

WHERE TO TAKE HEU MINIMIZATION – THE U.S. PERSPECTIVE

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Introduction

Thank you for this opportunity to discuss with you the U.S. perspective on minimization of HEU in civilian nuclear applications. Let me first begin by thanking the Government of Norway for taking the initiative in bringing us together to focus attention on this very important issue. The Nobel Peace Center where we are sitting today is an inspiring reminder of what our objectives are – to work together to help make the world a safer place.

In my speech today I would like to update you on some of the current U.S. efforts to minimize the use of HEU in the civilian sector as well as highlight some next steps regarding where to take HEU minimization in the future.

The Threat – Nuclear Terrorism

One of the most urgent threats we all face is that of nuclear terrorism. According to the U.S. National Counter Terrorism Center, the number of terrorist incidents worldwide has been on the rise in recent years. We have all felt the effects of terrorism and it afflicts all countries, whether it takes place in Russia, Indonesia, the United Kingdom, Sri Lanka, or the United States.

Nuclear terrorism would forever change the world as we know it. As a result, we are more cognizant of the urgent security requirement to keep nuclear materials out of the hands of terrorists. Our concern about these materials – particularly highly enriched uranium (HEU) and plutonium – is with good reason. If terrorists were to acquire plutonium or HEU, they would have overcome the most significant hurdle in the pathway to a nuclear weapon.

There are many potential sources of such nuclear materials around the world. Of course, the largest amount of materials comes from weapons programs. I am pleased to note that the United States and other governments are making significant strides in eliminating excess HEU from these programs.

Of particular concern, and the focus of this conference, are special nuclear materials at civil nuclear sites – sites which may be less well protected than defense facilities, yet which possess sufficient quantities of materials for use in improvised nuclear devices or INDs. At least 115 civilian research reactors around the world are still operating on HEU, and many metric tons of weapons-usable uranium are located in dozens of countries around the world.

We need to work together to reduce the risk posed by this material while preserving the important benefits derived from research reactors.

Current U.S. efforts – what have we already done?

Two years ago, the U.S. Department of Energy established the Global Threat Reduction Initiative to accelerate and expand efforts to reduce the threat posed by nuclear terrorism. GTRI is a cooperative global program designed to support countries' national programs to identify, secure, recover or facilitate the disposition of vulnerable nuclear and radiological materials around the world that pose a potential threat to the international community. To give you a sense of the level of international support for GTRI, over 500 participants from more than 100 countries participated in a GTRI International Partners Conference two years ago in Vienna. GTRI consolidated a number of programs which work together to minimize and, to the extent possible, eliminate the use of highly enriched uranium (HEU) in civil nuclear applications worldwide. The Office of Global Threat Reduction, which was set up to implement the initiative, oversees the Reduced Enrichment for Research and Test Reactors (RERTR) program, the Foreign Research Reactor Spent Nuclear Fuel (FRR SNF) Acceptance program, the Russian Research Reactor Fuel Return (RRRFR) program, the Global Research Reactor Security (GRRS) program, and the Gap Materials program. These five programs undertake complementary efforts to address the proliferation concerns of research reactor related materials.

As we seek to ensure a secure path for civil nuclear research - free from the proliferation risks posed by HEU - it is important to highlight that at its very core, GTRI is a cooperative program. Without our close cooperation with you, we would not be able to implement a program that is beneficial to all of us. We work with countries that have made voluntary decisions to convert based on national requirements. While we can appreciate that levels of enrichment and physical protection vary, we are concerned about all HEU in civil use, including in our own country. I would like to stress that the United States recognizes that we cannot ask others to do what we are not prepared to do ourselves. Therefore, GTRI has taken a lead role in the conversion of research reactors in the United States.

Existing HEU Minimization Programs

RERTR

The Reduced Enrichment for Research and Test Reactors program, also known as the RERTR program, works to convert research reactors and radioisotope production processes to the use of low enriched uranium (LEU) fuel and targets. The RERTR program has identified 106 research reactors around the globe, including in the United States, with which the program will cooperate on conversion.

The RERTR program assists reactor operators with conversion activities, provides incentives for operators to convert to LEU fuel, and supports the development of the higher-density LEU fuels. The program works to ensure that reactors can be converted safely, *without* major modifications to the reactor structure or equipment, *without* increasing the operating costs of the reactor, and *without* altering the scientific mission and function of the reactor. The RERTR program also works to develop LEU-based molybdenum-99 production processes to allow medical isotope production facilities to convert from the use of HEU to LEU targets.

Within the past year, the reactor research community has witnessed a number of very important HEU minimization successes, all aided in some way by the RERTR program. These include the first-ever conversion of a Russian-supplied research reactor, the VR-1 Sparrow research reactor at the Czech Technical University, as well conversion of the High Flux Reactor in the Netherlands, and the IRT-1 critical assembly at the Tajoura Center in Libya.

A very important element of RERTR is the technological development of higher-density fuels that will enable additional reactors to convert to LEU fuel. The U.S. participates in an international fuel development working group along with fuel developers from Argentina, Canada, France, South Korea, and Russia.

Conversion to LEU does not significantly impact reactor operations

It is important to note that conversion from the use of HEU to the use of LEU fuel does **not** significantly adversely impact reactor operations. If we were to simply replace HEU fuel with LEU fuel in a research reactor *without* any further modifications, this would typically result in a 5-10% decrease in neutron flux and a corresponding decrease in experiment performance. However, through fuel assembly design, core configuration, and experimental positions, an LEU-fueled reactor can have an experiment performance that is **not** significantly lower than one using HEU fuel. We conduct a comprehensive feasibility study for each reactor before conversion begins to determine the optimized configuration for the new LEU core. *The proof of this is that - to date - 43 of the 106 research reactors included in the RERTR program have successfully converted from the use of HEU to LEU. The converted reactors include multiple and diverse designs and utilization, and in all cases an LEU configuration acceptable to the operator was found with no significant decrease in the fuel cycle and experiment performance.*

In the RERTR program's efforts to convert medical isotope production processes to an LEU-based process, it has joined the IAEA-led Coordinated Research Project (CRP) entitled "Developing techniques for small scale indigenous Molybdenum 99 production using Low Enriched Uranium (LEU) fission or neutron activation." This past March, RERTR program experts attended a CRP workshop in Indonesia, where they performed a successful demonstration of LEU-based Moly-99 target production.

Additionally, DOE is supporting a study by the National Academy of Sciences to assess the feasibility of converting large-scale medical isotope production facilities to LEU-based processes. The RERTR program hopes to continue working with the radioisotope production community to retain the scientific and economic benefits of Moly-99 production, while addressing our mutual nonproliferation objectives.

RRRFR

The second program consolidated under GTRI, the Russian Research Reactor Fuel Return (RRRFR) program, works to repatriate fresh and irradiated Russian-origin fuel from over 20 Soviet-/Russian-supplied research reactors in 15 participating countries. This Tripartite Initiative among the United States, the Russian Federation, and the International

Atomic Energy Agency (IAEA) works hand-in-hand with the RERTR program to provide repatriation assistance to eligible facilities. In accordance with the Bratislava Joint Statement on Nuclear Security Cooperation by Presidents Bush and Putin, we plan to complete all shipments to return Russian-origin fresh HEU fuel by the end of 2006 and complete all shipments to return Russian-origin spent HEU fuel currently outside of research reactor cores by the end of 2010.

I am pleased to inform you that the GTRI Russian Fuel Return program has been very successful and I would like to congratulate our international partners for their efforts under this program. To date, we have successfully completed 8 shipments of Russian-origin fresh HEU fuel to Russia, the last of which returned roughly 14 kg of HEU from the Czech Technical University to the Russian Federation in September 2005. Looking ahead, we plan on completing six (6) shipments to repatriate additional quantities of Russian-origin fresh HEU by the end of the 2006.

Additionally, the RRRFR program, in close cooperation with Uzbekistan, Russia and Kazakhstan, recently witnessed the successful completion of the first Russian-origin spent HEU repatriation. This pilot project removed approximately 63 kg of spent HEU fuel over four consecutive shipments from the WWR-SM reactor at the Institute of Nuclear Physics in Uzbekistan to its ultimate destination in Russia. This accomplishment paves the way for future spent HEU repatriations under the RRRFR program from other countries such as Latvia and the Czech Republic in the near future.

FRR SNF Acceptance

The Foreign Research Reactor Spent Nuclear Fuel (FRR SNF) Acceptance program is the third research reactor program under GTRI. The U.S. Acceptance program supports our HEU minimization policy by taking back certain types of U.S.-origin HEU and LEU spent nuclear fuel and HEU target material. The United States will accept eligible spent fuel irradiated prior to May 2016 and returned to the United States by May 2019. The program provides assistance where necessary to implement shipments to the United States. Over the past year, we have repatriated 406 spent nuclear fuel assemblies from Austria, Greece, the Netherlands and Sweden. In addition, just last week, we successfully returned an additional 270 U.S.-origin spent HEU fuel assemblies from the Netherlands and Germany.

GRRS

The Global Research Reactor Security (GRRS) program is the fourth program folded into GTRI. The GRRS program works to improve the security of nuclear materials outside of the Former Soviet Union (FSU) until such time as they can be removed, repatriated, blended-down or otherwise disposed of under other programs.

To date, GRRS has provided security upgrades at eight (8) research reactors outside of the FSU and is currently providing security upgrades at ten (10) additional research reactors in five (5) countries. This is in addition to the bilateral U.S.-Russian Material, Protection, Control and Accounting (MPC&A) program to secure warheads and weapons-grade fissile material in the Russian Federation.

Gap Materials Program

In order to more comprehensively address additional quantities of nuclear material, GTRI developed a program to address material not covered by existing threat reduction efforts; in essence, filling the 'gaps' of existing programs. Under this program, GTRI works to develop partnerships with government agencies, facility operators, and commercial entities

to identify, remove and facilitate the final disposition of gap material. This material could potentially include: U.S.-origin HEU not covered by the FRR SNF Acceptance program; separated plutonium and plutonium-bearing material; and HEU material of non-U.S.- and non-Russian-origin. I would briefly note that GTRI has recently removed more than 35 kilograms of U.S.-origin fresh HEU in two shipments from Canada and Belgium. In addition, in coordination with GTRI, and as a way to encourage collaboration with the private sector, AREVA recently signed contracts for the recovery of more than 85 kilograms of U.S.-origin HEU from several facilities in Europe.

IAEA contribution

Let me also take a moment to express appreciation for the important role that the IAEA has played in these efforts. Director General ElBaradei, by speaking and writing on the dangers of HEU in civil applications, has been a catalyst in building international support for HEU Minimization. Nearly every aspect of the Agency is involved in assisting member states with converting their reactors to LEU. I would like to highlight the leadership role that Dr. Pablo Adelfang has played in identifying technical issues associated with LEU alternatives and organizing experts to address them. And the Technical Cooperation Department has been responsive to Member State requests for assistance and has admirably implemented these important conversion and repatriation projects.

Next Steps – Where to take HEU Minimization

Next I would like to talk about the future direction of HEU minimization. The following **five** concrete steps will further implement efforts to minimize the use of HEU in the civilian sector.

First, we plan to continue and accelerate our efforts to convert U.S. reactors. We will convert research two new research reactors at the University of Florida (UFTR) and Texas A&M University (NSCR) in September of this year, and are actively working to convert five additional domestic research reactors with existing LEU fuel by 2009. The conversion of these U.S. university research reactors is a critical milestone in our effort to reduce the utilization of weapons-useable nuclear material and highlights the high priority we place on HEU minimization in the future.

In addition to our efforts to convert U.S. university reactors, we also are working to convert the U.S. high power research reactors. We recently formed the U.S. High Power Reactor Working Group with reactor operators to jointly assess and pursue the conversions of the Advanced Test Reactor (and its critical assembly) at Idaho National Laboratory, the High Flux Isotope Reactor at Oak Ridge National Laboratory, the MITR-II reactor at the Massachusetts Institute of Technology, the NBSR reactor at the National Institute of Standards and Technology, and the MURR reactor at the University of Missouri. To enable the conversion of these reactors, the RERTR program has developed an aggressive, achievable schedule to develop the necessary U-Moly fuel by 2010.

Second, we plan to accelerate and expand our efforts to assist other countries with conversion of their research reactors from the use of HEU to LEU according to their national requirements. *Under the RERTR program, 42 additional research reactors around the world can convert with currently available LEU fuel.* To this end, in fiscal year 2006, six research reactors will be converted to operate with low enriched uranium (LEU). Our goal is work with the international community so as to convert an additional seven (7) research reactors in FY '07 and an additional eight (8) research reactors in FY '08. We are also evaluating the

possibility to increase the number of reactors to be addressed under the RERTR program. This study is currently underway to expand beyond the list of 106 reactors, possibly including some large pulse reactors and critical facilities. We will inform you about the results of the study when it is completed.

Third, we must continue to work together on development of economically feasible LEU alternatives for isotope production for medical applications. We commend the efforts of Argentina, Indonesia, and Australia which have already demonstrated the feasibility of an LEU-based medical isotope production process.

Fourth, we are prepared to join with other civil HEU holders in establishing international guidelines on the management of civil HEU. Such guidelines could incorporate requirements for accounting and reporting of national stocks of civilian HEU; strict standards for physical protection; conversion of all civil HEU reactors and medical isotope production processes to LEU where technically and economically feasible; and for designing new civilian reactors that only use LEU. Importantly, such guidelines would assure the international community that HEU holders remain committed to the principles of minimizing the use of HEU in peaceful nuclear activities.

Finally, as a specific next step, we would like to see a strengthened and expanded role for the IAEA in HEU minimization. The technical session of this symposium has clarified that the technical issues associated with conversion can be addressed. Given the upcoming celebration of the 50th Anniversary of the IAEA, it is an ideal time for Member States to make clear their preference for the use of LEU in civil applications. We are ready to support a resolution to that effect at the General Conference in September. The elements of a resolution could reflect the outcomes of this symposium. We would like to see the following ideas included:

- Recognition of the scientific and other benefits that have been derived from reactors and processes using HEU, and that substituting LEU should not significantly impact those benefits
- Acknowledgement of the risk of misuse of HEU and that using uranium enriched to less than 20% in civil applications where technically and economically feasible would be a worthwhile reduction in the risk.
- Recognition and acceleration of on-going efforts to convert HEU reactors and facilities to LEU where technically and economically feasible, including through the RERTR program
- Emphasis on the need for the development of very high density LEU fuels for facilities that cannot currently be converted
- Encouragement of the production of medical and other isotopes using LEU targets and recognition of IAEA support for research among interested parties
- Agreement that new research reactors will be designed to use only LEU

- Acknowledgement of the positive contribution of the IAEA's role in conversion of nuclear facilities and highlight the value of an enhanced IAEA role in advocating HEU Minimization in Civilian Use
- Identification of ways that IAEA can further strengthen its role by, for example, focusing assistance and cooperation solely on the use of LEU, where technically and economically feasible
- Encouragement to civil HEU holders to manage stocks according to best practices

Conclusion

In conclusion, I would like to once again commend and applaud the Government of Norway for organizing this very important conference. This conference is a crucial step in the process of building additional international support for efforts to minimize the use of HEU in the civilian sector. Looking forward, 50 more years of peaceful uses of nuclear technology can only happen if we continue to pursue and foster the atom in a way that does not compromise global security.

I hope we can carry forward the momentum of this conference to the upcoming IAEA General Conference in September with the goal of achieving a resolution supporting the minimization of HEU in civil applications worldwide. Together we need to continue to create a world where our children and our children's children can live with all the benefits of nuclear energy without the risk of nuclear terrorism.

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