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INTRODUCTION

Mr. Chairman and distinguished members of the committee, it is a pleasure to be able to testify today on the Comprehensive Nuclear Test-Ban Treaty. I am Paul Robinson, director of Sandia National Laboratories. Sandia National Laboratories is managed and operated for the United States Department of Energy by Sandia Corporation, a subsidiary of Lockheed Martin Corporation.

Throughout the history of nuclear weapons, Sandia has been responsible for the nonnuclear engineering development of all U.S. nuclear weapons and for systems integration of nuclear weapons with their delivery vehicles. Sandia's mission includes the design, certification, and assessment of the nonnuclear subsystems of nuclear weapons; safety, security, reliability, and use-control; issues associated with the production and dismantlement of nuclear weapons; surveillance and support of weapons in the stockpile; and substantial work in analysis of foreign nuclear weapon capabilities, nonproliferation, and treaty verification technologies.

Let me begin my testimony today with a very important statement: Testimony prepared by the directors of the national nuclear weapon laboratories is traditionally never vetted in advance. As the director of a nuclear weapon laboratory, I take very seriously my responsibility to provide objective technical counsel to all branches of the federal government. This is true of my testimony today. These remarks are my own, with help from technical experts within the laboratories and other experienced individuals whose views I have sought.

I am fortunate to have had unusually broad experience during my career in the technical management of our nation's nuclear weapons development and arms control programs. In the early 1980s I managed Los Alamos National Laboratory's defense programs. My responsibilities included nuclear weapons research, development, and testing; stockpile maintenance; strategic defense initiatives; inertial confinement fusion; nuclear materials and safeguards; advanced conventional weapons; and arms control and verification activities.

Prior to joining Sandia National Laboratories, it was my privilege to serve as chief negotiator and head of the U.S. delegation to the nuclear testing talks between the United States and the Soviet Union. Those negotiations produced protocols to the Threshold Test Ban Treaty and the Peaceful Nuclear Explosions Treaty. These two treaties had remained unratified for many years because of concerns that reliable technical means for verification were lacking. The protocols we negotiated provided procedures for on-site inspection and in-country technical verification that provided sufficient confidence in the verifiability of the agreements to proceed with ratification. I'm pleased to say that you voted unanimously to ratify these treaties and protocols, and they entered into force in December of 1990.

Verification is an issue that must be considered for the Comprehensive Nuclear Test-Ban Treaty as well, and I will discuss it later in my statement. However, I will begin by questioning three major expectations that have been claimed for this treaty. I will then devote the major portion of my statement to the technical issues associated with maintaining stockpile confidence under DOE's stockpile stewardship and management programs. I will review the important safeguards that the President has proposed should accompany your consent to the treaty, and I will offer some specific recommendations for your consideration.

EXPECTATIONS FOR THE CTBT VARY

There are different points of view as to the ultimate purpose of a prohibition on nuclear testing. Some see a test ban as a necessary, if not sufficient, step in a process to eventually eliminate nuclear weapons altogether. Others believe the prohibition will prevent the proliferation of nuclear weapons to states that do not yet have them. Still others suggest that by eliminating testing it will be possible to stop any further development of nuclear weapons technology, that is, to "freeze" the technology at its current levels everywhere. Whether the Comprehensive Nuclear Test-Ban Treaty could fulfill any of these expectations is problematic.

Disarmament Expectations

It is imperative that the United States-maintain and exercise its capability to design, certify, and produce nuclear weapons if it intends to have a reliable, safe, and credible nuclear deterrent over the long term. Nothing in the comprehensive Nuclear Test Ban Treaty prevents the United States or other nations from conducting nonnuclear-explosive stockpile activities to maintain and enhance the reliability and safety of its nuclear weapons, including:

$ disassembly or reassembly of nuclear weapons;

$ remanufacture of nuclear weapons;

- production of replacement weapon parts, including the production of new components;
- design or development of new nuclear weapons;
- flight testing of weapon components, or the production of inert weapons for flight testing;
- engineering tests of the mechanical and electrical components under a variety of environmental conditions;
- other changes to weapons that can be made without carrying out a nuclear weapon test explosion.

The Preamble of the Comprehensive Nuclear Test-Ban Treaty states that cessation of nuclear testing is "an effective measure of nuclear disarmament." Perhaps the drafters of this language believed that confidence in nuclear weapon stockpiles would inexorably erode over time to the point where they would no longer be regarded as credible weapons.

This is an unrealistic expectation, however, because no stockpile activities other than nuclear testing are prohibited by the treaty. Moreover, the President's proposed safeguards require annual certification and the right to invoke the "supreme national interest" clause of the treaty if necessary to restore stockpile confidence. The deterrent effect of the stockpile rests on *our own belief* that U.S. nuclear weapons will perform as designed, and we must not permit that confidence to erode.

Nonproliferation Expectations

President Clinton quite correctly observed that "American leaders since Presidents Eisenhower and Kennedy have believed a comprehensive test ban would be a major stride toward stopping the proliferation of nuclear weapons." Unfortunately, we know today that a test ban cannot prevent states from acquiring nuclear weapons if they are determined to do so. Credible nuclear weapons can be constructed without nuclear testing, as several nations, including South Africa, have demonstrated. The underground nuclear tests by India and Pakistan in 1998 are another example: These events were not developmental tests; they were demonstrations of a nuclear capability that had been developed much earlier, with little or no testilftc,

Proliferation decisions are most strongly influenced by factors such as how regional security environments evolve over the long term and whether the U.S. nuclear umbrella remains effective for our allies. Our nonproliferation objectives must be pursued vigorously through several avenues, including expanded intelligence capabilities and a comprehensive program of security coordination, export controls, counterproliferation options, economic incentives, and other means.

It is doubtful, however, that a nation could develop a potent and diverse nuclear arsenal without performing developmental and proof tests of warhead systems. Thus, there may be value in achieving an international norm that eschews further nuclear explosions. Such a norm, if abided by, may retard the development of major new national nuclear forces.

However, it must be acknowledged that a nuclear test ban is no barrier to the development of a few basic nuclear weapons by leaders of rogue states or even by well-financed terrorist groups. Unfortunately, I know of no means to effectively rule out such developments, although global safeguards on nuclear materials will remain the first lines of defense. Those who claim that by ending nuclear testing we will close off the threat of terrorist development and use of nuclear explosives mislead themselves. Congress should not accept such arguments as a basis for endorsing a test ban treaty.

"Freeze" Expectations

I am also concerned by the erroneous claims made by some that the Comprehensive Nuclear Test-Ban Treaty prohibits the United States or any other nation from deploying new nuclear weapon designs or adapting existing nuclear explosives for new warheads.

While the treaty does not prohibit the deployment of new nuclear desians, from a practical standpoint we are limited to previously tested concepts. It is indeed correct that the United States would be ill advised to place a sophisticated nuclear explosive design into the stockpile that had not been previously tested and validated. Consequently, the designs of primaries and secondaries are effectively frozen by a prohibition on testing. Los Alamos and Lawrence Livermore National Laboratories are responsible for nuclear explosives, and while they cannot create completely new concepts without testing, many previously tested designs could be weaponized to provide new military capabilities.

Over time, the question of whether the U.S. stockpile contains the appropriate warheads for the evolving threats is bound to become an issue. For example, if nuclear weapons emerge as the right answer to deter the use of other weapons of mass destruction in a regional conflict, the nuclear weapons we currently deploy may well carry too high a yield and be far too disproportionate a response to be a credible deterrent. Proven designs of lower yield exist that might be adaptable for new military requirements in the future. I believe that such weapons could be deployed this way without the need for nuclear tests.

Moreover, adapting deployed nuclear desicns to new delivery systems, or even other delivery modes, is not constrained by the elinu'nation of nuclear-yield testina. New delivery modes can be achieved and certified for older designs without nuclear testin-. For example, last year the United States completed conversion of a set of B61-7 gravity bombs into B61-11 earthpenetratin- warheads. They are now operationally deployed, havin- replaced the B53 -ravity bombs, which were retired, because they did not have modem safety features.

The modernization of warhead electronics and systems packaging is not only certainly possible, it is essential over time, so that older electronics can be replaced with modem components. In this process, emphasis is always placed on increasin- the safety, security, and use-control features of the system. Sandia carries this responsibility for all U.S. nuclear weapons.

VALIDATING STOCKPILE CONFIDENCE UNDER THE TEST BAN

There is no question that from a technical point of view, actual testing of desi-ns to confirm their performance is the desired regimen for any hich-technolocy device, from cars and airplanes to medical diagnostic equipment and computers. For a device as hi-hly consequential as a nuclear weapon, testin- of the complete system, both when it is first developed and periodically throughout its lifetime to ensure that acinc, effects do not invalidate its performance, is also the preferred methodology. I and others who are, or have been, responsible for the safety and reliability of the U.S. stockpile of nuclear weapons have testified to this obvious conclusion many times in the past. To forego that validation through testine, is, in short, to live with uncertainty.

When the Department of Energy's Office of Defense Programs, under the leadership of Victor Reis, proposed the Science-Based Stockpile Stewardship program as a means for ensuring the safety and reliability of nuclear weapons without testinc,, I agreed that Sandia National Laboratories would support that concept to.the best of its abilities. I could not offer a proof, nor can anyone then or since, that such an alternative means of certifying the adequacy of the U.S. stockpile will be successful. I believed then, as I do now, that it may be possible to develop the Science-Based Stockpile Stewardship approach as a substitute for nuclear testing for keepinpreviously-tested nuclear weapon desi-ns safe and reliable. However, this undertaking is an enormous challenge which no one should underestimate, and will carry a higher level of risk than at any time in the past.

The other laboratory directors and I have stated that Science-Based Stockpile Stewardship is the best means we know of to maintain U.S. nuclear weapons without nuclear explosive testing.

However, that statement is in some sense a tautology, as (a) we were instructed only to consider the case of no testing, and (b) attempting to gain a better scientific understanding of the physics of nuclear weaponry did not begin with the Ascience-based" stockpile stewardship effort, for the program had been rooted in the quest for a better science basis throughout its history. The difficulty we face is that we cannot today guarantee that Science-Based Stockpile Stewardship will be ultimately successful; nor can we Guarantee that it will be possible to prove that it is successful.

We depend on the engineers and scientists at the heart of this activity who are knowledgeable, experienced, and reasoned in their judgment for making stockpile stewardship succeed. Our confidence in their ability to perform these weighty responsibilities is gained through work on systems-level tasks that require them to think through the integration of the many individual activities of stewardship into a demonstrative product. In the past, this product was often a full-scale weaponization program or a nuclear test.

Confidence in the reliability and safety of the U.S. nuclear weapons stockpile will eventually decline without nuclear testing. However, the rate of erosion of that confidence is not predictable. Much of the erosion will be in the form of a shrinking base of experienced personnel who know how to perform the arcane responsibilities of stockpile stewardship. Whether the risk that will arise from this decline in confidence will be acceptable or not is a policy issue that must be considered in light of the benefits expected to be realized by a universal test ban. The Science-Based Stockpile Stewardship program is intended to mitigate that risk to the extent possible.

Reliability Confidence

Sandia's responsibility for stockpile confidence comprises reliability, safety, and use-control associated with the nonnuclear subsystems that control the operation of a nuclear warhead or bomb. Our confidence in the stockpile has always been anchored in the community of dedicated and experienced engineers and scientists who are expert in the activities of stockpile stewardship. Confidence is also maintained through exhaustive nonnuclear tests of components and systems, a long history of fielded weapons and their data, a careful preventive maintenance and replacement program, chemical analyses, computer modeling, and joint or independent reviews of our work.

We test and model the performance of nonnuclear components and systems in a variety of normal, abnormal, and hostile operational environments. We certify weapon performance under normal operating environments, and we validate and verify that components and systems will retain adequate functionality after exposure to hostile environments. Most normal operational

environments of concern for nonnuclear components and systems can be simulated without nuclear explosive tests.

The primary application of nuclear testing for Sandia has been to validate and verify the functionality of nonnuclear weapon components and the warhead as a system when exposed to hostile environments, such as the extreme radiation fluxes and mechanical impulses of fratricide, preemptive strike, or nuclear-armed anti-ballistic missile (ABM) defenses. In the past, Sandia conducted underground nuclear-weapon effects tests (in cooperation with the Defense Special Weapons Agency) to ascertain whether component and total-system prototypes would withstand such hostile environments. (For example, for the W88/Mark 5 Trident II system, the last weapon put into the stockpile, Sandia exposed prototypes of war-reserve hardware in six underground tests.) While the scenarios of fratricide, preemptive strike, and ABM defenses are less likely since the end of the Cold War and the significant drawdown in the nuclear forces of both sides, the possibility of these phenomena must still be planned for in the post-Cold-War era. Consequently, functionality of components and systems in hostile environments will remain a design requirement as long as nuclear weapons continue to be deployed by any potential adversary.

The nonnuclear components in today's nuclear warheads and bombs will ultimately become obsolete and irreproducible. We will be forced to abandon "sunset technology" and redesign components based on contemporary technology that can be supported by the constantly evolving industrial base. Therefore, revalidating the functionality of components in hostile environments will be a recurring need.

We are fortunate in recent years to have successfully developed aboveground experimental facilities that simulate many of the phenomena of hostile environments. The six underground radiation tests we conducted for the W88/Mark 5 were supplemented with more than 1,000 aboveground radiation tests using 15 different facilities. The available suite of aboveground simulation facilities today allows us to separately simulate most nuclear-weapon radiation spectra. Some of the gaps in this suite will be filled by the construction of new facilities proposed within DOE's Science-Based Stockpile Stewardship plan.

DOE's Advanced Supercon-iputing Initiative (ASCI) augments the utility of simulators through computational modeling. The knowledge gained from past underground nuclear tests and aboveground experiments is incorporated into computational models for both weapon physics and weapon effects. These models, combined with today's improved aboveground simulators, allow us to do a much better job of evaluating many of our nonnuclear subsystems and components than was possible in the past with underground tests alone.

However, it must be recognized that our simulation and modelinc, capabilities have limitations. The extreme radiation fluxes and mechanical impulses of a nuclear detonation cannot

be simulated. In addition, the physical size of hardware svstems that can be tested for complete systems response is lirlu'ted. In the future, the fidelitj of some aspects of our evolving computational models mav be unverifiable without nuclear testing. Ultimately, some design issues for new components and materials may not be resolvable at hi-h levels of confidence without nuclear testing. Even so, nuclear effects tests carried out in underground test chambers were always a compromise to the actual conditions that warheads would experience in military use. Thus, this is not the first time that we have been challenged to do the best job of simulating phenomena which can not be achieved experimentally.

The limitations of science-based validation (as opposed to nuclear-testin--based validation) may or may not prove to be important, depending on how the threat environment evolves in the future. If enemy nuclear threats do not chance significantly over the lonc, term (or if they decline as a result of further progess in arms control), these limitations will not seriously affect the stockpile. Under today's conditions of threat and technology, these limitations do not, in my opinion, present grave difficulties for Sandia's certification and validation responsibilities under a permanent nuclear test ban, provided that we receive sufficient funding, to maintain an adequate technical. staff and to build and operate the necessary aboveground simulation facilities.

Safety Confidence

Sandia's responsibility in nuclear weapon safety embraces the nonnuclear components and systems, in particular, the weapons' arming and firing systems. It is our job to answered the extent that it is technically feasible_that no accident can stimulate a warhead's arming and firing system in ways that would cause the weapon to detonate.

Over many years, Sandia has developed concepts and hardware that have been incorporated into the Enhanced Nuclear Detonation Safety (ENDS) system that is employed in most of the weapons in stockpile today. As technology advances, opportunities will arise for improving the safety design of nonnuclear systems of nuclear weapons, and we will, of course, pursue those opportunities. While improvements to safety and security systems for nuclear weapons can be developed and implemented without nuclear explosive testing, several attractive technical concepts for enhancement of these features will be foreclosed by the inability to test.

Another very important aspect of nuclear weapon safety involves the behavior of a weapon's conventional hich explosives in accident scenarios where energy bypasses the weapon's arming and firing system and directly impacts the nuclear assembly. Certain aspects of nuclear weapon safety (for example, one-point safety) are the specific purview of DOE's two nuclear design

laboratories, Los Alamos and Lawrence Livermore. In the past, it has been possible to calculate the effects of such impacts with good correlation to actual tests. In the future, validating nuclear

weapons safety will increasingly rely on such calculations, helped by the advanced computational capabilities that are becoming available, as well as on a consistent program of nonnuclear environmental and field testing.

VERIFYING COMPLIANCE WITH THE COMPREHENSIVE TEST BAN

Our capability to monitor the Comprehensive Nuclear Test-Ban Treaty cannot be characterized with a simple, short answer. Many factors influence our ability to detect a nuclear explosive test, including the precise attributes of the test (for example, its explosive yield, and its altitude or depth of burst), the geological and meteorological conditions in which the test occurs, the nature of measures taken by the testing entity to conceal the test, and the technical capabilities and operational limitations of the verification systems. The treaty bans any "nuclear explosion," but unfortunately, compliance with a strict zero-yield requirement is unverifiable. The limitations of verifiability introduce the possibility of inconsistent observance of the.ban under the threshold of delectability.

Verification Systems

Implementation of the Comprehensive Nuclear Test-Ban Treaty will create an extensive International Monitoring System (IMS) comprising facilities for seismological, radionuclide, hydroacoustic, and infrasound monitoring, which will be mana-ed by the Technical Secretariat of the Comprehensive Nuclear Test-Ban Treaty Organization. The individual monitoring facilities included in the EKAS will be operated by the nearly 90 countries hosting them, in accordance with treaty-based specifications and procedures. The detection threshold that was used informally by treaty negotiators as an unofficial target for the IMS was about I kiloton, non-evasively tested, in environments other than outer space. Although IMS coverage will not be uniform over the entire globe, it is expected to generally achieve that informal target.

In addition to the capabilities of the IMS remote monitoring system, parties to the treaty may also use their own national technical means (NTM) to verify compliance. Indeed, NTM will serve as the primary means by which the United States will monitor other countries' compliance with the Comprehensive Nuclear Test-Ban Treaty. Although U.S. NTM capabilities can be discussed in detail only at the classified level, we can say here that IMS and NTM capabilities complement each other in a number of important areas.

Under the treaty, each state party has the right to request an on-site inspection to clarify whether a nuclear explosion has occurred. However, obtaining an on-site inspection is not assured. The decision to approve a request for an on-site inspection must be made by an

affirmative vote of at least 30 of the 51 members of the treaty organization's Executive Council. Moreover, evidence derived through NTM might be discounted by some members of the

Executive Council; or a nation may be reluctant to submit NTM evidence for fear that doing so would reveal too much about its intelligence capabilities.

If an on-site inspection is granted, it offers the possibility of finding the "smoking gun" if, in fact, a clandestine nuclear test has been conducted. However, the requesting party's estimate of the location of the event must be sufficiently accurate to send an inspection team to the right place, and the team must be permitted to actually conduct its inspection there and gather sufficient evidence. My belief and experience, however, is that no nation would ever allow others to "catch it red-handed" by employing these provisions. National sovereignty claims would likely be invoked, or other chimera such as "its too dangerous to allow people to enter that site."

Notwithstanding these concerns, from a technical standpoint the combination of IMS, NTM, and on-site inspection provides an impressive, but less than perfect, capability to detect, locate, identify, and attribute nuclear explosions. But we must accepts news reports of seismic activity at the Russian test site last year illustrated_that data will not always be conclusive and some events will not be capable of definitive interpretation, particularly low-yield events, or devices evasively tested.

Tests with Yields Below the IMS Threshold of Detectability

Somewhere below the 1-kiloton informal target of the IMS, nuclear explosions are not detectable with current monitoring technology. (The threshold can be even higher if a testing entity employs evasive measures.)

With respect to our ability to detect very low-level explosions through NTM, not much can be said in an unclassified setting. We can say that U.S. national monitoring capabilities are better than those of the IMS at some locations and for some testing scenarios, and that the combination of the two is better than either alone.

Some promising technologies are under development that may extend our capability for detecting illicit nuclear explosions. Continued support of these R&D programs and of the implementation of planned enhancements to the operational monitoring system is essential. However, it is not possible_nor in my view will it likely ever become possible_to confidently detect lower yield explosions.

The treaty's zero-yield limitation on nuclear explosions could introduce some asymmetries between the United States and other parties to the treaty. Some nuclear experiments emit comparatively little energy. As you may know, it proved impossible in treaty negotiations to

articulate a technically defensible definition of "zero yield" that would prevent nuclear weapon test explosions while not prohibiting other nonweapon nuclear experiments (like inertial confinement

fusion and nonnuclear-explosive stockpile stewardship activities). Our understanding is that the treaty's zero-yield intent is to outlaw chemical-explosive-driven nuclear chain reactions that go super-critical, such as hydronuclear experiments, but not to ban subcritical chain reactions such as hydrodynamic experiments. The distinction is unverifiable, however, except to the experimenter.

I believe that nuclear testing in the subkiloton range could have utility for certain types of nuclear designs. However, it is very unlikely that the threshold for detection and yield measurement in most parts of the world will ever reach the level to identify these yields as nuclear tests, and hence as violations to the U.S. understanding of the treaty's central obligation. This raises the question as to whether the observed definition of zero should be the international standard of delectability, rather than the supposedly absolute but unverifiable zero yield that many people infer from the treaty.

THE PRESIDENT'S PROPOSED SAFEGUARDS

In August 1995, the directors of the nation's nuclear weapon laboratories consulted with the White House as the President formulated plans to seek a "zero yield" comprehensive test ban treaty. We told the President that our laboratories would step up to the challenge of maintaining the nation's nuclear deterrent under a comprehensive test ban, but that we could not guarantee success in such an endeavor. We individually and collectively had concerns as to whether we could adequately maintain the stockpile, since major uncertainties exist in our understanding of the physics of nuclear weapons.

The key question asked us was "What would it take to get you on-board?" One by one, the White House began advancing provisions to address our concerns. These grew to be the set of Safeguards now proposed and forwarded to you with the treaty. I want to be very clear that the lab directors did not "signup to a zero yield proposition" by itself but only in the context of these safeguards being essential ingredients.

On August 11, 1995, the President announced his decision to pursue a "zero yield" test ban, which would include "establishing concrete, specific safeguards that define the conditions under which the United States will enter into a comprehensive test ban." The safeguards are proposed to Congress as part of the ratification process and include the following commitments:

- **$** Supporting a program of science-based stockpile stewardship over the long term (Safeguard A)

- **$** Maintaining modern nuclear laboratory facilities (Safeguard B)

- **$** Maintaining the basic capability to resume nuclear testing if necessary (Safeguard C)

- **$** Continuing a comprehensive program of research and development in treaty monitoring

technology (Safeguard D)

- **$** Developing a broad range of intelligence gathering technologies for nuclear activities (Safeguard E)

- **$** Reserving the right to invoke the "supreme national interest" clause of the treaty to resume necessary testing if critical nuclear weapons could no longer be certified (Safearuard F)

The complete text of the President's six safeguards is included in his Letter of Transmittal accompanying the Comprehensive Nuclear Test-Ban Treaty sent to the Senate. It is reproduced in the appendix to this statement. But I want to focus briefly on some of them here:

- **$** The identification of a serious problem within weapons critical to our nation's deterrent would constitute a Supreme National Interest (Safeguard F.) This was the most important concession by far. We kept insisting that we could not be sure that sciencebased stockpile stewardship could mature in time to handle particular safety or reliability problems that might show up in the stockpile, leaving us powerless to solve these problems unless we could carry out nuclear tests. Somewhat to our dismay, the White House agreed that if such a situation arose, the President would agree to step back from the traducing the Supreme National Interest clause_in order to carry out whatever testing were necessary.

- **$** A new annual certification process for the weapons in the U.S. stockpile would be implemented to "ensure that our nuclear weapons remain safe and reliable under a comprehensive test ban." The presidential directive requires the Secretaries of Defense and Energy to prepare annually a joint certification report and letter to the President certifying the reliability and safety of the nuclear weapon types in stockpile. Important inputs to that report are letters from each of the nuclear weapon laboratories' directors. This process has now been implemented, and we have just completed the fourth annual certification. At Sandia our process is to thoroughly examine every aspect of each stockpile weapon system, reviewing all of the surveillance data, military returns and comments, and focus intently on any Significant Findings that have taken place. The annual certification report we make reflects somewhat less than a full report of this effort, its purpose being to report whether we have found any problems that, in our judgement, would require a nuclear test (or tests) to resolve or fix. Fortunately, in each of these past four years we have not yet encountered such a problem.

- **$** A set of safeguards would be adopted to assure a vigorous research and development program to address the shortcomings of Science-Based Stockpile Stewardship, the development of

better verification means, a greater emphasis on intelligence in nuclear development, and readiness of the Nevada Test Site to carry out tests should that become necessary.

As we have carried out our programs over the past four years since we negotiated these safeguards, although there has been more generous support of the nuclear weapons activities, there has been a multiplicity of worries in attempting to bring forward the program that we envisioned. One is as simple as having to deal with the large changeover in senior personnel at the Department of Energy. None of those who negotiated these safeguards with us, and the White House, is still in place; and there has never been the same level of "ownership" of these issues as there was on the part of those who negotiated them. (Perhaps it just human nature, that those who were not there will acquire different understandings of their import.) The bureaucracy that deals with budgets, from Departmental levels through the OMB, similarly has relaxed into more of a "business-as-usual" posture, and responds to our entreaties for the necessary budgets with the phrase "everyone needs more money." We emphasize how vital it is that the commitment enshrined in these safeguards be kept over the long term, because it is as the weapons age, and as more and more of the original designers retire, that the program will face its greatest challenges. It must not be shortchanged.

The safeguards do not now contain an explicit commitment to maintain a production infrastructure for nuclear weapons, and this is likely an error on our part. Regardless of how good the laboratories may be, stockpile stewardship will be impossible without a robust production capability. Replacement nuclear weapon components, structures, and subsystems will need to be manufactured as the stockpile ages. (The average ace of the weapons in the US stockpile today is higher than at any time in its 54-year history.) Althouch we are seeking to procure more of the nuclear weapon components we need from industrial sources, many technologies within weapons have no industrial counterpart and require specialized facilities operated solely for the purpose of manufacturing these components. Thus, not only will we need modern nuclear laboratory facilities, but we also will require modern production plants with close ties to industry and the laboratories. The lack of an explicit commitment to maintain the necessary manufacturing capabilities is an omission from the safeguards, which I hope Congress will address.

As discussed above, in the certification process the laboratories conduct reliability and safety investigations for each weapon type in the stockpile. In August of 1995 the laboratory directors and the White House also agreed that these annual certification reports, including any minority

reports, would be shared with the Congress as well. I would hope that you would also capture that agreement in law, since I believe it is vital that the Congress should be kept fully informed as

to the perceived state of health of the nation's most important strategic assets.

It is very important to understand that the statements I and the other laboratory directors made in 1995 regarding our ability to certify the stockpile were conditional on consistent adherence to the President's safeguards. Let me state emphatically that unless the United States places the hi-hest importance on maintaining these safeguards over time, the risks to our national security by the elimination of nuclear testing will become too high.

Bear in mind that laboratory directors of the future will be asked every year whether they can certify the reliability and safety of the stockpile. The certification process requires two major decisions on the part of laboratory directors: First, they must satisfy themselves that the scientists and engineers who are tasked to make technical judgments about the stockpile are capable of effectively doing so. And secondly, they must review and concur with the individual judgments made by staff regarding the condition of each weapon. If at some future time ScienceBased Stockpile Stewardship has not adequately progressed, and if laboratory competencies and facilities have been allowed to wither, I very much doubt that those future directors would be able to certify the stockpile. Making judgments today about future strategic consequences is perhaps the most difficult task you face in judging whether to ratify.

I am very concerned that these safeguards may not be vigorously sustained on a permanent basis. The President's certification directive for the sixth safeguard is a formal requirement that should ensure constant adherence to that item. However, the other five safeguards do not have a similar review process to ensure that they are consistently observed. As a condition of your consent to ratification, you may wish to institute your own periodic review and renewal of the complete set of safeguards and the processes for fulfilling them.

Lastly, I want to clarify that sometimes different voices within the current Administration have not been as careful in describing the support of the laboratory directors for the CTBT and the science-based stockpile stewardship program. Any statement that implies absolute support for these, without emphasizing how I in particular (although I believe my colleagues from the, other two labs also agree on this) tie this support to the successful fulfillment of the proposed safeguards, is incomplete and misleading.

Some advisors have asked me whether dependence on such proposed safeguards is sufficient insurance in a matter tied so directly to the nation's highest security. Indeed, the track record of the United States in long term support for safeguards has been dismal. The "readiness" safeguards that were put into being with the Limited Test Ban saw their budcet decline at a rate of about 50% per year once that treaty went into force. If such should happen here, it would be

disastrous. Yet the question of support is not nearly as keen today as it will be two to four administrations from now, as the weapons will be much older, the original designers will have

retired, and the need for scientific facilities and staff will be all the more urgent even than today. This will be a continuing great challenge for you and for the nation.

RECOMMENDATIONS

If the Senate decides to give its consent to the Comprehensive Nuclear Test-Ban Treaty, I would urge it to explicitly clarify certain issues in its ratification language:

1. **The President's six safeguards should be formalized.** A formal process should be established for monitoring the six safeguards that the President stated are the conditions under which the United States may enter into a comprehensive test ban. These safeguards will strengthen our commitments in the areas of stockpile stewardship, maintenance of our nuclear weapon competencies, test readiness, monitoring and verification, intelligence and analytical capabilities, and certification of stockpile reliability and safety. The safeguards should also be augmented with an explicit commitment to maintaining a robust manufacturing capability for unique nuclear weapon components and systems.

   Only one of the safeguards (the sixth) has a formal process in place for periodic review. The complete set of safeguards should be made subject to a formal process of periodic review, assessment, and renewal. Congress may wish to require, and be part of, such a formal process.

2. **Congress should be informed of any dissents in the certification process.** As I noted earlier, the President has established an annual reporting and certification requirement to ensure the reliability and safety of the stockpile under a comprehensive test ban. In the discussions among the White House, the Department of Energy, and the nuclear weapon laboratory directors just prior to the President's statement on August 11, 1995, the terms of reference for the annual certification procedure stipulated that any minority reports presented to the Secretaries of Energy and Defense would be shared with the Congress. Congress may wish to explicitly require that this be done.

   A certification disagreement would be an issue of grave importance and would involve the highest levels of information security protection. If serious enough, it would cause us to consider whether the nation's "supreme national interest" was at stake. Because of the great sensitivity of these and other safeguards issues, the Congress may wish to establish a means to vigilantly oversee the safeguards, as well as to monitor and consider any stockpile reliability and safety issues that may arise.

3. **The experimental activities we reaard as not prohibited by the treaty should be explicitly identified.** Currently, such activities include experiments in inertial confinement

fusion, fast-burst and pulse nuclear reactors, z-pinch and some pulsed-power research and facilities, other research into properties of chemical explosives and fissile materials, and all stockpile stewardship activities that do not involve actual nuclear explosions. Similar activities that may evolve as science progresses in the future should also not be prohibited by the Comprehensive Nuclear Test-Ban Treaty.

However, if we seek to establish the international delectability limit as the standard yield for permitted experiments, we should make it explicit that all parties to the treaty would abide by that limit. This would allow the United States to similarly carry out any experiments not prohibited_a position I would favor.

CONCLUSION

I appreciate this committee's interest in the impact of the Comprehensive Nuclear Test-Ban Treaty on the ability of the United States to maintain its nuclear arsenal and to verify compliance, issues, which I have addressed in this statement. I have endeavored to describe the technical issues associated with the treaty without prejudice to the merits of the treaty as national policy. The wisdom of endorsing the treaty as national policy is a question for you to decide. I suspect that the policy issues will be harder to evaluate than the technical issues.

Whether on balance the effect of a test ban to retard proliferation and further development of nuclear weapons is worth a similar penalty on the U.S. nuclear arsenal is the real crux of the dilemma. Reciprocity is one of the most difficult aspects of surrendering rights under a treaty. U.S. nuclear weapons have been an undeniable factor in preventing global war for many decades. Will constraining the further development of U.S. weapons, or more importantly, opening up the possibility that they may degrade without a means to prevent that loss (or perhaps to even know that degradation has taken place), be acceptable to us if other nations will be similarly constrained? This question is difficult enough even if we can assume fair observance of the treaty by all parties. However, it becomes significantly more worrisome if there is a likelihood that the treaty's constraints will be observed unequally: If the United States scrupulously restricts itself to zero yield while other nations may conduct experiments up to the threshold of international delectability, we will be at an intolerable disadvantage. I would advise against accepting limitations that permit such asymmetry.

The Science-Based Stockpile Stewardship program_though essential for continual certification of the stockpile does not today provide a guarantee of perpetual certifiability. On the other hand, even if Science-Based Stockpile Stewardship is successful beyond our

expectations, it may disclose flaws that would lead future laboratory directors to refuse to certify a particular nuclear weapon system. Consequently, it is very important that Congress consider the

impact of a failure to certify critical nuclear weapon systems at some point in the future. It is necessary to establish directives now for dealina, with that eventuality, because the possibility that such an event will occur is quite real, particularly as decades pass.

It is vitally important that the United States remain vigilant and competent in nuclear weapon science and technology. To a large extent, the prospects for peace and stability of most of the world are underpinned by that assurance. It is also important that U.S. actions in managing its nuclear weapons program support an effective nonproliferation policy. You must form a judgement whether the Comprehensive Nuclear Test-Ban Treaty will serve to enhance, or to diminish, national and global security.

APPENDIX

The President's Comprehensive Test Ban Treaty Safeguards

- **$** The conduct of a Science Based Stockpile Stewardship program to insure a high level of confidence in the safety and reliability of nuclear weapons in the active stockpile, including the conduct of a broad range of effective and continuing experimental programs.

- **$** The maintenance of modern nuclear laboratory facilities and programs in theoretical and exploratory nuclear technology which will attract, retain, and ensure the continued application of our human scientific resources to those programs on which continued progress in nuclear technology depends.

- **$** The maintenance of the basic capability to resume nuclear test activities prohibited by the CTBT should the United States cease to be bound to adhere to this treaty.

- **$** Continuation of a comprehensive research and development program to improve our treaty monitoring capabilities and operations.

- **$** The continuing development of a broad range of intelligence gathering and analytical capabilities and operations to ensure accurate and comprehensive information on worldwide nuclear arsenals, nuclear weapons development programs, and related nuclear programs.

- **$** The understanding that if the President of the United States is informed by the Secretary of Defense and the Secretary of Energy (DOE)_advised by the Nuclear Weapons Council, the Directors of DOE's nuclear weapons laboratories and the Commander of the U.S. Strategic Command_that a high level of confidence in the safety or reliability of a nuclear weapon type which the two Secretaries consider to be critical to our nuclear deterrent could no loncer be certified, the President, in consultation with Congress, would be prepared to withdraw from the CTBT under the standard "supreme national interests" clause in order to conduct whatever testing might be required.

With regard to the last safeguard:

- **$** The U.S. regards continued high confidence in the safety and reliability of its nuclear weapons stockpile as a matter affecting the supreme interests of the country and will regard

any events calling that confidence into question as "extraordinary events related to the subject matter of the treaty." It will exercise its rights under the "supreme national interests" clause if it judges that the safety or reliability of its nuclear weapons stockpile cannot be assured with the necessary high degree of confidence without nuclear testing.

- To implement that commitment, the Secretaries of Defense and Energy_advised by the Nuclear Weapons Council or NWC (comprising representatives of DoD, JCS, and DOE), the Directors of DOE's nuclear weapons laboratories and the Commander of the U.S. Strategic Command_will annually report to the President whether they can certify that the nation's nuclear weapons stockpile and all critical elements thereof are, to a high degree of confidence, safe and reliable, and, if they cannot do so, whether, in their opinion and that of the NWC, testing is necessary to assure, with a high degree of confidence, the adequacy of corrective measures to assure the safety and reliability of the stockpile, or elements thereof. The Secretaries will state the reasons for their conclusions, and the views of the NWC, reporting any minority views.

- After receiving the Secretaries' certification and accompanying report, including NWC and minority views, the President will provide them to the appropriate committees of the Congress, together with a report on the actions he has taken in light of them.

- If the President is advised, by the above procedure, that a high level of confidence in the safety or reliability of a nuclear weapon type critical to the nation's nuclear deterrent could no longer be certified without nuclear testing or that nuclear testing is necessary to assure the adequacy of corrective measures, the President will be prepared to exercise our "supreme national interests" rights under the Treaty, in order to conduct such testing.

- The procedure for such annual certification by the Secretaries, and for advice to them by the NWC, U.S. Strategic Command and the DOE nuclear weapon laboratories will be embodied in domestic law.