiate a nuclear war, with likely danger of tit for tat escalation, with A nuclear power than can reach US with NW? Maybe? Maybe if view mass casualty Attack as if they'd launched a first nuclear strike?

Can we rely on “existential deterrence” in this case, or Panda/Narang sole purpose Wordsmithing, or Schelling’s threat that leaves something to chance?

Need to disaggregate potential adversaries

Use Obama NPR framework:

Obviously this is not about terrorist threat

Countries w/o NW and in compliance with NPT—detractable via conventional punishment. Regime change seems less credible now after US 20 years' experience in Afghanistan and Iraq, and Syria lesson

Countries not in compliance with NPT (DPRK, perhaps Iran)—DPRK NW

Russia, China, others?—would it be credible for us to use NW?

Bearing in mind this caution . . .

Sagan, 2000:

“ . . . one should always be suspicious of debates in which both parties insist that their position provides the best solution to all dimensions of a complex problem. It is common for individuals and groups to avoid value trade-offs by insisting their preferred policy is the best answer for dealing with all aspects of a problem and will not create any significant costs [footnote Jervis]. Avoiding analyses of trade-offs, however, is very problematic in this case . . . ”

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PUBLIC LAW 110–181—JAN. 28, 2008 122 STAT. 327
[National Defense Authorization Act]

SEC. 1070. REVISED NUCLEAR POSTURE REVIEW.

(a) REQUIREMENT FOR COMPREHENSIVE REVIEW.—In order to clarify United States nuclear deterrence policy and strategy for the near term, the Secretary of Defense shall conduct a comprehensive review of the nuclear posture of the United States for the next 5 to 10 years. The Secretary shall conduct the review in consultation with the Secretary of Energy and the Secretary of State.

(b) ELEMENTS OF REVIEW.—The nuclear posture review shall include the following elements:

(1) The role of nuclear forces in United States military strategy, planning, and programming.

(2) The policy requirements and objectives for the United States to maintain a safe, reliable, and credible nuclear deterrence posture.

(3) The relationship among United States nuclear deterrence policy, targeting strategy, and arms control objectives.

....

Footnotes:

Bonfire wanted bacteria resistant to as many as ten antibiotics; evidently they more typically achieved only 7 or 8.

STI-1 is vaccine strain of anthrax. Soviets/Russians use live vaccine. Good dual-use rationale. But....

minimum inhibitory concentration (MIC): the lowest concentration of an antimicrobial drug that will inhibit the visible growth of a microorganism after overnight incubation.

Transformation (uptake of genetically engineered plasmids from environment) with *Bacillus cereus*; then conjugation with *B. anthracis*; 1995