



***VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT
AND SPECIAL NUCLEAR MATERIAL CONTROLS***

A Report to Congress

by

**The Technical Advisory Committee on
Verification of Fissile Material and Nuclear Warhead Controls**

**under the auspices of
The United States Department of Energy**

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VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

The FY-1991 Defense Authorization Act (Section 3151) required the President to establish a Technical Advisory Committee in order to prepare "a comprehensive technical report:"

- **To examine onsite monitoring techniques, inspection arrangements, and NTM that could be used to verify**
 - **Dismantlement agreements with the Soviet Union**
 - **Mutual US-Soviet ban on Pu and HEU for nuclear weapons**
 - **End-use or disposal of SNM recovered from dismantled warheads**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

REPORT PROCESS

- **President Bush delegated his responsibility under the Act to the Secretary of Energy in April 1991**
- **Advisory Committee seated May 1991**
- **DOE OACN technical staff had begun working issues much earlier**
- **Report delivered to the National Security Council staff July 1, 1991**
- **Interagency review process resulted in Presidential transmittal letter stating overarching policy in October 1991**



**VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT
AND SPECIAL NUCLEAR MATERIAL CONTROLS**

**TECHNICAL ADVISORY COMMITTEE
ON
VERIFICATION OF FISSILE MATERIAL AND NUCLEAR WARHEAD CONTROLS**

**Ambassador C. Paul Robinson
(Chairman)**

**Vice President, Sandia National Laboratories
past Head, U.S. Delegation of the NTT**

Frank Baranowski

past Director of Nuclear Fuel Cycle, ERDA

Ronald Ewing

Chairman, MASINT Committee, IC Staff

Dr. Harry Groh

formerly of Savannah River Plant

Dr. Ted Gold

Sr. Vice President, Hicks and Associates

Dwight Heffelbower

President, Mason & Hanger Corporation

John Meinhardt

**Sandia National Laboratories
past Acting Assistant Secretary for Defense Programs**

Professor Wolfgang Panofsky

**Assistant Director, Stanford Linear Accelerator
Chairman, NAS Committee on Arms Control**

Paul Vanstrum

Past President, Union Carbide Nuclear Division



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

TIME FRAME

- **Report probably requested to help structure the debate in strategic weapons arms control after START, to deal directly with the nuclear weapons themselves (not by attribution in association with delivery vehicles)**
- **Undertaken in the final days of the Cold War environment**
- **Predated the Iraqi revelations**
- **Transmitted to Congress by President Bush shortly after his Nuclear Initiative (of 9/27/91)**
 - **the President's Nuclear Initiative (PNI) took us out of a "verification" environment into one of "transparency"**

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release

October 7, 1991

TEXT OF A LETTER FROM
THE PRESIDENT TO THE SPEAKER OF
THE HOUSE OF REPRESENTATIVES AND
THE PRESIDENT OF THE SENATE

October 7, 1991

Dear Mr. Speaker:

(Dear Mr. President:)

I am transmitting with this letter a report to the Congress: Verification of Nuclear Warhead Dismantlement and Special Nuclear Material Controls as required by section 3151 of the National Defense Authorization Act for Fiscal Year 1991. The report reflects the views of a Technical Advisory Committee On the subject defined by Congress: on-site monitoring techniques, inspection arrangements, and national technical means that might be useful to verify the dismantlement of nuclear warheads, a ban on the production of plutonium and highly enriched uranium for nuclear weapons, and the disposition of these materials recovered from dismantled nuclear warheads.

A distinguished panel of Government and nongovernment technical experts was assembled, according to Federal Advisory Committee Act guidelines, to serve as the Technical Advisory Committee under the requirements of the Act. They have summarized their findings in the unclassified Executive Summary, and approve the material presented in the classified full report, initially prepared by the Department of Energy. The Technical Advisory Committee had full independence in expressing their expert opinions on these matters. The Committee was chaired by Ambassador C. Paul Robinson who served as the U.S. Ambassador to the Nuclear Testing Talks.

The mandate to the Committee in the legislation was challenging. It is difficult and potentially misleading to evaluate verification issues in isolation from the details of a potential agreement. Since there are no such agreements drafted, the adequacy of the verification measures could only be discussed in broad and general terms. That said, the report makes clear the difficulties and risks involved. As the Advisory Committee reports, the United States could not effectively verify the number of existing warheads or the amount of special nuclear material currently on hand. We likewise could not have high confidence in discovering clandestine warhead or special nuclear material stockpiles. In addition, the report notes the extreme difficulty of monitoring the many potential paths in which nuclear warheads or special nuclear material could be produced.

The Committee charter was limited to the assessment of technical verification arrangements and techniques, and therefore their report does not address the broader national security implications of the possible outcomes defined in the legislation. The Committee was in unanimous agreement, however, that for any controls regarding warhead demilitarization or special nuclear material production, maintenance of an effective and modern nuclear deterrent must not be compromised.

Sincerely,

GEORGE BUSH



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

CONTEXT

- **Report addressed technical issues of verification, not overall policy**

Note: Found to be very difficult to treat verification without

- **precise knowledge of provisions to be verified, including the military context and national security risks**
- **Verification effectiveness is just one factor in that policy assessment**
- **Overarching question was and remains whether agreements would support US national security**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

CONTEXT (cont'd)

- **Verification goes beyond monitoring, inspection, and NTM**
 - **Includes other non-technical intelligence information, as well as political judgement**
- **All potential production and assembly routes plus the effectiveness of our ability to verify activities must be addressed when making assessments of national security issues**
- **Agreements on dismantlement and SNM controls should be viewed as supplements to limits on warheads or delivery vehicles**
- **There are significant asymmetries between US and Soviet production and operations infrastructures**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

WARHEAD AND SNM OBSERVABLES

- **Many observables are technically useful for onsite inspection activities, but use would reveal restricted data/sensitive information**
 - **Radiation emissions (neutron and gamma-ray) most useful**
 - **Others (shape, weight, center-of-gravity) of little value**
 - **Active interrogation of treaty-limited items would likely be required for some tasks**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

INSPECTION ARRANGEMENTS

General Conclusions

- Efficacy of onsite monitoring *highly* dependent upon negotiated implementation arrangements
- Specific treaty provisions should be negotiated only with adequate knowledge of the limitations of chosen inspection and monitoring techniques
- Techniques provided and employed by inspected party unacceptable for verification
- Random sampling could help reduce implementation costs and intelligence gathering

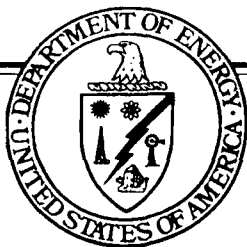


VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

NATIONAL TECHNICAL MEANS

General Conclusions

- **Warhead dismantlement and material production signatures and observables are of limited value for detection and monitoring by national technical means (NTM)**
- **NTM cannot be relied upon to detect clandestine weapon sites or SNM production**
- **NTM may have use in monitoring shut-down declared facilities**
- **Prospects for developing NTM detection and identification methods for clandestine sites is low**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

VERIFICATION OF WARHEAD DISMANTLEMENT

- **Technically speaking, verified dismantlement could be accomplished with high confidence, but not without risks to sensitive information**
- **Initialization is difficult/impossible, because of**
 - **ease of concealment of warheads**
 - **lack of useful observables**
- **It might be possible to develop techniques for warhead identification that reduce the risk of information disclosure**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

VERIFICATION OF WARHEAD DISMANTLEMENT (cont'd)

- **Chain-of-custody and portal-perimeter monitoring arrangements offer verification with less intrusiveness than radiation emission measurements**
- **Separating new warhead production functions from dismantlement functions may require:**
 - **modified or dedicated facilities**
 - **new processes or procedures for carrying out dismantlement in on-site inspection (OSI) regimes**
- **Verified destruction of non-nuclear parts has little arms control significance**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

VERIFICATION OF SNM PRODUCTION CONTROLS/CUTOFF

- **Initialization is difficult/impossible**
- **Decreasing stockpiles in future makes uncertainties in SNM stockpiles even more important**
- **Soviet integrated civilian/military complex complicates initialization of SNM inventories for weapons**
- **Verifying limits on SNM production requires monitoring appropriate elements of the civilian fuel cycle**
- **Tritium production reactors and all SNM production and use would have to be monitored**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

VERIFICATION OF SNM PRODUCTION CONTROLS/CUTOFF (cont'd)

- **Detecting and identifying production from clandestine enrichment plants is very difficult**
- **Detection of reactors less difficult, but cannot be ensured**
- **New technologies may open up significant new opportunities for SNM production with minimal observables**
- **Possible benefits of monitoring SNM and related facilities**
 - **Opportunities for onsite presence at more Soviet facilities**
 - **Strengthening of commitments to the Nonproliferation Treaty (NPT)**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

VERIFICATION OF SNM DISPOSITION

- Most disposition options are reversible at some cost
- Blending HEU reduces weapon utility of material, but offers some additional opportunity for diversion
- Weapon utility of Pu can be reduced by denaturing
 - Denatured Pu can be purified chemically at lower cost of production than new Pu
- Long-term storage an option
 - Form and location of materials a critical factor
 - "full-up" weapons systems or intact components easily returned to stockpile to facilitate breakout
- Returning SNM to non-weapons programs brings other programs under monitoring requirements and enlarges monitoring tasks



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

MULTILATERAL CONSIDERATIONS

- **Allowed margins of error in determining the size and disposition of a stockpile depend on**
 - **Specific treaties involved**
 - **Whether parties have weapons programs**
- **US NPT obligations must be considered**
 - **Members of proliferant or non-proliferant states may be involved inspecting US facilities**
- **Potential positive impacts include reinforcement of international perception of NPT Parties' intent to abide by Article VI**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

TAC SUMMARY DISCUSSION

- **Technical Advisory Committee fulfilled its instructions, stating that:**
 - **the report described the state of the art for technical verification in the subject areas**
 - **they would not be surprised if both the liberal and conservative arms control constituencies find fault with the report: it neither advocates dismantlement and SNM controls nor does it reject them**
 - **however, even without specific provisions, it seems clear that the monitoring and identifying of SNM initial inventories and subsequent clandestine production of SNM would be difficult, if not impossible**
 - **limiting some routes by which an adversary can manufacture nuclear weapons, but not successfully addressing all potential paths, is not a sound basis for agreements that are to improve national security**
 - **honest, hard attention should be paid to the fundamental issue of the degree of risk that would exist under intrusive inspections of warheads**
 - **the assigned issue becomes more complicated, rather than less, when the potential for redesign and remanufacture of existing warhead stockpiles is taken into account**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

RELEVANCE TODAY

Question: What, if any, relevance do the findings in the Report to Congress have in today's world?

- It would be presumptuous and probably misleading to say that the President and the NSC used the technical assessments in developing the U.S. policy which ultimately led to the Nuclear Initiative

However:

- The virtual impossibility of accurately determining and capturing all previous Soviet weapons and materials within a treaty agreement was likely one factor leading to the PNI



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

RELEVANCE TODAY (Cont'd)

- **The difficulty in applying inspection procedures and instruments so as not to reveal restricted data and other sensitive information was noted throughout the report, and was likely another consideration leading to the PNI**
- **Conventional wisdom regarding efficacy of NTM in detecting and monitoring clandestine weapons development/production activities likely shifted to that offered in the report, away from the previous public sector assumptions of ubiquity**
- **Specific measurement and inspection methods described all have relevance in today's world for bilateral safeguards to effect transparency**
 - **arms control objectives would be easier to meet under a transparency regime, however**



VERIFICATION OF NUCLEAR WARHEAD DISMANTLEMENT AND SPECIAL NUCLEAR MATERIAL CONTROLS

RELEVANCE TODAY (Cont'd)

- **The application of measurement technologies to help effect "transparent" warhead dismantlement and SNM controls under such provisions as The Soviet Nuclear Threat Reduction Act (SNTRA) will be closely weighed against real benefit, and thus technology will likely be used only sparingly**

When one considers the fundamental finding of the 3151 Report -- that of the extreme difficulty (nay, impossibility) of confidently capturing large weapon state production activities under a technical verification regime -- coupled to the real world situation of the end of the communist era in the Former Soviet Union, then the real value of the more pragmatic and expeditious approach to nuclear disarmament under the President's Nuclear Initiative can be readily seen