Lecture 5 Part 1: The Acheson-Lilienthal Report and the Baruch Plan

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QUESTIONS TO BE ADDRESSED:

I. **Why bother with previous nuclear control initiatives?**

II. **What did the authors of the earliest initiatives—the Acheson- Lilienthal Report, Baruch Plan, and Eisenhower's Atoms for Peace Program—see as the nuclear war threat to be controlled?**

III. **How did their nuclear threat perceptions shape their views of which nuclear activities and materials were safe or dangerous and how they should be controlled?**

IV. **How sound were their nuclear threat perceptions and how best to mitigate them?**

I. Why bother with previous nuclear control initiatives?

Today, nuclear arms control is treated differently than nuclear nonproliferation. It generally is focused on restricting nuclear weapons between the United States and Russia—two states that possess an overwhelming majority of the world's nuclear weapons. Nuclear nonproliferation, on the other hand, focuses on limiting the spread of nuclear technology that might be diverted from peaceful to military purposes. The working assumption most opinion leaders have is that nuclear arms control is a much more serious undertaking than nuclear nonproliferation.

This view, however, is relatively new. In the 1940s and 1950s, both the horizontal spread of nuclear weapons to additional states and the vertical proliferation quantitatively and qualitatively within existing nuclear arsenals were seen as being intimately related. As such, most of the nuclear control proposals made through the 1950s—the Acheson-Lilienthal Report, the Baruch Plan, the Atoms for Peace Program (which resulted in the creation of the International Atomic Energy Agency (IAEA), the Nuclear Nonproliferation Treaty (NPT), and the Fissile Materials Cut-off Treaty (FMCT)—originally addressed both nuclear arms control and nuclear nonproliferation concerns. Starting in the 1960s, though, nuclear arms control

increasingly became a separate endeavor from nuclear nonproliferation. Nuclear arms control talks limiting the testing of nuclear weapons, missile defenses, and nuclear delivery systems were negotiated mostly with the Soviets. These negotiations were distinct from and given a higher political profile than efforts to reduce the further spread of nuclear weapons-related technologies (e.g., the Nuclear Suppliers Group, the Missile Technology Control Regime, NPT Review Conferences, etc.).

With the nuclear challenges states like Iran and North Korea are now posing, though, the relative importance of horizontal nuclear proliferation is increasing. Also, civilian nuclear agreements that the United States has reached with India, China, Japan, and South Korea and may negotiate with states such as Saudi Arabia[1], raise fundamental military and security alliance relations issues. Finally, with the increased nuclear capabilities of China, India, Pakistan, Israel, nuclear arms control that only focuses only on the United States and with Russia is increasingly incomplete. Because of this, the links between vertical arms control, international security, and efforts to stem horizontal nuclear proliferation are increasing.

All of this suggests the utility of understanding earlier attempts at international control of nuclear energy with an eye to how sound these previous, more comprehensive attempts at control were. Understanding how well or poorly they performed, however, is difficult. The reason why is simple; All nuclear control initiatives are designed to prevent nuclear crises but explaining why something did not happen is always rebuttable. Many proposed initiatives, moreover, were never adopted.

There is, however, a work around. This is afforded by clarifying what the strategic assumptions were behind each nuclear control initiative. What future nuclear threat did its authors think was most likely? How sound were these views? How did they propose to reduce the probability of such dangers? How sound were their proposals? What did they believe needed to be controlled and why? What did each believe was dangerous or safe, and why?

If the answers they gave were unsound, it would suggest that the authors did not really understand the character of the problem they faced. Get the problem wrong, and the answer you come up with is unlikely to solve anything and could very well compound the real problem

1. For more on the risks of a potential U.S.-Saudi civilian nuclear agreement, see, e.g., Victor Gilinsky and Henry Sokolski, “Don’t Give Saudi Arabia an Easy Path to Nukes,” *Foreign Policy*, March 1, 2018, http://foreignpolicy.com/2018/03/01/dont-give-saudi-arabia-an-easy-path-to-nukes/.

by controlling for the wrong thing or controlling against what mattered in too tight or too loose a fashion. Assessing these earlier calls can help us assess our own efforts today.[2]

We will attempt to answer all of these questions in the next three chapters and show how they clarify the key nuclear control initiatives launched since the end of the Second World War. Three of the earliest and most important of these initiatives were 1. the Acheson-Lilienthal Report on the International Control of Atomic Energy and the United Nations (UN) proposal that tracked this report's recommendations, the Baruch Plan; 2. Eisenhower's Atoms for Peace Program and the International Atomic Energy Agency, which Eisenhower's program called for; 3. and the Nuclear Nonproliferation Treaty (NPT).

The Acheson-Lilienthal Report and the Baruch Plan

II. What did the authors of the earliest initiatives—the Acheson-Lilienthal Report and Baruch Plan—see as the nuclear war threat to be controlled?

Figure 1: Bombing of Hiroshima

The first attempt at international control of nuclear energy was outlined by the Acheson-Lilienthal Report and formally delivered to the UN General Assembly in 1946 by Bernard Baruch in what is now known as the Baruch Plan.

In 1946, the nuclear threat U.S. officials feared was nothing less than the destruction of civilization. Hiroshima and Nagasaki were poster children for the world's possible unfolding.[3] If a hostile state (read Russia) ever got nuclear weapons, U.S. officials assumed Moscow could attack at any time and, if it did, U.S. air defenses would prove wanting (one bomber or, later, one missile, would always get through). Strikes naturally would focus on the largest cities; the aggressor would always win.

2. More on this point can be found in the first chapter of Henry Sokolski, *The Best of Intentions: America's Campaign against Strategic Weapons Proliferation* (Westport, CT: Praeger Publishers, 2001), 1-12.
3. For more on how Hiroshima, Nagasaki, and the Atomic bomb was viewed in popular culture, see, e.g., Paul Boyer, *By the Bomb's Early Light: American Thought and Culture at the Dawn of the Atomic Age* (New York: Pantheon Books, 1985), 27-106.

These points were made in two reports by key scientists working on the Manhattan Project. One was the Franck Report, which was intended for the Secretary of War.[4] Dr. Franck headed the chemical division of the Metallurgical Laboratory at Chicago and chaired a secret panel of scientists who advised Washington in 1945 not to bomb Japan but instead keep the bomb secret or conduct a demonstration shot. The report emphasized that *"in no other type of warfare does the advantage lie so heavily with the aggressor*."[5] Meanwhile, a separate Metallurgical Laboratory report, known as the Jeffries Report, by Zay Jefferies,[6] which was submitted to key managers of the Manhattan Project several months earlier, made the same point with an analogy that seemed compelling:

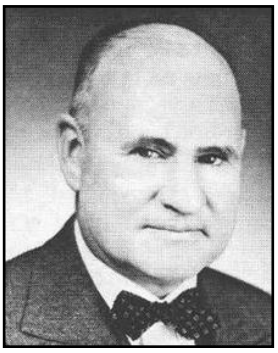

Figure 2: Zay Jefferies

> A nation or even a political group, given the opportunity to start aggression by a sudden use of nuclear destruction devices will be able to unleash a 'blitzkrieg' infinitely more terrifying than that of 1939–40. A sudden blow of this kind might literally wipe out even the largest nation—or at least all of its production centers—and decide the issue on the first day of the war. If two people are in a room of 100 by 100 feet and have no weapons except their bare fists, the attacker has only a slight advantage over his opponent. But if each of them has a machine gun in his hand the attacker is sure to be victorious…with the production of nuclear bombs...the world situation approaches that of two men with machine guns in a 100 by 100 foot room.[7]

Figure 3: Harry Truman, Clement

Both reports recommended international control and ownership of all nuclear plants and materials as the only way to avoid the worst. This recommendation, in turn, was adopted in an agreed declaration by the leaders of the key states cooperating in the Manhattan Project—the United States, United Kingdom, and Canada—on November 15, 1945. This declaration noted that against nuclear weapons, there could be no defense and that the future of civilization required nothing less than the international control of nuclear energy and the prevention of war. The declaration was serious. To secure such restraints, President Truman commissioned the top figures in the Manhattan Project to report on how best to go about international control of nuclear energy.

4. See J. Franck, et al., "The Franck Report," reprinted in Alice Kimball Smith, *A Peril and a Hope* (Chicago: University of Chicago Press, 1965), 560-565.

5. Ibid., p. 563.

6. Zay Jefferies, et al., "Prospectus on Nucleonics (The Jeffries Report)," reprinted in Alice Kimball Smith, *A Peril and a Hope,* 539-559.

7. Ibid., 552.

This effort is known by its most prominent report panelists: Dean Acheson, then-Undersecretary of State, serving as the panel's chairman and who later became Secretary of State, and David Lilienthal, chairman of the Tennessee Valley Authority—the entity that supplied electricity to the Manhattan Project.[8] The key author of this review was J. Robert Oppenheimer, the guiding scientific light of the Manhattan Project and of the laboratory at Los Alamos.

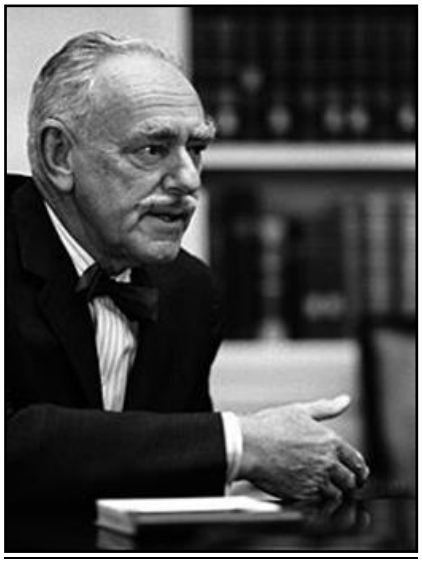

Figure 4: Dean Acheson

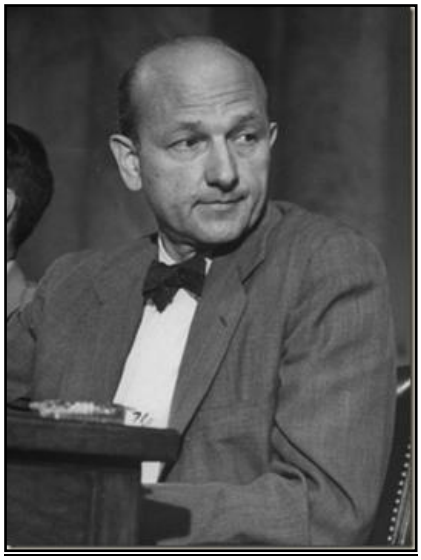

Figure 5: David E. Lilienthal

The assumption that the aggressor would always win featured prominently in this review as did that city centers were the primary target. The report viewed nuclear weapons as being revolutionary, "particularly as weapons of strategic bombardment aimed at the destruction of enemy cities and the eradication of their populations." It also asserted that "there can be no adequate military defense against atomic weapons." Finally, the report asserted that the uncontrolled development of nuclear energy "would not only intensify the ferocity of warfare, but might directly contribute to the outbreak of war." [9]

The UN proposal, known as the Baruch Plan, which was filed for the United States by Barnard Baruch, a prominent and politically active financier, captured this view succinctly: Nuclear

8. *The Acheson-Lilienthal Report: Report on the International Control of Atomic Energy* (Washington, DC: U.S. Government Printing Office, 1946), http://www.learnworld.com/ZNW/LWText.Acheson-Lilienthal.html.
9. Ibid., 1-2.

weapons, Baruch argued, forced a choice between "the quick and the dead."[10] This seemed all the more certain if, as expected, Russia acquired these weapons.

As noted earlier in the discussion of nuclear deterrence, this view is rebuttable. In fact, striking first may not assure ultimate victory in nuclear war unless one can be certain that the targeted party cannot strike back. Thus, striking an opponent's strategic forces should get priority over striking population, and, to varying degrees, passive and active defenses are possible to protect these forces against being knocked out. Such defenses and the ability to strike back would complicate and possibly deter surprise nuclear aggressor attacks. With sufficient defenses, one might even survive a first strike. Nuclear weapons made wars potentially much more destructive. It is hardly clear, however, that their use in every case would necessarily destroy all of civilization or demand the creation of international government.

III. How did their nuclear threat perceptions shape their views of which nuclear activities and materials were safe or dangerous and how they should be controlled?

The authors of Acheson-Lilienthal and the Baruch Plan, however, did not accept these rebuttals. Because they assumed that the aggressor would always win, that there was no defense, and that the survival of civilization hung in the balance, the controls they recommended were comprehensive and quite strict. Unfortunately, they proved to be too demanding for the Soviets to accept. They also exaggerated the threat that nuclear weapons actually posed. Nonetheless, a good portion of the report's key recommendations are worth reflecting upon today.

Among their recommendations was an insistence that a clear distinction be made between "safe" nuclear activities and materials and "dangerous" ones. Safe nuclear activities and materials were ones so distant from bomb making that nations could possess them and occasional international inspections alone could assure that no worrisome military diversions could be completed without setting off alarm bells well before any bombs were built. Dangerous nuclear activities and materials, on the other hand, were so coeval with bomb making that the Acheson-Lilienthal panel recommended that no nation be allowed to own

10. Bernard Baruch, *The Baruch Plan*, presented to the United Nations Atomic Energy Commission, June 14, 1946, http://nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/arms-control-disarmament/baruch-plan_1946-06-14.htm.

them.[11] The report made it clear that all dangerous nuclear activities and materials had to be placed under international ownership:

> Take the case of a controlled reactor, a power pile, producing plutonium. Assume an international agreement barring use of the plutonium in a bomb, but permitting use of the pile for heat or power. No system of inspection, we have concluded, could afford any reasonable security against diversion of such materials to the purposes of war. If nations may engage in this dangerous field, and only national good faith and international policing stand in the way, *the very existence of the prohibition* against the use of such piles to produce fissionable material suitable for bombs would tend to stimulate and encourage surreptitious evasions. This danger in the situation is attributable to the fact that this potentially hazardous activity is carried on by nations or their citizens.[12]

The report made a similar case regarding the mining of uranium. If prospecting for uranium was allowed, it difficult to discern if the ore was being mined to fuel peaceful reactors or military production machines or to be used as feed for enrichment to make bombs. To reduce these uncertainties to "manageable proportions," the report argued that no nation should be allowed to mine or possess uranium, that only an international nuclear authority should be allowed to do so:

> For then it would be true that not the purpose of those who mine or possess uranium ore but the mere fact of their mining or possessing it becomes illegal, and national violation is an unambiguous danger signal of warlike purposes. The very opening of a mine by anyone other than the international agency is a "red light" without more.[13]

Thus, the report recommended that all dangerous materials and activities be owned or operated by a new international body the UN would have to create, the International Atomic Energy Authority.

What did the Acheson-Lilienthal Report believe were dangerous nuclear activities and materials?

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11. For a more recent argument about the difficulty of separating 'safe' from 'dangerous' nuclear activities, see Albert Wohlstetter, et al., "On Keeping "Dangerous" Activities in Check." in *Swords from Plowshares: The Military Potential of Civilian-Nuclear Energy* (Chicago: University of Chicago Press, 1979), 47-70.
12. See The Acheson-Lilienthal Report, 21.
13, Ibid, 22

1. **Uranium mining**: In 1946, uranium was thought to be extremely scarce. Because of this, the mining or processing of uranium ore was assumed to be an activity that would be easy to control. Since no nuclear activity, peaceful or martial, would be possible without access to this ore, the panel recommended international ownership and control of uranium mining. Any country found mining its own uranium would immediately be found in violation of the proposed control regime.

Figure 6: Uranium Mining

2. **Nuclear fuel-making plants**: The report determined that enriching uranium, chemically separating plutonium from spent reactor fuel, or operating facilities that processed or fabricated these materials could bring a state to the very brink of bomb making.

Figure 7: Iranian President Mahmoud Ahmadinejad Visits the Natanz Uranium Enrichment Facilities

3. **Nuclear weapons explosive materials**: These could be used directly to make nuclear weapons cores, i.e., plutonium and highly enriched uranium.

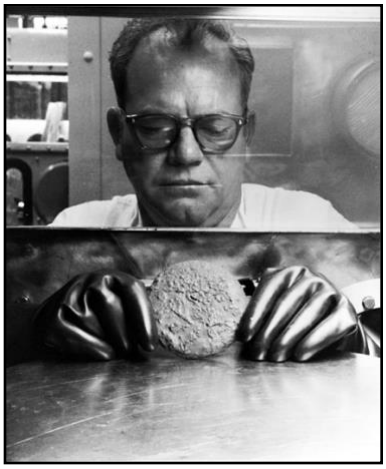

Figure 8: Worker Handling Plutonium

4. **Reactors optimized to make plutonium**: These included graphite or heavy water-moderated production reactors or fast reactors, which could easily be optimized to make plutonium for bombs.

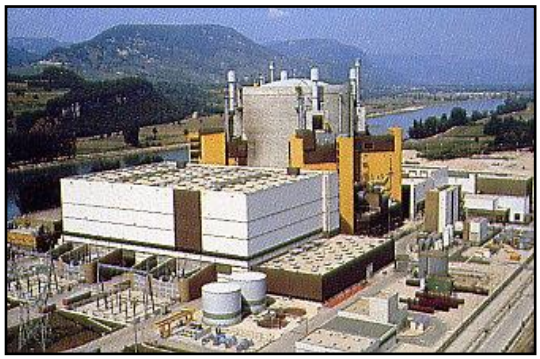

Figure 9: Super Phenix, Breeder Reactor, France

5. **Nuclear weapons research and development related activities**: The report identified both as being dangerous nuclear activities.

Figure 10: Explosive Lenses Arranged in Soccer Ball Shape

What did the report consider to be safe activities and materials?

1. **Small research reactors producing isotopes for medical, agricultural, and industrial purposes:** These reactors, the report noted, could be built so they could not make a bomb's worth of plutonium except over a very long period of time, e.g., a decade or more. Periodic inspections could easily spot a diversion well before any bomb could be built.

MIT Research Reactor

2. **"Denatured" nuclear materials, e.g., low enriched uranium and natural uranium**: These materials cannot be used to make bombs unless they were "enriched" with gaseous diffusion enrichment plants. These plants, though, would take at least a year to build and would take nearly an additional year of operation to produce their first gram of weapons-grade uranium. As a practical matter, these plants, their operation, and their construction could not be hidden. So while the report viewed uranium mining and enrichment

Figure 12: Nuclear Fuel Assembly

as being dangerous activities, the report viewed the uranium and low enriched uranium that these dangerous activities produced to — be "safe" materials.

How did the report categorize power reactors?

Initially, the Acheson-Lilienthal Report listed power reactors that burned "denatured" fissile material as being sufficiently safe to allow for national versus international ownership. This conclusion rested on the notion that the low or unenriched uranium used to fuel these reactors lacked sufficient fissile U235 to be fashioned into a bomb. It also presumed that the plutonium the power reactors produced would have so many undesirable isotopic "denaturants" (Pu 240 and Pu 242) it too would be unusable to make weapons.

After the report's March publication, however, the report's science advisors worried that the report had made too much of denaturing. In a follow-on press release dated April 9, 1946, they warned that denaturing, in fact, should not be relied upon as an absolute barrier to the bomb.

Figure 13: Sequoyah, Units 1 & 2

What the report referred as "denaturants" included the normal build-up of plutonium isotopes 240 and 242 in reactors optimized to produce economic amounts of electricity. The report distinguished these plants from military production reactors optimized to produce plutonium 239 and 241.

As noted earlier, isotopes of plutonium found in up to 40 percent of the plutonium normally produced in power reactors (and known as "reactor-grade plutonium") are far more prone to spontaneously emit neutrons and heat than the odd isotopes of plutonium — plutonium 239 and plutonium 241. Plutonium 240 and plutonium 242 also increase heat management issues and the likelihood of undesirable preignition in weapons designs as primitive as the bomb dropped on Nagasaki..

As for uranium, the report's authors assumed that it was so scarce that the only way a power reactor industry could emerge was if natural or fertile uranium (U238) blanketed the reactor core so it could be transmuted into plutonium, which could be chemically separated out and fashioned into fresh fuel to power other power reactors. Initially, the authors of the report

thought that this plutonium would contain enough Pu-240 and Pu-242 "denaturants" to render it and the power reactors that produced it of no use to make bombs.

Yet, even in 1946, several of the scientists advising the Acheson-Lilienthal Report knew that "denatured" uranium or plutonium could not assure safety against military use. In the case of low enriched and natural uranium, they knew this material could be enriched further to weapons grade. Building and operating enrichment plants could take time, but it could be done. As they explained in their April press release:

> … In every case denaturing is accomplished by adding to the explosive an isotope, which has the same chemical properties. These isotopes cannot be separated by ordinary chemical means. The separation requires plants of the same general type as our plants at Oak Ridge, though not of the same magnitude. The construction of such plants and the use of such plants to process enough material for a significant number of atomic bombs would probably require not less than one nor more than three years. Even if such plants are in existence and ready to operate some months must elapse before bomb production is significant. But unless there is reasonable assurance that such plants do not exist *it would be unwise to rely on denaturing to insure an interval of as much as a year.*[14]

They also knew that the preignition problems posed by Pu-240 and Pu-242 in reactor-grade plutonium might be overcome with weapons designs enhancements (e.g., as hollow cores and levitated pits, concepts that were proposed before the Trinity Shot but considered to be too risky to try out in the first bombs to be used against Japan). These design enhancements were actually proven in nuclear tests conducted in the late 1940s. As a result, these experts demanded that a press release be issued stating that denaturing could not be relied upon to prevent nuclear weapons from being built.[15] As they noted :

> The Report does not contend nor is it in fact true, that a system of control based solely on denaturing could provide adequate safety…In some cases denaturing will not completely preclude making atomic weapons...Further technical information will be required, as will also a much more complete experience of the peacetime uses of atomic energy and its economics, before precise estimates of the value of denaturing can be formulated…Denaturing, though valuable in

14. U.S. Department of State. Press Release No. 235 (April 9, 1946), http://www.learnworld.com/ZNW/LWText.Acheson-Lilienthal.html#release
15. Ibid.

adding to the flexibility of a system of controls, cannot of itself eliminate the dangers of atomic warfare.[16]

This press release was itself a demonstration of another key point raised in the Acheson-Lilienthal Report—that the line between what was safe and dangerous would move as scientists' understanding of nuclear energy and weapons designs progressed. We know that power reactor plutonium can be used to make multi-kiloton or higher yield nuclear weapons.[17]

Nuclear controls by inspections alone: Doomed to fail

In addition to making a distinction between what was safe and dangerous, the Acheson-Lilienthal Report emphasized that any system of control over nuclear energy that depended solely on inspections was doomed to fail. Again, the report's authors used the example of plutonium and plutonium production piles to make their point:

> Assume an international agreement barring use of the plutonium in a bomb, but permitting use of the pile for heat or power. No system of inspection, we have concluded, could afford any reasonable security against the diversion of such materials to the purposes of war. If nations may engage in this dangerous field, and only national good faith and international policing stand in the way, *the very existence of the prohibition against the use of such piles to produce fissionable material suitable for bombs would tend to stimulate and encourage surreptitious evasions.* This danger in the situation is attributable to the fact that this potentially hazardous activity is carried on by nations or their citizens…. So long as intrinsically dangerous activities may be carried on by nations, rivalries are inevitable and fears are engendered that place so great a pressure upon a system of international enforcement by police methods that no degree of ingenuity or technical competence could possibly hope to cope with them…We are convinced that *if the production of fissionable materials by national governments (or by private organizations under their control) is permitted, systems of inspection cannot by themselves made "effective safeguards* to

16. Ibid.

17. See, e.g., Sokolski, 17-19; Victor Gilinsky, Harmon Hubbard, and Marvin Miller, "Fresh Examination of the Proliferation Dangers of Light Water Reactors," *Nonproliferation Policy Education Center*, Updated March 2017, originally published October 22, 2004, http://npolicy.org/article_file/1701_Fresh_Examination_of_LWR_Proliferation_Dangers.pdf; and Arthur Steiner, Denaturing Through the Years, AJS 10-6-75.

> protect complying states against the hazards of violations and evasions."*…In short, any system based on outlawing the purely military development of atomic energy and relying solely on inspection for enforcement would at the outset be surrounded by conditions which would destroy the system.*[18]

That is why the report insisted that dangerous nuclear activities and materials had to be owned and operated by an international authority. This view is much tougher than what is popular today. In fact, the current nonproliferation regime allows states to enrich uranium and chemically separate plutonium from spent reactor fuel. The regime also allows states to possess highly enriched uranium and separated plutonium and to operate any kind of reactor. More important, it relies entirely on inspection and police type methods—the very approach the Acheson-Lilienthal Report warned could never work.

True safeguards must set off alarms early enough to prevent bombs from being built

The report also had a very strict view about what nuclear safeguards required of nationally owned nuclear materials and facilities. The most important of the required attributes is what is now commonly referred to as timely warning. As the Acheson-Lilienthal Report made clear, any effective nuclear safeguard against military diversions had to provide

> unambiguous and reliable danger signals if a nation takes steps that do or may indicate the beginning of atomic warfare. Those danger signals must flash early enough to leave time adequate to permit other nations—alone or in concert—to take appropriate action.[19]

The notion here is that an inspection regime must be able to reliably detect possible military diversions early enough to allow outside parties to intervene to prevent the diversion from resulting in a working nuclear bomb. Thus, small research reactors could be safeguarded since it might take 10 years or more for a military diversion to succeed in diverting enough plutonium from such plants to make a single weapon and diversion activities surely could be detected well before a bomb was actually made.

Trying to safeguard weapons usable uranium or plutonium, on the other hand, would be impractical since these materials could be inserted into an implosion or gun device in a matter of days or hours. That is why the Acheson-Lilienthal Report listed so many materials and activities as being too dangerous to allow nations to own and operate themselves: The report's

18. Acheson-Lilienthal Report, 4-5, 8.
19. Ibid., 9.

authors knew inspections alone could not safeguard these activities and materials against being diverted quickly to make bombs.

Enforcement: Going to War against Violators

When it came to enforcement, the Acheson-Lilienthal Report relied heavily on states being willing to go to war. It recommended that the International Atomic Energy Authority operate dangerous plants capable of making nuclear weapons materials in a variety of locations globally so that if any state chose to violate the Authority's prohibitions by seizing such plants, the states most threatened by such acts "of atomic war" could use International Atomic Energy Authority plants in their region to arm themselves if needed. Other aggrieved states would be expected to declare war on the violating party. The report's authors argued that it was most unlikely that any state would actually use nuclear arms in such a war since it would take "a year or more" before any party could acquire such weapons:

> With appropriate world-wide distribution of stockpiles and facilities; with design rendered as little dangerous as possible; with stockpiles of dangerous materials kept at the lowest level consistent with good economics and engineering; there will be no need for a sense of insecurity on the part of any of the major powers. *Seizures will afford no immediate tactical advantage. They would in fact be an instantaneous dramatic danger signal, and they would permit, under the conditions stated, a substantial period of time for other nations to take all possible measures of defense. For it should be borne in mind that even if facilities are seized, a year or more would be required after seizure before atomic weapons could be produced in quantities sufficient to have an important influence on the outcome of war.* Considering the psychological factors in public opinion, the fixing of danger signals that are clear, simple, and vivid seems to us of utmost importance.[20]

Bernard Baruch, who was asked by President Truman to turn the Acheson-Lilienthal Report's findings into an actual proposal for consideration by the United Nations, though, thought this approach to enforcement was too crude as it relied in all cases on states entering into a state of war unilaterally. He suggested in his UN version of the Acheson-Lilienthal Report that

20. Ibid., 48.

appropriate or "condign" punishments be decided upon in advance for a variety of infractions—from minor violations to the worst.[21]

Limiting nuclear power economically

As for promoting the use of nuclear power, the Acheson-Lilienthal Report was optimistic that nuclear power might yet become economical but skeptical that this might be achieved anytime soon. It would take time for the International Atomic Energy Authority to produce enough "denatured" plutonium fuel to run such power plants. For every kilowatt of power produced in a nationally owned power plant, the report thought the International Atomic Energy Authority would have to own and operate a kilowatt of plutonium production reactors in order to produce enough "denatured" plutonium to run a nationally owned power plant. Half of the world's reactors, in short, would be military production reactors (e.g., heavy water, graphite or fast reactors) owned and operated by the International Atomic Energy Authority. In any case, when it came to determining where power plants might be sited to optimize their economical use, the Acheson-Lilienthal Report sensibly recommended relying heavily on economic market signals:

> The problem of power producing piles should be somewhat less difficult in the case of the non-dangerous plants. In these, fissionable materials will be denatured. The charter should be able to provide for their allocation of this type of plant in accordance with more conventional economic standards. It might be possible to provide that they should be located on the basis of competitive bids among interested nations. On such a basis, countries with ample power resources in water, coal, or oil would limit their bids to those warranted by the costs of alternative sources. Those countries having few or expensive ordinary sources of power might bid higher, but below the cost of other alternatives. In this way the maximum usefulness of fissionable materials with the greatest conservation of other sources of power would be secured.[22]

21. One issue with this plan, though, was that the UN charter's condition that penalization of UN members only come after the approval of the UN Security Council and its five great power members, see Sokolski, 16.
22. Acheson-Lilienthal Report, 49

IV. How sound were their nuclear threat perceptions and how best to mitigate them?

Many of the nuclear control recommendations of the Acheson-Lilienthal Report and the UN proposal made sense, yet they failed to be adopted.

A key reason why was that having presumed that nuclear aggressors will always win, that there was no defense, and that defeat would be catastrophic to civilization, the United States demanded that the Soviet Union open itself up to international inspections *before* the United States gave up its weapons. This was a nonstarter for the Russians, who actually were working feverishly to duplicate the bomb the United States dropped on Nagasaki.

In addition, the Baruch Plan demanded that the UN Security Council operate against nuclear violators with the approval of a mere majority of the council membership. A majority, rather than consensus, it was argued, would have to do. Again, the Russians could hardly abide by this.

In fairness, it is unclear how much a Russia ruled by Stalin would ever be willing to work with other countries to limit its chance to get nuclear weapons, but it is tempting to speculate how much of what was sound about the Acheson-Lilienthal Report might have been given more serious consideration had the United States not made such stringent upfront demands of the Russians regarding inspections and disallowing UN Security Council vetoes of actions against violators.[23]

Such speculation becomes all the more tantalizing when one considers just how questionable America's view of the nuclear threat was. As a analysts, such as Jacob Viner noted at the time, the assumption that nuclear aggressors would always win whatever wars they waged was rebuttable.[24] Although it might be true that a bigger bomb would not neutralize a smaller one, a country with a larger strategic force that was dispersed and well protected against attack with air defenses and hardening would likely be able to prevail against a small nuclear attack and be able to strike back with decisive results. Failure to knock most or all of an opponent's nuclear forces out would then open the aggressor to retaliation and likely defeat or greater destruction. Fear of this alone might prevent aggressors from attacking in the first place.

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23. For more on this point, see Albert Wohlstetter, et al., *Swords from Plowshares: The Military Potential of Civilian-Nuclear Energy*, 56-58.

24. Jacob Viner, "The Implications of the Atomic Bomb for International Relations," in *Symposium on Atomic Energy and its Implications: Papers read at the joint meeting of the American Philosophical Society and the National Academy of Sciences, November 16 and 17, 1945,* Philadelphia: American Philosophical Society, 1946.