ABSTRACT

During the January 1994 Summit Presidents Clinton and Yeltsin agreed on the goal of ensuring the “transparency and irreversibility” of the nuclear arms reduction process. As a result, negotiations are presently underway between the United States Government and the Russian Federation to confirm the stockpiles of plutonium and highly enriched uranium removed from nuclear weapons. In December 1994 the United States presented a paper to the Russian Federation proposing additional measures to provide broader transparency of nuclear arms reduction. The U.S. Department of Energy is studying the implementation of these broader transparency measures at appropriate DOE facilities. The results of the studies include draft protocols for implementation, assessments of the implementation procedures and the impacts on the facilities and estimates of the cost to implement these measures at various facilities.

INTRODUCTION

BACKGROUND During the January 1994 Summit Presidents Clinton and Yeltsin agreed on a goal of ensuring the “transparency and irreversibility” of the nuclear arms reduction process. The following March the United States and Russia agreed to host reciprocal inspections to confirm the stockpiles of plutonium and highly enriched uranium (HEU) removed from nuclear weapons. In May negotiations to establish the framework for mutual reciprocal inspections (MRI) began. These negotiations have been successful in that significant progress is being made toward implementation of MRI.

In order to expand the transparency effort beyond stockpiles of plutonium and HEU removed from nuclear warheads, in December 1994 the United States proposed additional measures to provide broader transparency and irreversibility of nuclear arms reductions. The U.S. proposal includes five specific measures, including MRI, which would be carried out on a reciprocal basis by the parties. It is envisioned that the mutual understanding of nuclear weapons dismantlement and fissile material practices fostered by these measures could become the cornerstone of future nonproliferation cooperation.

In the above paper, the United States stated the belief that an initial bilateral transparency and irreversibility regime should specifically include:

- Reciprocal exchanges of detailed information on aggregate stockpiles of nuclear warheads, stocks of fissile materials, and on their safety and security;
- A commitment by each side never to use material declared excess to military needs in weapons;
- Mutual reciprocal inspections to confirm the stockpiles of HEU and plutonium removed from nuclear weapons to confirm that dismantlement is occurring and that stockpiles declared to be excess are not being returned to weapons;
- A cooperative arrangement to monitor warheads declared excess and awaiting dismantlement, to further confirm the dismantlement of these nuclear weapons; and
- Cooperative measures to confirm and clarify our reciprocal declarations of fissile material stockpiles, including limited spot-checks at fissile material sites (excluding plutonium and HEU in weapons and HEU fabricated into naval fuel or located within naval fuel fabrication facilities), and...
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exchanges of fissile material production records, with visits to the production sites.

CURRENT NEGOTIATIONS Following the presentation of the U.S. paper to the Russian officials, the sides have agreed to focus energies on establishing an agreement for cooperation allowing the exchange of Restricted Data. Specifically, the Agreement for Cooperation authorizes the U.S. and Russia to exchange classified and sensitive information pertaining to:

Information on aggregate stockpiles of nuclear warheads, or stocks of fissile materials and their safety and security;

Information derived from or to facilitate reciprocal monitoring at storage facilities of fissile materials removed from nuclear warheads and declared to be excess to national security requirements; and

Information to facilitate the monitoring compliance with the June 23, 1994, agreement concerning the shutdown of plutonium production reactors and the cessation of the use of newly produced plutonium in nuclear warheads.

Negotiations on an Agreement for Cooperation are underway and hopefully can be complete by the end of 1995. Once this agreement is concluded, the administrative path would be cleared for negotiation of these transparency elements.

The U.S. has thus far established a step-by-step approach to implementing this transparency regime and drafting discrete agreements for each element. MRI negotiations are underway and a draft Stockpile Data Exchange Agreement was presented to the Russians in June 1995. The work presented here, once complete, could constitute the substance of future agreements for dismantlement activities.

TRANSPARENCY STUDY GROUP The Negotiations and Analysis Division of the Department of Energy’s Office of Arms Control and Nonproliferation set up a study group to develop and evaluate ways by which DOE and its various facilities and laboratories could implement the above transparency measures. The study group developed potential procedures and protocols and estimated the costs and impacts of implementation at a DOE facility. The purpose of the study was to provide information that could be used in choosing the particular implementation methods for the transparency measures.

The participating organizations in the study represented the nuclear weapons laboratories, the facilities associated with the production of fissile materials or fissile material components, and the facility for the assembly and disassembly of nuclear weapons.

 POTENTIAL IMPLEMENTATION OF TRANSPARENCY MEASURES

The implementation procedures considered for the various transparency measures were developed using the following general criteria:

- Procedures that could be implemented by DOE facilities to provide transparency to the U.S. dismantlement process;

- Procedures that would be of reciprocal value in confirming the dismantlement of nuclear weapons and the securing of the resulting excess fissile materials; and

- Procedures that are practical in terms of operational impacts and overall costs of implementation.

DECLARATIONS Declarations establish the foundation for any transparency regime. The Transparency Study Group is recommending a graded approach to declarations. This graded approach is meant to ensure the integrity of data as the transparency regime moves from a broad national inventory, the first level of detail, to the more detailed site inventory and finally specific inventories for areas within a site.

For the national data exchange, DOE could possibly rely on the Nuclear Materials Management and Safeguards System (NMMSS) to provide the information of total quantities of materials. The study group is working with Defense Programs to agree on inventory codes and definitions that ensure that the NMMSS data accurately represents the inventory.

The Transparency Study Group assumed that stockpile data would be confirmed on a site-by-site basis. If a side requests to confirm the stockpile data, information at the two, more detailed, levels would be required. At the second level a site would provide data on inventories (type, form, and quantity) by material balance area (MBA), or other convenient basis. That information would be transmitted to the confirming side, who could then select a limited number of MBA’s for detailed spot-checks. At that point, the visited site would provide an item-by-item inventory for the specific MBA’s. The side could then use an agreed sampling plan for confirming such data.
IRREVERSIBILITY COMMITMENTS

The irreversibility commitment, as envisioned by the U.S. Government, would be a wholly political commitment, requiring no special implementation activities on the part of DOE facilities. This commitment, however, does establish the political intent of the other parts of the transparency regime. For instance, the goal of spot checks of the weapons components declared to be excess would be to ensure that they are not again used in a nuclear weapon.

MUTUAL RECIPROCAL INSPECTIONS

Since this measure is already being negotiated between the U.S. and Russia it was not considered in the activities considered by the Transparency Study Group. A brief summary of the MRI activities is included for completeness.

In March of 1994, in a joint statement by Secretary O’Leary and Minister Mikhailov, the United States and Russia agreed to host reciprocal inspections to confirm the stockpiles of plutonium and HEU removed from nuclear warheads. In May negotiations to establish the framework for MRI for plutonium components from dismantled warheads were begun. Since that time the American and Russian delegations have exchanged visits to storage facilities in the two countries and observed each other’s demonstrations of detector hardware proposed for the confirmatory measurements. U.S. and Russian technical experts have held several consulting sessions to further define measurement techniques and joint U.S./Russian experiments on unclassified plutonium pieces was held at Livermore on November of 1994. However, the technical experts have been unable to arrive at measurement schemes that give adequate confidence that the measured item is indeed a component, without revealing classified or sensitive information. As a result the U.S. and Russia are currently negotiating an Agreement for Cooperation allowing the exchange of classified or sensitive information during the measurements. A solution to this problem is one of the main goals of consultations scheduled for June, 1995. At this time the U.S. policy community is still formulating its views on how to extend the MRI regime to HEU.

COOPERATIVE MEASURES TO CONFIRM DECLARATIONS

Confirmation of declarations will generally fall into two categories. The first being the confirmation of fissile material declarations including excess warheads, fissile material components, and other fissile materials as determined by the declarations. The second category is the confirmation of the past and present production of plutonium and HEU. Implementation of measures to confirm declarations would be cooperative, reciprocal visits to sites with spot-check inspections (SCI) of declared materials and/or activities. The objective of SCI is for each side to have increased confidence that the declarations made by each side are correct and that the goals of transparency and irreversibility are being met.

It is anticipated that the inventory of all fissile material and past or present fissile material production activities will be declared. Thus, it is possible that a large number of DOE facilities could be subject to SCI. Those facilities which possess excess material from dismantled weapons would also be subject to the MRI procedures currently being negotiated. It is anticipated that facilities possessing small quantities of fissile material will not be likely candidates for SCI and that certain waste, scrap, and residue will be excluded from SCI. Also, certain materials may be excluded from SCI while they are at specific locations or undergoing specific operations in order to protect sensitive information.
RESULTS OF STUDIES

DRAFT PROTOCOLS One of the tasks given to the Transparency Study Group was to develop draft protocols for the proposed transparency measures. The U.S. and Russia are already negotiating Mutual Reciprocal Inspections and thus the implementation procedures and the protocol for this measure is being developed. The Transparency Study Group developed implementation procedures and draft protocols and made assessments for the other measures as appropriate. Subgroups made up of representatives from those DOE facilities most likely to be affected by these additional transparency measures were assigned to work on each of these protocols. Three draft protocols have been developed relating to the following transparency measures:

- Declarations;
- Limited chain of custody; and
- Spot-checks to confirm declarations.

A special report is also being prepared that deals with the unique problems associated with the declaration and confirmation of fissile material production. Production will be declared by year and material type consistent with stockpile information. Spot-checks on past production (if possible) will be performed. Specific spot-check technologies have not been identified for some production methods. Spot-checks will probably require access to production records of all types (i.e.: power usage, material movements, and final shipments). Forensic verification of these records should be allowed and environmental sample may also be of use. The spot-check technologies used will favor those techniques which provide an independent indicator of production histories. Specific protocols and spot-check techniques have not been defined.

While each of the draft protocols and assessments varied because of the different nature of the transparency measure they all addressed the following general areas: goal, assumptions, possible options, costs, impacts, and recommendations. The implementation procedures and the impact on operations and the implementation costs were of particular importance to the various DOE facilities. A brief summary of each is given in the following two sections.

IMPLEMENTATION PROCEEDURES AND IMPACTS As expected the impact of a transparency measure on a facility is proportional to the relative intrusiveness of the measure. Declarations were perceived as having minimal impact on the operation of a facility and spot checks to confirm the various declarations could potentially have the greatest impact because of the large number of areas within the facility that could be subject to inspection.

Declarations This would be required of all DOE facilities that handle fissile material, warhead components, and/or warheads. However the impact would in all likelihood be minimal. The major impact on operations would result from the necessity to provide personnel to prepare the data for the various declarations. Also, there was concern about the degree and accuracy required and amount of effort that may be necessary to verify the accuracy of the declarations. Confirmation by one party of the declarations of the other party would be accomplished through the process of spot-checks at the various facilities.

Limited Chain of Custody LCC for warheads that have been declared excess and the fissile material removed from them would presently only affect two DOE facilities: the Pantex plant in Amarillo, Texas, where warheads are dismantled and the pits from dismantled warheads are stored and the Y-12 Plant in Oak Ridge, Tennessee, where the secondaries from dismantled warheads are stored and reprocessed. In general it is thought that the LCC would employ information management systems already available to provide summations of pertinent data about the shipment, dismantlement, storage, and reprocessing of excess warheads and materials. The impact of implementation of LCC, like declarations, would be that of providing personnel to perform additional record keeping and document preparation. Also, like declarations, confirmation of the LCC would be accomplished by spot-checks at the facilities.

Spot-Checks to Confirm Declarations Implementation of spot-checks could be very similar to the implementation of mutual reciprocal inspections presently being negotiated. MRI as being negotiated is restricted to excess fissile material removed from dismantled warheads and would thus be restricted to Pantex and Y-12 and then only allowed in those areas which contained the appropriate materials. However, spot-checks will be much broader in scope in that they could be used to confirm all declarations of fissile material inventories and production as well as limited chain of custody. Any DOE facility with declared material would be subject to spot-checks. The impact of implementing spot-checks will be at least as great as MRI and very likely greater. Some major impacts would be:

- Additional security during inspection;
- Loss of facility security information;
- Operator and inspector exposure to radiation;
- Additional record keeping to document spot-checks;
- Reconfiguration of storage facilities to separate out critical materials and operations;
- Major delays in meeting operational and production objectives;
- Monetary penalties for delays of contractor work in inspection areas; and
- Effort required to prepare for a potential spot-check.

COSTS As part of the Transparency Study Group activities each laboratory or facility was asked to estimate the costs of preparing for and implementing any transparency measures that would be applicable to that facility. These estimates were based on the initial proposals for implementation procedures and as a result they were very preliminary. It was evident from the first estimates of costs that accurate estimates will depend on careful definition of the exact preparation and implementation activities.

In terms of costs the transparency measures fall into two markedly different categories. Declarations of inventories and limited chain of custody for excess warheads which consist mainly of compiling and reporting already existing data were estimated by the majority of the facilities as requiring minimal cost, less that $100,000 per year. One facility estimated much higher, but the reason may have been a misinterpretation of what effort was going to required.

The other category of transparency measures relate to mutual reciprocal inspections and spot-checks to confirm declared inventories. These are very similar in that they both require preparing for and hosting inspections. Generally, facilities which would be subject to both measures, estimated the costs of these two activities to be nearly the same. However, the variation in estimated costs from facility to facility was much greater than in the case of declarations and LCC. The greatest variations were in the estimates of costs to prepare for spot-checks. The estimated costs for preparation ranged from less than $100,000 to over $3 million. The estimated costs for hosting a visit ranged from $10,000 to over $300,000. Again, these variation are the result the facilities not knowing exactly what is required in preparing for and hosting spot-checks or MRI. It will probably take several iterations of operational requirements and cost estimates to have confidence in the estimated costs of the various transparency measures.

NEXT STEPS With high-level U.S. and Russian attention focused on negotiations for an Agreement for Cooperation, now is the time for DOE to give as much thought as possible to broader transparency measures. The following activities are of particular importance:

- The Transparency Study Group will summarize its initial findings and circulate them to DOE program offices for detailed review;
- The DOE and the U.S. interagency at-large are very concerned with the costs of such a regime. To ensure that these procedures and costs are adequately defined, the Transparency Study Group should iterate on a regular basis with the facilities, field offices, and program offices; and
- Finally, the Transparency Study Group should continue to work to find lower impact methods of meeting U.S. nuclear arms reduction transparency goals.

SUMMARY

The United States has proposed to the Russians a broader transparency and irreversibility regime for the nuclear arms reduction process. A DOE sponsored Transparency Study Group is developing and assessing procedures and protocols for effectively implementing the measures of the proposed regime at the appropriate U.S. nuclear weapons facilities. The preliminary assessment is that certain, relatively unintrusive, measures such as declarations of stockpiles of warheads and fissile materials and limited chain of custody for excess warheads awaiting dismantlement could be accomplished without significant operational impact or costs. The implementation of measures such as mutual reciprocal inspections to confirm the inventory of fissile material removed from dismantled warheads and spot-check inspections to confirm declarations of warhead stockpiles, fissile material inventories, and fissile material production could be very intrusive. These intrusive measures could result in significant operational impact and cost. The initial procedures and protocols for the transparency measures and the estimates of operational impacts and cost need to be refined and iterated in order to demonstrate with reasonable confidence that warheads are being dismantled with minimum operational impact and cost.

REFERENCES