Preparatory Committee for the 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons

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Implementing the action plan of the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, in particular action 61: second International Symposium on the Minimization of Highly Enriched Uranium

Working paper submitted by Austria and Norway

From 23 to 25 January 2012, Austria, Norway and the Nuclear Threat Initiative co-hosted the second International Symposium on the Minimization of Highly Enriched Uranium in Vienna in cooperation with the International Atomic Energy Agency (IAEA). With a view to implementing the action plan of the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, the summary of the Symposium is submitted for information and consideration by States parties.

Symposium summary

Building on the results of the first Symposium, held in Oslo in 2006, the Vienna Symposium revisited the issue of minimization of highly enriched uranium and reviewed the progress made and scope of efforts to date, as well as remaining challenges and possible new measures to address them. Support for minimization of highly enriched uranium in the civilian sector is growing — this has been reflected at the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons and the 2010 Nuclear Security Summit. The Symposium focused attention on minimization of highly enriched uranium in the civilian nuclear complex around the world, provided realistic policy discussion and elaboration, and facilitated a dialogue about national and international efforts to minimize and eventually eliminate the use of highly enriched uranium in the civilian sector.

Ambassador Jan Petersen of Norway opened the Symposium by emphasizing the objective of minimizing highly enriched uranium in the overall context of creating a safer world free from nuclear weapons. While recognizing that nearly all the highly enriched uranium in the world is for military use, the quantities in civilian use are still sufficient to constitute a considerable threat should they be acquired or re-directed for non-peaceful purposes. The minimization of highly enriched uranium is important as a non-proliferation concern, to advance international cooperation on the peaceful uses of nuclear energy and to support nuclear disarmament. Therefore, IAEA plays an essential role in verification and promoting accountability, safety and security of peaceful applications of nuclear technology globally.

Following the speech by Mr. Petersen, the following topics were discussed in six panels:

- Operating facilities fuelled by highly enriched uranium and remaining challenges
- Minimization successes: technical, political and economic drivers
- Minimization challenges in the United States of America and the Russian Federation: political, technical and economic issues
- Global minimization challenges: political, technical and economic issues
- International cooperative efforts: Governments, industry and international organizations
- High-level policy views on minimization of highly enriched uranium

Summary of Symposium discussions

The use of highly enriched uranium for a host of civilian and military purposes poses real safety and security risks, and time is not on our side. Large amounts of highly enriched uranium for civilian and military purposes exist in many countries. The bulk of this highly enriched uranium is located in the United States and the Russian Federation, although significant stockpiles are also found in many other States. Great progress in the minimization of highly enriched uranium stocks and utilization has been achieved in the past decade, including the conversion of reactors fuelled by highly enriched uranium to low enriched uranium, cooperative efforts such as the United States-Russian Federation highly enriched uranium blend-down programme (megatons to megawatts) and material conversion and consolidation programme have achieved important successes. However, many challenges remain.

Considerable attention was given to the use of highly enriched uranium in research facilities, propulsion vessels and in stocks, both in the civilian and military (non-explosive) areas. There was overall agreement that there were more than 100 remaining facilities fuelled by highly enriched uranium globally and that hundreds of kilograms of highly enriched uranium were used annually in civilian facilities. Other fuel cycle activities that involve highly enriched uranium at additional sites and locations, such as fuel manufacturing, transport and waste handling, represent an important additional challenge.

One of these key challenges is to fully understand the scope of the problem. This can be improved through transparency. There is no mandatory transparency regime or regular public declaration regarding civilian highly enriched uranium stockpiles, although all non-nuclear weapon States provide confidential reporting under their IAEA safeguards agreements. France, Germany and the United Kingdom of Great Britain and Northern Ireland provide declarations on civilian highly enriched uranium holdings for publication by IAEA as an addendum to their voluntary civilian plutonium declaration. Until there is a norm for increasing transparency of civilian highly enriched uranium holdings, voluntary declarations by all States with highly enriched uranium should be encouraged. One additional challenge with regard to transparency is how to include military non-explosive stockpiles. It may be advisable to include in declarations on highly enriched uranium the inventories of material resulting from nuclear disarmament, material declared in excess of defence needs and material in active and reserve stockpiles for military, naval propulsion.

Another challenge is determining the right balance between removal of highly enriched uranium and increasing security for material in place. While conversion and removal activities can create increased security risks through changes in material forms and transport requirements, these must be weighed on a case-by-case basis against the longer-term risk reductions generated by the consolidation and elimination of such material. Efforts to remove, eliminate or consolidate holdings of highly enriched uranium should be carried out in a manner that provides the highest level of security for this material, including during its transport.

There have been great successes — even breakthroughs — in minimization of highly enriched uranium in the last five years. Many research reactor facilities, including those in Romania and Uzbekistan have successfully moved to low enriched uranium cores with the active financial and technical support of programmes in the United States and the Russian Federation. These cases reflect the important foundational elements of a successful research reactor conversion effort: effective legal and regulatory frameworks, active support and positive decision-making of the Government and facility operator, international cooperation, qualified national and international experts to manage the process and the assistance of IAEA. It is important to remember that reactor conversion and fuel removal efforts often span multiple administrations. Therefore, a deliberate campaign to build a broad constituency of support, including in the public through the media, can be important.

There has been significant progress on conversion of molybdenum-99 production processes as well. All major commercial suppliers have made the political commitment to convert their facilities and processes to use low enriched uranium before 2015, and Australia (through a technology partnership with Argentina) has led the way in developing the capacity to become a commercial producer of low enriched uranium-based molybdenum-99. It is advisable to convert current uranium fission-based processes from highly enriched uranium to low enriched uranium using variations of existing technologies while new approaches, such as neutron activation and solution reactors, are developed and assessed for their potential.

The economics are not yet clear regarding conversion decisions, and this is due in part to the lack of real cost recovery in past molybdenum-99 production activities. In order to make educated decisions about the impact of introducing low enriched uranium-based molybdenum-99, it is important to undertake, as the Organization for Economic Cooperation and Development is doing now, a full cost assessment of the molybdenum-technetium supply chain. The pace, scale, timing and scope of conversion efforts have commercial and economic impacts that must be understood and may also affect reliability of supply. Reliability of fuel and target material is a conversion driver because a predicted future difficulty in procuring highly enriched uranium for medical isotope production could lead to a positive decision to convert in order to avoid supply interruptions. However, unreasonable fears about the unreliability of material suppliers should not be used to justify potentially problematic fuel cycle decisions.

It is also important to ensure that predictable regulatory regimes are supportive of low enriched uranium-based molybdenum-99 production approaches so that the supply is assured. Countries should be prepared to facilitate the timely licensing of both low enriched uranium-based production processes and the medical isotopes that are produced. International cooperation in this area is critical, and it is important to recognize the linked relationships and to coordinate the different players, including different nationalities and the public and private sectors.

The United States and the Russian Federation have a special responsibility for minimization of highly enriched uranium because they possess more than 90 per cent of the global stockpile of highly enriched uranium and operate more than 50 per cent of the research reactors fuelled by highly enriched uranium. They have also provided most of the highly enriched uranium research reactors around the world and the material to fuel them. Important progress has been made as both countries have facilitated major reactor conversion and fuel take-back efforts, and have engaged in efforts to consolidate their nuclear complexes. In particular, the Global Threat Reduction Initiative of the United States Department of Energy has facilitated the conversion or shutdown of 38 reactors since 2004 and is developing new low enriched uranium fuels for reactors that cannot be converted with existing fuels.

There is still a great deal of work to do in the United States and the Russian Federation, including making policy decisions that take perceived risk into account. Highly enriched uranium is still used by facilities within the traditional scope of the Reduced Enrichment for Research and Test Reactors (RERTR) Programme, and many facilities — for example, critical assemblies and pulsed reactors — do not have viable conversion or shutdown paths. In addition, highly enriched uranium is still used by facilities outside the traditional scope of the RERTR Programme, and the reactors that remain to be converted are the most technically challenging. However, while these challenges do exist for certain facilities, in particular high-flux reactors and reactors with unique fuel designs, conversion is possible in almost all instances, provided that the fuel in development is properly qualified. It is important to note that for conversion to be sustainable, operators must be confident that post-conversion performance objectives for the reactors will be met. Work done to date suggests that conversion, in almost all cases, does not degrade performance. It is more difficult to ensure operator and Government commitment to the objective of highly enriched uranium minimization owing to competing pressures such as increased costs, the length of time required to complete the conversion mission and operational and regulatory uncertainty.

The United States and the Russian Federation must now broaden and accelerate existing programmes to incorporate additional facilities and materials and broaden policy approaches and incentives across the spectrum of programmes for the minimization of highly enriched uranium. In addition, it would be valuable for the Russian Federation to develop a strategic plan on nuclear science and technology to determine how many research reactors and critical assemblies are needed to enable the State’s overall scientific mission, in order to ensure that minimization programmes have forward momentum and are sustainable and irreversible.

Outside of the United States and the Russian Federation, significant challenges to the minimization agenda remain. There are a smaller number of facilities that await feasible conversion strategies, but those that remain outside current conversion plans pose the greatest challenges. With some of these facilities, conversion remains a question of priorities. If the decision is made that no sacrifice in performance metrics is acceptable, it becomes difficult to imagine conversion decisions before new fuels under development become available. Therefore, in considering conversion, we must ask how much performance is enough. Is more always better? In some very limited cases it might be necessary to envision a layered policy approach that might include:

- Pursuing a commitment to reduce enrichment as far below weapons grade as possible
- An ongoing assessment of the real performance needs of the facility
- A firm commitment to continued development of low enriched uranium fuels in the meantime
- A commitment to convert as soon as feasible

In other types of facilities based on highly enriched uranium in some countries, such as the fast critical assembly in Japan, there is a lack of strategic direction regarding the current use and future need for the facility. Reduced enrichment below weapons grade may be advisable for these facilities as well, in advance of a full conversion to low enriched uranium or a decision to shut down.

International cooperation is vital to efforts for the minimization of highly enriched uranium. The United States Global Threat Reduction Initiative is an example of one country working bilaterally with other States to reduce highly enriched uranium in research reactors and production of medical isotopes, and facilitating international collaborative efforts on issues such as new fuel development and material removal. Some international activities are intended to create an incentive for the use of low enriched uranium-based products and processes, such as only purchasing medical isotopes made from low enriched uranium. Other efforts focus on the reduction and removal of highly enriched uranium. States should take on more visible, active roles in both bilateral and multilateral minimization efforts.

IAEA works with member States around the world, upon request, to convert research reactors fuelled by highly enriched uranium, to convert medical isotope production processes from highly enriched uranium to low enriched uranium, and to assist member States in repatriating spent and fresh highly enriched uranium reactor fuel to its country of origin. This work should be supported and expanded, where possible. There are multiple paths that might be pursued to continue international efforts for the minimization of highly enriched uranium:

- Prioritizing and addressing the threats that are considered most serious
- Dealing with the States and programmes that have the most material in an effort to reduce those amounts

- Finding the areas that are easiest to work on, the "low-hanging fruit", technically and politically

Current minimization goals are driven primarily by security concerns. While most States are aware of work on minimization of highly enriched uranium, nuclear security does not have the same drivers — for example, a major, catastrophic event — that has motivated improvements in nuclear safety. One of the major contributions that international organizations and non-governmental organizations can make to these efforts is providing forums for discussion about security of highly enriched uranium. One specific measure is implementation of international security accreditation — such as that being developed by the World Institute for Nuclear Security — that would ensure highly enriched uranium remaining at a site is adequately secured.

High-level policy commitments guide practical minimization efforts. For several States, political considerations related to the implementation of the action plan from the 2010 Review Conference, Security Council resolutions and commitments made within the Nuclear Security Summit process, are important drivers for minimization of highly enriched uranium. Informal discussions, such as the 2006 Oslo Symposium, have developed recommendations that are pursued by Governments. It is vital that future meetings, such as the Nuclear Security Summit to be held in Seoul in 2012, build and expand these efforts and move the agenda forward in concrete ways.

For example, Ukraine — in addition to its decision to renounce nuclear weapons in the 1990s — has also committed, with IAEA support, to remove all stocks of highly enriched uranium. The United States has used the Nuclear Security Summit to expand its decades-long commitment to minimization of highly enriched uranium and to build and expand international partnerships in those efforts. Political commitments at the highest levels in those two countries, and in many others, are vital for sustained minimization success. It is necessary to build on such successes by engaging countries outside the Nuclear Security Summit and Non-proliferation Treaty processes.

Some proposed and existing measures complement minimization efforts. Some countries may consider a voluntary commitment not to possess any highly enriched uranium or separated plutonium 239. A further step would be to establish a national or regional zone free of nuclear weapons usable material. Also, multilateral fuel assurance mechanisms, like the IAEA International Nuclear Fuel Bank, help support the objectives of the Treaty on the Non-Proliferation of Nuclear Weapons of facilitating the peaceful uses of nuclear energy and supporting global nuclear non-proliferation, while not constraining any State's right to the peaceful benefits of nuclear energy. Similarly, complying with the expanding IAEA nuclear security and safety framework, including the Convention on the Physical Protection of Nuclear Material and its amendment, INFCIRC/225/Revision 5, and other security- and safety-related instruments, helps in reducing risks of terrorist incidents and of accidents, while increasing the confidence of the international community. At the regional level, examples of close cooperation exist in Europe and Latin America.

Policy ideas and recommendations from the Symposium co-hosts

The following recommendations may not be universally shared by all the Symposium participants, but they reflect a possible policy agenda moving forward.

They aim to promote tangible progress, as well as a culture of transparency, trust and cooperation in the peaceful uses of nuclear energy that also ensures the highest level of safety, security and non-proliferation.

Minimization of highly enriched uranium

1. Continue to convert highly enriched uranium-based facilities and processes, remove material from as many countries and locations as possible and ensure the highest levels of security wherever these materials remain.

2. Finish the miniature neutron source reactor conversion process, recognizing that politically difficult locations make such activities challenging but also necessary.

3. Consider additional incentives for conversion and removal.

4. Establish an internationally agreed norm that low enriched uranium will be used in place of highly enriched uranium in any new facility or process under development, design or construction (including in possible new applications such as space reactors).

5. For facilities for which low enriched uranium fuels are not yet available, secure commitment to reduce enrichment below weapons grade and to the lowest level possible, until such time as low enriched uranium fuel can be qualified.

6. Develop an international, cooperative research and development programme to examine options for the management of spent fuel from newly developed low enriched uranium fuel types resulting from conversion efforts.

7. Encourage security requirements that correspond to material types and demonstrate where conversion to low enriched uranium assists in lowering security costs, in order to encourage conversion decisions.

8. Encourage members of IAEA to recognize and support the expertise and capacity of the Agency to further assist international endeavours for the minimization of highly enriched uranium.

Civilian naval propulsion reactors

1. Establish a global norm that low enriched uranium will be used in place of highly enriched uranium in any new nuclear-powered civilian vessels.

2. Phase out or convert existing civilian vessels fuelled by highly enriched uranium.

Transparency

1. Develop international standards or guidelines for public declarations of inventories of highly enriched uranium on a regular basis with consistent form and content.

2. Encourage the voluntary declaration of inventories of highly enriched uranium globally, and in particular, given the large quantities, the declaration of more highly enriched uranium to be in excess of military needs (including from naval programmes) and commit to blend down material declared to be in excess.

3. Promote and support independent efforts that add to public understanding of facilities and stocks.

Expansion of efforts

1. Expand the scope of conversion efforts to include critical assemblies and pulsed reactors.

2. Recognizing the challenges, begin a conversation on assessing inventory needs for ongoing use of highly enriched uranium in military vessels, and conduct a feasibility study to allow for possible low enriched uranium-based vessels for future generations of submarines and aircraft carriers.

3. Shift the focus of international dialogue from minimization of highly enriched uranium to the elimination of civilian uses of highly enriched uranium.

Conclusion

The fundamental goal of minimization of highly enriched uranium is to enable a path towards a safer world. The proceedings of the second International Symposium on the Minimization of Highly Enriched Uranium show that, while there may remain differences on pace and priority, there is a robust and growing consensus on the principle. It is the responsibility of all stakeholders to seize the moment, broaden the consensus and make commitments irreversible.