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Multilateralization of the Nuclear Fuel Cycle
The First Practical Steps

Yury Yudin editor

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About the cover

The storage facility of the guaranteed reserve of low-enriched uranium at Angarsk. The containers hold 120t of low-enriched uranium hexafluoride.

Image courtesy of the International Uranium Enrichment Center.

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FOREWORD

One of the most crucial challenges the world faces today is to develop and implement security measures to prevent civilian nuclear energy and fuel cycle facilities from becoming a mechanism of proliferation of nuclear weapon capabilities. A multilateral approach to the fuel cycle would provide additional assurances of supply of nuclear fuel and eventually place the sensitive steps of the cycle under international control. Such an approach could ensure that the benefits of nuclear energy are made available to all, while strengthening the non-proliferation regime through verifiably safe and secure management of the fuel cycle.

In September 2008, the United Nations Institute for Disarmament Research launched a study on the various proposals for multinational approaches to the nuclear fuel cycle. One of the main objectives of the study is to stimulate discussion within the international community—including governmental experts, non-governmental organizations and academia—on the political, economic and technical opportunities and obstacles related to these proposals. Some of the proposals have already become operational, while some are at advanced stages of development and may become operational soon. For the future implementation of these projects, it is essential to have publicly available analyses of the practical issues that will be faced.

The two studies presented here deal with three multilateral fuel cycle projects: the Russian International Uranium Enrichment Center, the Russian guaranteed low-enriched uranium reserve and the International Atomic Energy Agency low-enriched uranium bank. We hope that these analyses will be stimulating and useful for those working to develop and implement multilateral fuel cycle arrangements.

Theresa Hitchens
Director
UNIDIR

INTRODUCTION

Yuri Yudin

From the outset of the nuclear age the international community has faced the following challenge: how to find a way to manage global nuclear fuel cycles that will make "the benefits of peaceful applications of nuclear technology" available to all states on an equitable and non-discriminatory basis while simultaneously reducing the risks of nuclear proliferation to acceptable levels.

At the heart of the problem is the large overlap between civilian and military applications of nuclear energy, which both depend essentially on the same key ingredient: fissile material. The most sensitive fuel cycle technologies from a proliferation perspective are technologies of uranium enrichment and spent fuel reprocessing because they are capable of providing materials that are directly usable in a nuclear weapon or a nuclear explosive device—high-enriched uranium and separated plutonium.

The challenge to countering nuclear proliferation stems from the fact that there is no technological barrier between the production of low-enriched uranium (LEU) for nuclear reactors and high-enriched uranium for weapons or between separating plutonium for peaceful purposes or for military purposes. With the existing system of highly national control of nuclear activities, more states could acquire the capability to produce materials directly usable for, or easily convertible to, explosive use.

While the dual-use nature of nuclear technology cannot be changed, something could be done to change the way in which this technology is managed. More than once the world has turned to the idea of multilateral management of the nuclear fuel cycle and multilateral mechanisms that would provide additional assurances of supply of fuel for nuclear power reactors.

The first interest in institutional arrangements for the nuclear fuel cycle dates back to the start of the nuclear age. The first effort to define a policy on the international control of atomic energy was done by the authors of

the 1946 *Report on the International Control of Atomic Energy*, which called for a United Nations authority to own and control all uranium deposits and all fissile material and ensure that atomic research was conducted for peaceful purposes only. Several feasibility studies on multilateral approaches to the nuclear fuel cycle were undertaken in the 1970s and 1980s. Those studies touched upon various aspects of assurances of long-term supply of nuclear fuel and services, including multinational or international backup or safety net arrangements, an international nuclear fuel bank, the possibility of regional fuel-cycle facilities and prospects for multilateral cooperation on plutonium storage. But until recently none of the proposals or initiatives for multilateralization led anywhere, not least due to the general lack of political will among states.

In 2005 through 2007, in response to the call of International Atomic Energy Agency (IAEA) Director General Mohamed ElBaradei, governments, the nuclear industry and non-governmental organizations put forward a dozen proposals regarding multilateral approaches to the nuclear fuel cycle and assurances of supply of LEU and nuclear fuel.

These proposals mainly focused on the front end of the nuclear fuel cycle, trying to discourage additional states from developing their own uranium enrichment capabilities by building mechanisms of assured supply of LEU through setting up reserves and establishing multilateral uranium enrichment facilities. But these proposed multilateral mechanisms have not won support among some non-supplier states, which tend to see them as an attempt to deprive non-nuclear-weapon states of the right to peaceful nuclear technology, as given by article IV on the Nuclear Non-Proliferation Treaty, to create a supplier "cartel" and corner the international nuclear market, and to introduce additional discrimination into the non-proliferation regime, beyond that already present in the distinction between the nuclear-weapon states and non-nuclear-weapon states.

Nevertheless, certainly more progress towards the operationalization of multilateral fuel-cycle mechanisms has been made during the last five to six years than during the 1970s and 1980s. Discussions with supplier and non-supplier states have shown that the way to proceed would be in establishing multilateral mechanisms with voluntary participation that do not require states to "forego" the development of, or the building and operation of, domestic fuel cycle facilities. Both supplier and non-supplier

states have also agreed that multilateral fuel-cycle mechanisms should not disturb the international market for nuclear fuel cycle services, especially for supply of front-end services, such as uranium enrichment and nuclear fuel. According to this, many projected multilateral supply mechanisms are designed as a "guarantee-in-depth" or a supplement instrument that would be triggered only in the event of a disruption of normal commercial supplies for reasons not related to non-proliferation, commercial or technical considerations.

In the current discussions on multilateral fuel-cycle mechanisms, a few front-runner concepts have emerged on assurances of supply of LEU and the possibility of setting up international uranium enrichment centres: the Russian Federation initiative to establish the International Uranium Enrichment Center (IUEC) and a reserve of LEU for supply to the IAEA for its member states, the establishment of an IAEA LEU bank, the UK-led enrichment "bonding" concept, and the German Multilateral Enrichment Sanctuary Project. These proposals aim to back up the commercial nuclear market and add to the nuclear fuel options of non-supplier states, thus increasing their confidence in continuing reliance on nuclear power and proposing to them an attractive alternative to building their own plants and facing the trouble and expense of developing their own fuel cycle technologies.

In-depth analysis of the existing multilateral fuel-cycle mechanisms is essential for future implementation of multilateral fuel cycle projects. This book investigates the two operational Russian mechanisms—the IUEC and the guaranteed LEU reserve—and the incipient IAEA LEU bank.

The first study, by Anton Khlopkov, outlines the key stages in the implementation of the Russian initiatives and details the steps undertaken to make them operational. The IUEC is considered by Russia as a first practical step towards the creation of a global nuclear power infrastructure proposed in 2006 by Russian President Vladimir Putin. He proposed to create "a global infrastructure that will give all interested countries equal access to nuclear energy, while stressing reliable compliance with the requirements of the non-proliferation regime", including "the creation of a system of international centers providing nuclear fuel cycle services, including enrichment, on a non-discriminatory basis and under the control of the IAEA".

To establish the IUEC and the LEU reserve, the executive and legislative branches of the Russian Federation implemented several required modifications to its national legislation, signed international agreements with other states as well as with the IAEA, issued relevant executive orders, guaranteed the issuance of the licences and authorizations required under Russian law for the subsequent export of the LEU out of the Russian Federation, etc. Khlopkov outlines all these practical steps towards operationalization of the IUEC and the LEU reserve and analyzes the preliminary outcomes of these two projects and the experience gained from their implementation.

The second study, by Zoryana Vovchok, discusses various legal issues pertaining to the choice of a state or states to host the future IAEA LEU bank. The selection of a location for the bank will be influenced by various political, economic and technical considerations.

The proposal for an IAEA LEU bank approved by the IAEA Board of Governors on 3 December 2010 does not provide a great amount of detail with regard to the Host State. The Board of Governors only "request[ed] the Director General to consider proposals from any Member State interested to act as a Host State for the IAEA LEU bank on the basis foreseen in this document and to negotiate with it a draft Host State Agreement",[1] which has to ensure "the application of IAEA safeguards to the LEU in the IAEA LEU bank, as well as the application of the safety standards and measures, and the physical protection measures by the Host State or States".[2] The necessary legal framework of the host state or states is still to be defined by the IAEA Secretariat. Vovchok's study provides the first comprehensive, publicly available analysis of the necessary legal framework.

The 2010 Review Conference of the Treaty on the Non-Proliferation of Nuclear Weapons agreed on an action plan, which for the first time specified a set of measurable benchmarks to facilitate the assessment of progress towards the main goals of the Treaty over the next five-year review cycle. Action 58 calls for continuing "to discuss further, in a non-discriminatory and transparent manner under the auspices of IAEA or regional forums, the development of multilateral approaches to the nuclear fuel cycle, including the possibilities of creating mechanisms for assurance of nuclear fuel supply". This study paper seeks to contribute to this discussion.

PRACTICAL IMPLEMENTATION: THE RUSSIAN EXPERIENCE

Anton Khlopkov*

INTRODUCTION

The dual nature of nuclear energy—the fact that it can be used for both peaceful and military purposes—became clear in the 1940s. In June 1946, Bernard Baruch, US representative to the UN Atomic Energy Commission, urged governments to hand over control and ownership of civil nuclear activities and materials to the International Atomic Development Authority. From the 1950s through the 1980s repeated attempts were made, primarily in the framework of the International Atomic Energy Agency (IAEA), to study the possibility of putting into practice proposals on setting up international centres offering nuclear fuel cycle (NFC) services as an alternative to national programmes. In addition, some states, especially the United States, promoted the idea of multinational NFC facilities instead of national ones. For example, during consultations in the 1970s, the United States insisted that Iran should internationalize its project to build a spent nuclear fuel reprocessing plant and invite Pakistan to join the project. But all such initiatives remained on paper for a variety of reasons, chief among them the inability of states to agree on the specific terms of multilateral approaches. There was little taste for relinquishing the national right to develop some elements of the nuclear fuel cycle enshrined in the Nuclear Non-Proliferation Treaty (NPT).

Amid renewed interest in nuclear energy and the widely predicted nuclear renaissance, over the period of May 2006 through October 2007 several

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All views expressed herein should be understood to be solely those of the author. The views and conclusions expressed in the paper should not be interpreted as representing the views of his employers.

states, groups of states, commercial companies and a non-governmental organization have come up with a total of 12 complementary proposals on multilateral arrangements for the guaranteed provision of NFC services. Most of these proposals focus on assured access to the front end of the NFC.[1]

In January 2006 Vladimir Putin, Russia's second president, put forward the initiative of setting up a system of international NFC centres specializing in four key areas: uranium enrichment, spent fuel management, nuclear training, and nuclear energy research and development. As the first step Russia proposed the creation of an international uranium enrichment facility. In May 2007 Russia and Kazakhstan signed an intergovernmental agreement on creating the International Uranium Enrichment Center (IUEC). The aim of the project is to provide assured access to uranium enrichment to interested parties without the transfer of sensitive technology. The role of the IUEC is to cater to the interests of nuclear "newcomer" states, which are only just beginning to develop nuclear energy and whose demand for uranium enrichment services is fairly limited. Participation in the IUEC does not entail any restrictions on the development of national NFC programmes, which member states are free to pursue within the limits of their NPT obligations.

The purpose of the IUEC is not to offer uranium isotope separation services on a large commercial scale for the subsequent marketing of enriched uranium product. The centre will rely on the existing enrichment capacity of the Angarsk Electrolysis Chemical Complex (AECC). As of late 2010, the IUEC had reserved 600,000 SWU of the AECC's annual separation capacity for its own needs.[2] That is enough to refuel five or six 1,000MW light water reactors every year. Ukraine and Armenia have now joined Russia and Kazakhstan as members of the IUEC.

In June 2007, in the context of article 7 of the agreement on setting up the IUEC and in response to the IAEA Director General's initiative on assurances of supply of nuclear fuel, Russia put forward another nuclear initiative. It proposed the creation of a guaranteed reserve of low-enriched uranium (LEU) under IAEA control. The idea was to put in place a backup mechanism under IAEA auspices: states that find themselves unable to procure LEU on the open market for political reasons can use the guaranteed reserve as a supply of last resort to keep their reactors running.

In December 2008 the IUEC made delivery on a pilot contract for enriched uranium product. In December 2010 Russia completed the formation of a guaranteed reserve of LEU. The IUEC and the IAEA-controlled LEU reserve are the first proposals on nuclear fuel supply assurances to have been put into practice since the first ideas to that effect were aired in the 1950s.

One of the goals behind the creation of the IUEC and the guaranteed LEU reserve was to overcome the existing scepticism about the feasibility of putting such initiatives into practice, to remove an important psychological barrier that hampers the creation of international NFC centres. In addition, it is safe to say that the IUEC and the guaranteed LEU reserve could provide valuable experience in building practical mechanisms of assured access to NFC services. That experience could be very useful in the future. In fact, some of the solutions developed for the LEU reserve are already being used as part of the project to establish the IAEA nuclear fuel bank, including the eligibility criteria for receiving material from the bank, the transfer of liability for any nuclear damage, etc.

The IUEC can also serve as a prototype for regional NFC centres amid growing interest in nuclear energy among newcomer states and entire regions, such as the Middle East and South-East Asia. Most of the states in these regions have neither the technology nor indeed the economic need to build their own uranium isotope separation plants, as their individual national markets for enriched uranium will be relatively small. The IUEC could be an attractive model for securing assured LEU supply by means of establishing regional NFC centres, based on existing enrichment plants or new ones.

Let us recall that the IUEC was created as part of the Russian presidential initiative to set up a network of international centres offering NFC services. The IUEC, being a pilot project, can be used as a test bed for a range of solutions that would need to be developed for the international NFC centres. Apart from the uranium enrichment centre, the initiative envisions three other types of centres specializing in spent fuel management, the training of nuclear specialists, and nuclear energy research and development.

In the context of nuclear disarmament, the launch of the IUEC offers possible principles and mechanisms for placing under international control those facilities in nuclear-weapon states that were previously involved

in weapons programmes. The AECC, whose uranium isotope separation capacity the IUEC relies on, first ended its involvement in high-enriched uranium production for nuclear weapons; then it was included on the list of Russian nuclear sites available for IAEA safeguards procedures; then one of the facilities on the territory of the AECC (the IUEC nuclear storage) was actually selected by the IAEA for conducting those procedures. In addition, there are plans to allow the IUEC to acquire a stake in the AECC at some point in the future.

Last but not least, the implementation of the Russian initiative on NFC supply assurances has resulted in greater transparency of the Russian nuclear industry and enabled the IAEA to step up its safeguards activities in the country. As part of the IUEC project, in 2007 Russia put its first uranium enrichment plant on the list of nuclear sites available for IAEA safeguards procedures.

INTERNATIONAL URANIUM ENRICHMENT CENTER

There has been a rapid resurgence of interest in nuclear energy in recent years. According to the World Nuclear Association, 440 nuclear reactors were in operation globally as of April 2011, another 61 are being built, and a further 158 have been ordered or planned.[3] Most of these new reactors are to be built in countries that already have nuclear power plants. But there are also 10 newcomer states that are planning to build up to 25 reactors. The vast majority of the units now in operation are light water reactors, fuelled by LEU. That raises concerns over the spread of proliferation-sensitive NFC technologies, primarily the technology of uranium enrichment. The newcomer states, meanwhile, are interested in reliable and "uninterrupted supply of NFC services, including uranium enrichment services".[4] These considerations have given a new lease on life to a number of initiatives aimed at creating a network of guaranteed and non-discriminatory supply of nuclear fuel while at the same time preventing the proliferation of nuclear weapons capability and dual-use technologies.

Over the period of May 2006 to October 2007 several states, groups of states, commercial companies and a non-governmental organization have come up with a total of 12 complementary proposals on multilateral arrangements for the guaranteed provision of NFC services.[5] The Russian

Federation is the first state to have put some of these proposals into practice. In 2008 the International Uranium Enrichment Center in Angarsk completed the first contractual deliveries of enriched uranium product, and in December 2010 Russia completed the creation of a guaranteed LEU reserve.

The initiative to set up a network of centres offering NFC services, including uranium enrichment, under IAEA control and based on non-discriminatory access, was outlined by Russia President Vladimir Putin during the Eurasian Economic Community summit in St Petersburg on 25 January 2006. The initiative aimed to:

- increase the share of nuclear energy in global electricity generation; and
- offer states that are developing or planning to develop nuclear energy non-discriminatory and guaranteed access to NFC services.[6]

The initiative included the creation of NFC centres focusing on the following services and activities:

- uranium enrichment;
- spent fuel management;
- training of nuclear specialists; and
- development of innovative nuclear energy technologies.[7]

As a pilot project Russia decided to set up the IUEC. Kazakhstan joined the project as a co-founder. A bilateral agreement to that effect was signed by the two governments at a special ceremony in Astana on 10 May 2007.[8]

Under article 3 of the agreement, the main objective set before the IUEC was to ensure guaranteed access to uranium enrichment services, primarily to those member states of the Center that are not developing uranium enrichment capability on their national territory. However, the agreement does not impose any restrictions on the right of the member states to develop indigenous enrichment capability.

The IUEC is primarily a political initiative aimed at strengthening the non-proliferation regime by providing an alternative to national uranium enrichment programmes—enrichment being a proliferation-sensitive part

of the fuel cycle in that it can be relatively easily redirected from peaceful to military uses. The IUEC was designed as a mechanism for providing guaranteed access to enrichment services.[9] It focuses on the interests of states that are only just beginning to develop nuclear energy and whose demand for enrichment services is still fairly limited. The initiative does not have the scope to provide isotope separation services on a large scale for subsequent resale of enriched uranium product. Furthermore, the initiative is based on the principle of market neutrality, in that it will not add any new uranium suppliers to the world market for uranium enrichment services. The end users—the energy companies of states developing their own nuclear energy sector—in IUEC member states will have preferential access to the IUEC enrichment services. The IUEC initiative does not allow for the reselling of the Center's product on the open market. In this sense it does not affect the existing commercial market for uranium enrichment services.

Under articles 3 and 5 of the agreement, the IUEC is to be established as a joint-stock company and can be joined by third parties. The admission of any new members must be approved by all existing members and requires an intergovernmental agreement to be signed with the new member state. Once that is done, the new member state appoints an authorized company that acquires a stake in the IUEC. At present the authorized organizations are Rosatom for Russia, Kazatomprom for Kazakhstan, the Nuclear Fuel Concern for Ukraine and the Armenian Nuclear Power Plant for Armenia.

The AECC in Russia was selected as the site to host the IUEC. Its advantages compared to the other three Russian uranium enrichment facilities include spare capacity and infrastructure that can be used by the IUEC. Its specialists already have experience in applying IAEA safeguards,[10] and there is an existing uranium conversion plant in the complex.[11]

At present there are no plans to build new separation capacity specifically for the IUEC. Instead the Center will rely on the existing capacity of the AECC, some of which will be reserved for the IUEC for its contractual commitments. Under the terms of the initiative, the separation facilities will not actually be run by the IUEC, and specialists from the Center's member states will have no access to enrichment technology. At a later stage of the initiative the IUEC may be allowed to acquire a stake in the AECC of up to 25%. Under article 9 of the Agreement, Russia will not transfer any enrichment technology or equipment to the IUEC or its members.

At present the AECC has an annual separation capacity of about 2.6 million SWU, which is to be increased to 4.2 million by 2015.[12] At the first stage of the initiative some 600,000 SWU will be reserved for the IUEC. That is enough for the initial fuel load for two 1,000MW light water reactors, or for refuelling five or six such reactors.

On 6 August 2007 IUEC stakeholders held their first meeting to approve the Center's charter. On 5 September the IUEC completed its registration as a legal entity. Its authorized capital is RUB 26 million (about US$ 1 million), consisting of 26,000 ordinary RUB 1,000 shares. Under the terms of the charter, the authorized capital can go up as well as down. Kazakhstan contributed RUB 2.6 million to the authorized capital and received a 10% stake in the venture, with Russia owning the remaining 90%. In future the plan is to dilute the Russian stake to 50% plus one share through the admission of new member states or by increasing the stakes held by existing members.

The benefits the IUEC offers to its members include:[13]

- greater energy security through guaranteed access to LEU or uranium enrichment services at market prices; and
- the usual shareholder rights under Russian law, including participation in running the company and receiving annual dividends.[14] Shareholders can expect dividends in proportion to their stake in the authorized capital; they also have the right to guaranteed LEU supplies in proportion to their stake. Member states can also request additional supplies if other members, primarily Russia, choose not to claim some or all of their quota.

On 5 August and 16 November 2009 Armenia and Ukraine, respectively, became new members of the IUEC after all required intergovernmental procedures had been completed. On 5 October 2010 Ukraine's 10% stake in the IUEC was formally transferred to the authorized representative of the Ukrainian government, the state-owned Nuclear Fuel Concern. Armenia is expected to complete the transfer of its own stake to its chosen representative, Armenian Nuclear Power Plant, by mid-2011.[15] Russia's share in the IUEC will then be reduced to 70%. Armenia, Kazakhstan and Ukraine will own 10% apiece, entitling them to a guaranteed annual supply of uranium enrichment services to the amount of 60,000 SWU. Membership talks are under way with a number of nuclear newcomers,

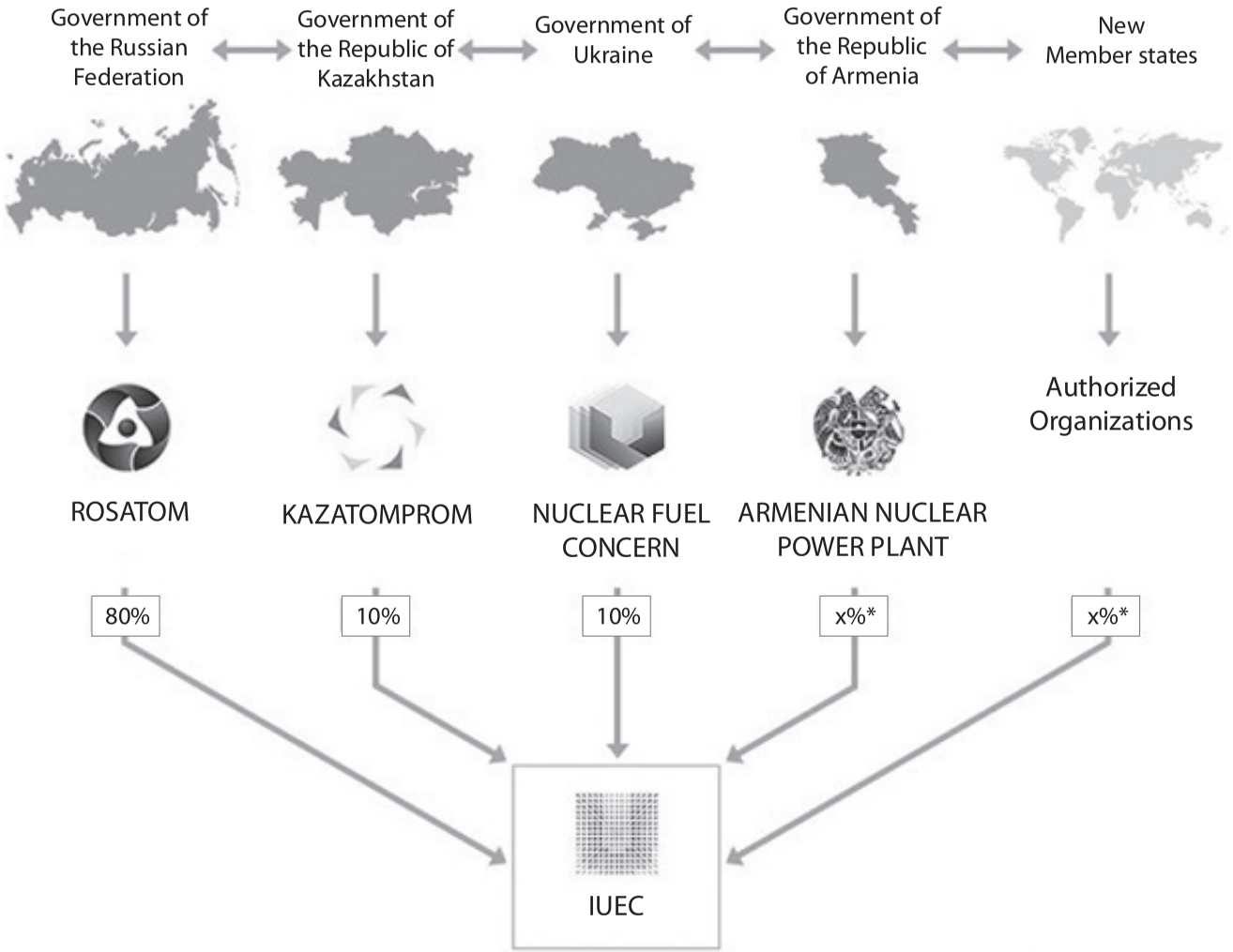
including Jordan, Mongolia and Viet Nam.[16] When new member states join the IUEC, the existing stakeholders may approve an additional issuance of shares. A decision may also be made to increase the AECC separation capacity reserved for IUEC use.

On 25 August 2008 the Russian president signed Decree no. 1251 adding the IUEC to the list of Russian legal entities allowed to own nuclear materials. On 1 September the Center was granted by Rostekhnadzor (the Federal Service for Environmental, Industrial and Nuclear Supervision) a three-year licence for use of nuclear materials. On 10 October it also received a five-year license from the FSB (the Security Service of the Russian Federation) to perform activities requiring access to information constituting Russian state secrets.

The implementation of the IUEC initiative was going in parallel with the consolidation of the Russian nuclear industry under Rosatom, a vertically integrated state corporation. On 27 April 2007 President Putin signed Decree no. 556 "On the Restructuring of the Russian Nuclear Energy Industry". Under the terms of addendum 5 to the Decree, the AECC was included in the list of the companies to be privatized and to be restructured into open joint-stock companies.

Deliveries under the first IUEC contract for the supply of enriched uranium product were completed in December 2008 to test the arrangements reached with the AECC, as well as communication procedures with the Russian Federal Customs Service, and the sea port of St Petersburg, as well as the numerous logistics, insurance and other mechanisms required for the provision of uranium enrichment services. As of February 2011 the pilot contract on which the delivery was made in December 2008 has been the IUEC's only contract for enriched uranium delivery. The name of the customer in that contract has not been disclosed in the company's reports. The completion of the legal procedures required for the transfer of a 10% stake in the IUEC to Ukraine's Nuclear Fuel Concern opens the prospect of regular commercial contracts. Ukraine has 15 nuclear energy reactors in operation, whereas Kazakhstan has none, and all the Russian demand for uranium enrichment is being met by the country's own existing commercial uranium enrichment suppliers.

IUEC structure as of December 2010



* acquisition of shares from the Russian share provided that the Russian Federation maintains control (50% + 1 share)

Source: IUEC.

GUARANTEED LEU RESERVE

On 7 June 2007 Russia informed the IAEA of its intention to set aside a certain amount of enriched uranium product as a deposit for a guaranteed reserve being located at the IUEC. The reserve was designed as an additional mechanism of ensuring guaranteed LEU supply. The proposal of the Government of the Russian Federation was made in response to the IAEA Director General's initiative on assurances of supply of nuclear fuel,[17] and in the context of article 7 of the IUEC agreement. The article states that the parties may create a reserve of natural or enriched uranium at the IUEC, in accordance with Russian law and in coordination with the IAEA.

Speaking on 18 September 2007 at the fifty-first IAEA General Conference, Rosatom Director General Sergey Kiriyenko informed the agency members about the key specifications of the future reserve. He said the reserve would be large enough for two fuel loads for a 1,000MW light water reactor.[18]

Shortly afterwards Rosatom and the IAEA Secretariat entered consultations to develop a reliable mechanism that would enable the Agency to receive nuclear material from the reserve and supply it to a state that had requested assistance, regardless of the political circumstances. The two sides also discussed the eligibility criteria for receiving material from the reserve. Preliminary results of these discussions were outlined in a June 2009 report by the IAEA Director General, titled "Assurance of Supply—Russian Federation Initiative to Establish a Reserve of Low Enriched Uranium (LEU) to the IAEA for Its Member States".[19]

In accordance with the mechanism that was agreed by Rosatom and the IAEA, upon notification from the Director General of the Agency, the Government of the Russian Federation shall deliver from the guaranteed physical reserve the LEU requested to the IAEA in St Petersburg for further supply to the specified IAEA member state; the IAEA will verify that there has been no diversion of declared nuclear material and that there are no issues are under consideration by the IAEA Board of Governors relating to the application of IAEA safeguards. At the insistence of the IAEA it has been agreed that the transfer of ownership of the uranium being delivered from the guaranteed reserve will take place at the sea port so as to minimize the agency's potential liability for any nuclear damage, and to rule it out completely during the transportation of the material to the

St Petersburg sea port. In practice, ownership of the LEU shipment from the guaranteed reserve will be transferred almost immediately to the state that had requested the shipment. The LEU could be transferred to any non-nuclear-weapon state where the state has in force an agreement with the IAEA requiring the application of safeguards on all its peaceful nuclear activities.

In a 5 November 2009 letter to the IAEA Director General, the Russian permanent representative to the Agency requested to distribute a draft of the agreement between Russia and the IAEA on the establishment of a reserve for the member states, and to put the proposal on creating a physical reserve of LEU on Russian territory on the agenda of the next meeting of the IAEA Board of Governors in November.

After a discussion on 27 November 2009 the Board of Governors approved the draft of the agreement between Russia and the IAEA, and authorized the Director General to sign that agreement.[20] The Board also approved a model agreement to be signed between the IAEA and every member state requesting an LEU delivery from the reserve.

The agreement was signed at a ceremony in Vienna on 29 March 2010. IAEA Director General Yukiya Amano and IUEC Director General Alexey Lebedev also signed a contract on the implementation of certain technical and commercial aspects of the agreement. Under that contract, the IUEC is responsible for the delivery of LEU to the IAEA from the reserve.[21]

Article I.1 of the agreement stipulates that the size of the reserve is set at 120t of uranium hexafluoride enriched to 2–4.95% of U-235, with at least one third of that reserve enriched to 4.95%. According to article V the reserve is to be stored on the territory of the Russian Federation in a facility that is under IAEA safeguards based on the 21 February 1985 Safeguards Agreement between the Soviet Union and the IAEA (INFCIRC/327).

Article II.1 designates the IUEC as the authorized organization for the implementation of the agreement on the Russian side. Article V.1 stipulates that the guaranteed physical reserve is to be stored at a facility of the authorized organization.

The price of the LEU supplied from the reserve will be calculated based on publically available average spot market prices for the month preceding

the request for delivery. The value of the reserve is estimated at US$ 300 million as of early 2011.

Documents approved by the IAEA Board of Governors in November 2009 include the following eligibility criteria for receiving LEU from the reserve:

- an IAEA member state experiencing a disruption in the supply of LEU for its nuclear power reactors, that is not related to technical or commercial considerations, may request the Director General to provide assistance, in accordance with the IAEA's statutory function to, inter alia, act as an intermediary for the purpose of securing the performance of fuel cycle services or the supply of nuclear material, to obtain a specified quantity of LEU for the operation of specific nuclear power plants in that member state, along with an explanation of the circumstances in support of its request. In practice, a claim of disruption would be considered, if there is prima facie evidence proving the claim and no clear information to the contrary;
- a state requesting supply of LEU should have in force a safeguards agreement that applies to the LEU that would be supplied, and if the receiving state is a non-nuclear-weapon state then it should have placed all of its peaceful nuclear facilities under IAEA safeguards; and
- a conclusion must have been drawn in respect of the requesting state on the non-diversion of declared nuclear material in the most recent Safeguards Implementation Report, and there must be no safeguards issues under current consideration by the IAEA Board of Governors.[22]

If the request for an LEU delivery from the reserve is approved, the state that made the application must sign an agreement with the IAEA outlining all the terms of the delivery and the state's commitments regarding the use of the supplied material. The state must undertake the following commitments:

- not to use the LEU received from the IAEA to make a nuclear weapon or any nuclear explosive device—the LEU should be used exclusively for fuel fabrication for the generation of energy;
- not to further enrich the LEU received from the reserve and not to reprocess the spent nuclear fuel produced through the use of the LEU unless otherwise agreed with the IAEA; and

- to ensure proper safety standards and measures for the LEU received from the reserve in accordance with the existing standards.

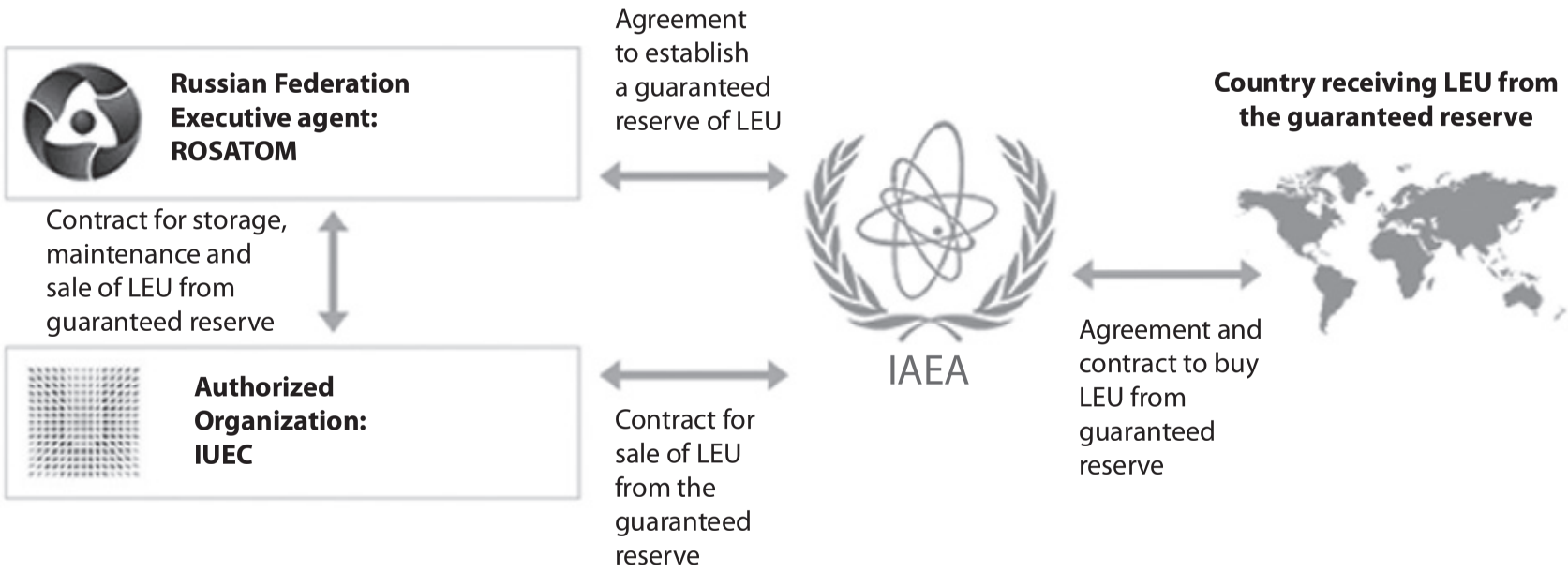
Once this agreement is signed, the IAEA Director General authorizes the LEU delivery from the reserve—without being required to take the matter to the Board of Governors or Russia. That is one of the key elements of the assurances mechanism. The Director General will not have to seek the approval of the Board of Governors, which may include representatives of states that may have suspended commercial uranium supplies for political reasons and might therefore try to block the allocation of uranium from the reserve. Under the agreement on establishing the reserve, upon receipt by Rosatom from the IAEA Director General of a request for delivery, the Russian Government shall make all necessary arrangements for issuing in a timely manner all authorizations and licenses that are required in accordance with the legislation of the Russian Federation.

Once the request is received from the IAEA Director General, the necessary quantity of LEU should be delivered from Angarsk to the St Petersburg sea port, whereupon the shipment becomes the property of the IAEA. Upon taking delivery of the shipment the IAEA immediately transfers its ownership to the state that had submitted the request, to limit liability in the case of accident. At that point Russia and the IAEA enter negotiations on replenishing the physical reserve of uranium to its initial size.

All the costs of implementing the agreement on establishing a guaranteed physical reserve of LEU will be borne by Russia, including the cost of creating the actual reserve, all the running costs (storage, nuclear safety and security measures, application of IAEA safeguards, etc.) as well as shipping costs (loading and container shipment to the St Petersburg sea port). The estimated annual cost of maintaining a guaranteed LEU reserve is in the hundreds of thousands of dollars. About US$ 1 million has already been spent on setting up the IUEC storage facility where the reserve is maintained.[23]

In late November 2010 the accumulation of the 120t of LEU was completed. In late December the IAEA conducted its first inspection at the IUEC storage facility, thereby formally placing it under the IAEA safeguards system. On 29 January 2011 the agreement between Russia and the IAEA on the creation of a guaranteed reserve entered into force.

Mechanism of LEU supply from the guaranteed reserve



Source: IUEC.

THE ROLE OF THE IAEA

Ever since Russia put forward the initiative on setting up a network of international NFC centres, it has viewed the IAEA as an important partner in that initiative's implementation. Announcing the initiative, then President Vladimir Putin said that the NFC centres should be set up "under IAEA control".[24] Article 10.3. of the agreement on the creation of the IUEC stipulates that "nuclear materials … are subject to IAEA safeguards within the territory of the Russian Federation, where applicable" in accordance with the 1985 Safeguards Agreement between the Soviet Union and the IAEA.

Under the IUEC and the guaranteed LEU reserve initiatives, the IAEA carries out three main functions:

- the IAEA does not have any regular role in the operation and management of the IUEC. However the Agency may participate in the work of the IUEC Joint Consultative Commission in an advisory capacity. The Commission deals with disputes between the IUEC executive bodies and addresses additional measures as may be required to enhance performance and efficiency of the founding agreement. As of February 2011, an IAEA representative has taken part in one meeting of the Joint Consultative Commission. The issue on the agenda of the meeting was the admission of Armenia's and Ukraine's authorized organizations to the IUEC as shareholders;
- the IAEA controls the guaranteed LEU reserve held at the IUEC storage facility, that is, the agency will make the decision on using the uranium reserve if a request to that effect is submitted by an IAEA member (the mechanism of supplying uranium from the guaranteed reserve has been described above); and
- the IAEA applies safeguards mechanisms to the IUEC storage facility.

The IAEA safeguards had previously been applied in practice to only three facilities in Russia: the IR-8 research reactor at the Kurchatov Institute, a VVER-1000 energy reactor (the no. 5 reactor of the Novovoronezhskaya nuclear power plant); and the Machine-Building Plant in Elektrostal (Moscow Region) where fresh nuclear fuel removed from Iraq had been stored.[25]

Also, even before the Safeguards Agreement was signed with Russia in 1985, IAEA inspectors conducted a pilot safeguards procedure at one of the VVER-440 reactors of the Novovoronezh nuclear power plant; several reactors of that type were being built in Eastern Europe at the time. In 1991 Russia conducted preparations to place the BN-600 fast-neutron reactor at the Beloyarskaya nuclear power plant under IAEA safeguards. The Agency was potentially interested in the reactor as a test bed for new safeguards procedures designed specifically for fast-neutron reactors. But due to financial constraints the IAEA has never conducted any actual safeguards procedures at the site.[26] For the same reason not a single facility that Russia has added to the eligibility list in recent years had actually been selected by the IAEA for conducting safeguards procedures. As a result, the IUEC uranium storage is the first Russian nuclear facility chosen by the IAEA for safeguards procedures in the past several years. (In fact, until very recently Russia remained the only nuclear-weapon state in which the IAEA safeguards procedures were not being conducted.) For the IAEA to be able to conduct safeguards procedures in Russia, several changes had to be made to Russian customs regulations to allow the inspectors to import the required equipment into Russia.

In order to facilitate access to the AECC for IAEA inspectors, in the fall of 2006 the Russian government removed the company from the list of "highly restricted access" companies. On 5 February 2007 the Russian Foreign Ministry officially informed the IAEA that Russia is prepared to grant IAEA inspectors access to the AECC and discuss the mechanisms of placing the IUEC under Agency safeguards. An IAEA delegation visited the facility on 20–22 March and discussed with Rosatom experts the implementation of the initiative to set up the IUEC at the AECC. The agenda included the application of IAEA safeguards to the IUEC operation. On 27 December 2007, in accordance with a government resolution, the IUEC and the AECC were put on the list of facilities that are eligible for IAEA safeguards under the 1985 Safeguards Agreement between the Soviet Union and the IAEA.

Following consultations both sides agreed that it would not be feasible to place the AECC under the safeguards system, because:

- Russia is a nuclear-weapon state under the NPT, which means that it is not obliged to place all of its nuclear material and facilities under IAEA safeguards and does so only on a voluntarily basis. Under article

1(a) of the agreement between the Soviet Union and the IAEA on the application of safeguards in the Soviet Union signed on 21 February 1985, Russia shall accept the application of safeguards by the Agency on all source or special fissionable material in peaceful nuclear facilities to be designated by Russia within its territory;

- under article 3(d) of the Safeguards Agreement between the Soviet Union and the IAEA, in applying the safeguards the Agency shall be guided by the objective of ensuring further development and improvement of safeguards techniques. At the same time, the IAEA is not interested in placing the entire AECC under the safeguards system in order to test the application of safeguards mechanisms at Russian-designed enrichment facilities. The Agency has already had an opportunity to test these mechanisms as part of the implementation of a contract to build an enrichment facility in China using Russian technology. Under the 18 December 1992 intergovernmental agreement signed between Russia and China on the construction of a gas centrifuge uranium enrichment plant on Chinese territory, Beijing undertook a commitment to place the new plant under IAEA safeguards. The Agency had not had previous experience with facilities of that type. The mechanism of safeguards at the URENCO gas centrifuge plants is substantially different from the mechanisms required for the Russian plants because the design of these plants is quite different. The Agency had therefore set up a trilateral working group that included experts from Russia, China and the IAEA itself. The Russian delegation included AECC experts. Also, one of the AECC enrichment facilities was chosen as a prototype for the new plant in China;[27] and
- under article 14 of the Safeguards Agreement, Russia and the Agency will bear the expenses incurred in implementing their respective responsibilities under the agreement. In practice, however, the IAEA tries not to increase the level of its safeguards activity in the nuclear-weapon states so as not to divert its financial and human resources from maintaining safeguards in non-nuclear-weapon states.

Rosatom and IAEA specialists agreed that only the IUEC storage where the actual LEU reserve is being kept should be placed under the IAEA safeguards. Article V.1. of the agreement emphasizes that “the guaranteed physical reserve of LEU … shall be stored in a facility … that is under IAEA safeguards”. Under article V.2, “the costs for the application of safeguards … shall be borne by the Government of the Russian Federation”.

The IUEC storage facility was selected by the IAEA for safeguards on 1 July 2010.[28] On 3 August Rosatom confirmed that the IUEC was ready to receive the IAEA inspectors and to have the necessary monitoring equipment installed on the premises.[29] On 30 September IAEA inspectors arrived at Angarsk and began the installation of the equipment required for conducting the safeguards procedures.[30] On 1 December it was announced that the accumulation of the physical LEU reserve at the IUEC site had been completed, and on 13 December the IAEA conducted its first inspection of the IUEC storage facility.[31]

After the inclusion in 2010 of AECC on the list of facilities open to safeguards procedures, the same step was taken with regard to the Siberian Chemical Complex, which is Russia's third-largest isotope separation plant.[32] It is therefore safe to say that the implementation of the initiative on multilateral approaches to the nuclear fuel cycle has resulted in greater transparency in the Russian nuclear industry, including its uranium enrichment plants.

WHY HAVE THE RUSSIAN INITIATIVES REACHED THIS STAGE?

Of the 12 initiatives on multilateral approaches to the nuclear fuel cycle, only two, both of them Russian, have been put into practice as of February 2011. The IUEC is up and running in Angarsk, and there is now a guaranteed reserve of LEU, held at the IUEC storage facility and controlled by the IAEA, but owned by Russia. Why have these two initiatives been implemented in practice while others still remain on paper? There are several contributing factors.

First, the initiative to build a global nuclear infrastructure was announced by the Russian president himself, and has therefore enjoyed strong political backing. Russia, which is one of the depositaries of the NPT, saw this as an important foreign-policy initiative, especially in the context of strengthening the nuclear non-proliferation regime and facilitating the development of peaceful nuclear energy. Most likely, the fact that this is a presidential initiative also helped it to be approved by the IAEA Board of Governors.

Second, the initiative received strong support from the Russian nuclear industry leadership, which is currently in the middle of an energetic

campaign to win new markets. The IUEC was one of the central issues under discussion during the recent trips of Rosatom Director General Sergey Kiriyenko to those states that are interested in developing nuclear energy. The industry therefore welcomes any new mechanisms that provide additional assurances of the reliability of the existing NFC services market, making nuclear energy a more attractive option to newcomer states.

Third, neither the IUEC nor the LEU reserve required new isotope separation infrastructure to be built. That contrasts sharply with Germany's proposal to build a multilateral uranium enrichment plant in an area to be administered by the IAEA. Russia's total capital expenditure to implement its two initiatives had reached only US$ 1 million by the end of 2010, which was spent setting up the IUEC storage facility. The expeditious creation of the LEU reserve was also made possible by Russia's willingness to shoulder all capital and running costs.

Fourth, the initiatives to set up the IUEC and the LEU reserve do not restrict the right of participating states to develop enrichment technologies on their national territories. The same cannot be said about the reserve of nuclear fuel proposed by the United States in September 2005 in Vienna,[33] or the Concept for a Multilateral Mechanism for Reliable Access to Nuclear Fuel proposed in June 2006 by a group of six enrichment service supplier states.[34]

Many developing countries view the proposed multilateral approaches to the nuclear fuel cycle as an attempt to restrict their right to develop nuclear energy, which is enshrined in the NPT. The situation is compounded by the fact that some of these initiatives really do make participation conditional on relinquishing the right to pursue national uranium enrichment programmes. Witness also the cautious wording of the recommendations for nuclear disarmament adopted unanimously at the NPT Review Conference in May 2010. The document urges the member states to continue:

> to discuss in a non-discriminatory and transparent manner under the auspices of IAEA or regional forums, the development of multilateral approaches to the nuclear fuel cycle, including the possibilities to create mechanisms for assurance of nuclear fuel supply … without affecting rights under the Treaty and without prejudice to national fuel cycle policies, while tackling the technical, legal and economic

> complexities surrounding these issues, including in this regard the requirement of IAEA full scope safeguards.[35]

The difficulties posed by the mixed international reaction to some of the initiatives can also be illustrated by the IAEA Board of Governors vote in November 2009 on the Russian proposal to set up a guaranteed LEU reserve. The resolution was introduced by Russia jointly with 13 other states (Azerbaijan, Canada, Denmark, France, Japan, Spain, Mongolia, the Netherlands, the Republic of Korea, Romania, Ukraine, the United Kingdom and the United States). Of the 34 members of the Board, 23 supported the proposal, 8 voted against it and 3 abstained.[36]

It must be noted, however, that the IUEC proposal initially made participation conditional on foregoing national enrichment programmes. A provision to that effect was included in the draft of the agreement on setting up the IUEC. Article 6 of the document read that "the IUEC is open for joining by interested organizations representing third countries which abide by their commitments under the NPT and do not have uranium enrichment facilities on their territory".[37] But during discussions on the multilateral NFC initiatives at the IAEA many states indicated that they were not prepared to relinquish the right to pursue uranium enrichment programmes (these included Argentina, Australia, Canada, Kazakhstan, South Africa and Ukraine). As a result, the requirement was struck out of the final text of the IUEC agreement shortly before the signing ceremony. The agreement between the governments of Russia and Kazakhstan merely reads that states that do not develop uranium enrichment facilities on their own territory will be the first in line for IUEC services.

PROJECT OUTCOMES AND EXPERIENCE GAINED

The IUEC has yet to commence regular shipments to its stakeholders (only one delivery has been made as of December 2010), and the LEU reserve was officially inaugurated only in December 2010. Nevertheless, some conclusions can already be made as to the effects the Russian initiatives may have on multilateral approaches to the nuclear fuel cycle. It has already become clear that the creation of the IUEC and guaranteed LEU reserve may help future multilateral NFC and guaranteed reserve projects in the following ways:

1. The implementation of the Russian initiatives in practice could help to overcome the existing scepticism regarding the feasibility of such initiatives dating back to the failures from the 1950 to the 1980s. It could also help to remove an important psychological barrier on the path to the creation of international NFC centres. At the same time, the vote on the Russian initiative by the IAEA Board of Governors has demonstrated that international approaches to the NFC and assurance mechanisms require more active participation by the states of the Non-Aligned Movement.

2. The establishment of the guaranteed reserve has bolstered the role of the IAEA in regard to energy; the Agency has lately been accused by some developing countries of focusing too much on its safeguards activities and neglecting its mission of facilitating the global development of nuclear energy. The establishment of a guaranteed LEU reserve gives the IAEA new tools to carry out its statutory functions. One of these functions, per article III.A.1 of the statute, is to encourage the "development and practical application of … atomic energy for peaceful uses throughout the world; and, if requested to do so, to act as an intermediary for the purposes of securing the performance of services or the supplying of materials, equipment, or facilities by one member of the Agency for another".

3. In the context of multilateral approaches to the nuclear fuel cycle, the IUEC can also be viewed as a pilot project and a test bed to sort out various organizational issues and gain valuable experience that can later be used for setting up new centres. The IAEA and Rosatom experts spent almost three years negotiating the mechanism of supply assurances, the eligibility criteria for access to material from the guaranteed reserve, and the ownership of liability for any nuclear-related damage. This valuable experience can facilitate the implementation of future initiatives on assurances of LEU supply. In fact, it has already been used during the practical implementation of the initiative to set up the IAEA nuclear fuel bank. As for the IAEA itself, this has been the first experience of conducting commercial talks and signing a commercial contract—more specifically, the contract between the IAEA and the IUEC on the supply of material from the guaranteed LEU reserve.

4. The IUEC project is not without its shortcomings. The most serious is that the Center does not have its own uranium enrichment capacity

at this stage, which makes participation in the initiative less attractive to potential customers. But the experience gained—both positive and negative—can be very useful in setting up regional uranium enrichment centres, the need for which will become obvious in the coming years as an increasing number of states and indeed entire regions (South-East Asia, the Middle East, etc.) are showing keen interest in nuclear energy. These states have neither the technology nor economic need to build national enrichment facilities, especially considering that their national markets for enriched uranium will be rather small. The IUEC could serve as a viable model for guaranteeing supply by means of establishing regional enrichment centres.

5. The idea of denationalizing sensitive facilities in the context of nuclear disarmament and the aspiration to achieve "nuclear zero" has received new impetus in recent years. Now that the IUEC is up and running we have a clearer idea of the possible mechanisms for extending IAEA and multilateral controls to national enrichment facilities previously involved in the military programmes of a nuclear-weapon state.[38] The mechanism for the AECC, whose separation capacity the IUEC relies on, included the following steps:

- in the 1980s Russia ended the AECC's involvement in the production of highly enriched uranium for nuclear weapons;
- in 2007 the AECC was added to the list of facilities that can be selected by the IAEA for safeguards procedures;
- in 2010 one of the facilities on the premises of the AECC (the IUEC nuclear storage) was actually selected by the IAEA for safeguards procedures; and
- there are plans to allow the IUEC to acquire a stake in the AECC.

The AECC could therefore serve as one of the models for the phased transition of enrichment facilities previously involved in military nuclear programmes to being part of an assured LEU supply mechanism.

APPENDIX A

IUEC AND LEU RESERVE TIMELINE

2006

25 January—Speaking at a summit of the Eurasian Economic Community in St Petersburg, Russian president Vladimir Putin announces the initiative to set up "a network of international centres offering nuclear fuel cycle services, including enrichment, under IAEA control" based on the principle of non-discriminatory access.

22 September—At the fiftieth IAEA General Conference Russia officially informs the Agency that it is setting up the IUEC at the Angarsk Electrolysis Chemical Complex as a pilot project in the framework of the Russian presidential initiative.

November—The Russian Government removes the AECC from the list of "severely restricted access" facilities in order to enable the creation of the IUEC on the AECC's premises.

2007

5 February—The Russian Foreign Ministry officially informs the IAEA that Russia is prepared to grant IAEA inspectors access to the AECC and to discuss the mechanism of placing the IUEC under IAEA safeguards.

6 February—The Government of Kazakhstan adopts a resolution "On Signing the Agreement between the Government of the Republic of Kazakhstan and the Government of the Russian Federation on Foundation of the International Uranium Enrichment Center".

27 April—President Vladimir Putin signs decree no. 556 "On the Restructuring of Russia's Nuclear Energy Sector" under which the AECC is included in the list of companies to be restructured into public joint-stock companies.

10 May—The governments of Russia and Kazakhstan sign the agreement on the foundation of the IUEC. The ceremony is held in Astana.

7 June—Russia officially proposes the creation of a guaranteed LEU reserve in response to IAEA Director General Mohamed ElBaradei's initiative on assurances of supply of nuclear fuel.

3 August—The Russian–Kazakh agreement on the foundation of the IUEC enters into force.

6 August—Stakeholders approve the charter of the IUEC, drawn in accordance with Russian law.

5 September—The IUEC obtains registration as a legal entity and as a public joint-stock company.

18 September—At the fifty-first IAEA General Conference, Rosatom Director General Sergey Kiriyenko informs IAEA members about the specifications of the guaranteed LEU reserve to be created.

27 December—The Russian Government adds the IUEC and the AECC to the list of facilities that are eligible for IAEA safeguards in accordance with the 21 February 1985 Safeguards Agreement between the Soviet Union and the IAEA.

2008

17 January—The Russian Foreign Ministry officially informs the IAEA that the IUEC and the AECC have been added to the list of facilities that are eligible for IAEA safeguards.

1 February—The Russian Government issues a resolution on the participation of the Republic of Armenia's authorized organization in the IUEC.

25 August—Russian presidential decree no. 1251 adds the IUEC to the list of Russian legal entities allowed to own nuclear materials.

1 September—The IUEC obtains a license for use of nuclear materials from the Federal Service for Environmental, Industrial and Nuclear Supervision (Rostekhnadzor), valid until 31 August 2011.

10 October—The IUEC obtains a license from the Security Service of the Russian Federation (FSB) to conduct activities requiring access to information constituting Russian state secrets, valid until 2 October 2013.

27 November—The Ukrainian Cabinet of Ministers approves a draft of the agreement with Russia and Kazakhstan on Ukraine's participation in the IUEC.

December—The IUEC delivers its first shipment of enriched uranium product.

2009

31 January—The Russian Government issues a resolution on the participation of Ukraine's authorized organization in the IUEC.

13 March—The Russian Foreign Ministry submits to the IAEA a document detailing the Russian initiative on the creation of a guaranteed LEU reserve (INFCIRC/748).

5 August—The intergovernmental agreement on Armenia's participation in the IUEC is signed.

26 October—A 90% stake in the IUEC owned by Tenex is transferred to Rosatom, following the approval of the transfer by the Federal Anti-Monopoly Service.

16 November—Diplomatic notes are exchanged with the Ukrainian Government on the participation of the authorized Ukrainian company in the IUEC.

27 November—The IAEA Board of Governors approves a draft of the agreement between the Government of the Russian Federation and the IAEA on setting up a reserve for guaranteed provision of LEU to IAEA members at the request of the IAEA; the Board authorizes the Director General to sign the agreement.

2010

29 March—The Government of the Russian Federation and the IAEA sign the agreement regarding establishment on Russian territory of a physical reserve of LEU and the supply of LEU therefrom to the IAEA for its member states. The agreement is signed by IAEA Director General Yukiya Amano and Rosatom Director General Sergey Kiriyenko.

29 March—The IUEC and the IAEA sign a contract on the implementation of certain technical and commercial aspects of the agreement, under which the IUEC undertakes to supply LEU from the guaranteed reserve to the IAEA. The contract is signed by IAEA Director General Yukiya Amano and IUEC Director General Alexey Lebedev.

1 July—The IAEA selects the IUEC storage facility for safeguards application.

30 September—IAEA inspectors begin the installation of monitoring equipment at the IUEC storage facility as part of the safeguards procedures.

5 October—The procedure of transferring a 10% stake in the IUEC to Ukraine's authorized organization is completed.

29 November—The stocking of the guaranteed LEU reserve (120t) is completed.

13 December—The first full-scale IAEA inspection is conducted at the IUEC storage facility.

2011

29 January—The agreement between the Government of the Russian Federation and the IAEA regarding establishment on Russian territory of a physical reserve of LEU and the supply of LEU therefrom to the IAEA for its member states enters into force.

APPENDIX B

IUEC FOUNDING AGREEMENT

Agreement between the Government of the Russian Federation and the Government of the Republic of Kazakhstan on Foundation of the International Uranium Enrichment Center

(unofficial translation, available at <http://eng.iuec.ru/docs/agreement/>)

The Government of the Russian Federation and the Government of the Republic of Kazakhstan, hereinafter referred to as "the Parties",

understanding the need of every possible strengthening of nuclear weapons non proliferation regime and the jeopardy of sensitive nuclear technologies proliferation including the uranium enrichment technology,

recognizing the right of the States to a non-discriminatory and assured access to the amenities of use of nuclear energy for peaceful purposes upon their compliance with the obligations provided by the international nuclear weapons non-proliferation regime,

whereas the Russian Federation and the Republic of Kazakhstan are the parties to the Nuclear Weapons Non-Proliferation Treaty of July 1st, 1968,

considering that as of the Date of Conclusion of this Agreement the Republic of Kazakhstan does not have uranium enrichment facilities within its territory,

sharing the understanding that the establishment of international centers for providing services in nuclear fuel cycle, including uranium enrichment under control (safeguards) of the International Atomic Energy Agency (hereinafter referred to as "the IAEA") is the key element of the global infrastructure of atomic energy allowing to ensure an equal access of all interested countries to the atomic energy provided the nuclear weapons non-proliferation regime has been met,

based on the Agreement between the Government of the Russian Federation and the Government of the Republic of Kazakhstan on cooperation in the use of nuclear energy for peaceful purposes of September 23rd, 1993, and the Agreement between the Government of the Russian Federation and the Government of the Republic of Kazakhstan on integration of nuclear fuel cycle facilities on July 6th, 1998,

based on the intentions of the Russian Federation and the Republic of Kazakhstan to develop nuclear industry and enhance performance of bilateral cooperation by joining cooperative potentials of both countries in the use of nuclear energy for peaceful purposes,

have agreed as follows:

Article 1

This Agreement is made for the purposes of establishing the International Uranium Enrichment Center (hereinafter referred to as "the Center") and defining the basic terms of its activity.

Article 2

1. The executive bodies of the Parties under this Agreement are the following:

From the Russian Side: the Federal Agency for Atomic Energy;

From the Kazakhstan Side: the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan.

2. The authorized initiating bodies of the Center (the participants of the Center) are the following:

From the Russian Side: Joint Stock Company "Techsnabexport";
From the Kazakhstan Side: Joint Stock Company "National Atomic Company Kazatomprom".

3. In the event of change of executive bodies and authorized initiating bodies, their names or activities, the Parties shall notify each other through diplomatic channels about such a change.

Article 3

The Center shall be established pursuant to the Laws of the Russian Federation as an Joint Stock Company by the authorized initiating bodies, as defined in the Article 2 herein and based in Angarsk (the Russian Federation).

The main task of the Center is to secure an assured access to the uranium enrichment facilities, based with Federal State Unitary Enterprise "Angarsk Electrolysis Chemical Complex" (hereinafter referred to as "the Facility") primarily for institutional participants of the Center from the states which do not develop the uranium enrichment facilities on their territory, for the purposes of providing the uranium enrichment services for fuel fabrication (powders, pellets, fuel assemblies) for nuclear industry needs.

To do its business the Center shall meet the provisions of this Agreement, the Laws of the Russian Federation and the Articles of Association of the Center.

The authority and operating practices of the Center shall be guided by its Articles of Association to be approved by the authorized initiating bodies as may be agreed with the executive bodies of the Parties.

Article 4

In accordance with the laws of their countries the Parties shall contribute to the executive bodies and authorized initiating bodies to provide the required conditions for the establishment of the Center and promote the Center's business, including the acquisition of interest in uranium enrichment facilities.

Article 5

1. The Center is open for interested entities of the third states that perform the obligations under the Nuclear Weapons Non-Proliferation Treaty of July 1st, 1968 and share the objectives and tasks of the Center. Such participation shall be effected by individual government-to-government agreements between the Parties hereto and governments of the third States in the manner prescribed in the Articles of Association of the Center.

2. Institutional participants of the Center shall be entitled to dividends and have the right to participate in the management of the Center, inter alia, to the knowledge of details related to the Center's business and operations

and bear responsibility under the Laws of the Russian Federation and Articles of Association of the Center.

3. The enriched uranium produced by the Center and exported from the Russian Federation shall be used for fuel fabrication (powders, pellets, fuel assemblies) for nuclear industry needs.

Article 6

For the effective implementation of the objectives of this Agreement the Parties shall establish the Joint Consultative Commission (hereinafter referred to as "the Commission"), which Commission shall:

Deal with disputes between the executive bodies of the Parties concerning the interpretation and application of this Agreement including without limitation to those related to securing of the requirements of nuclear weapons non-proliferation regime.

Address additional measures as may be required to enhance performance and efficiency of this Agreement.

The executive bodies of the Parties shall determine Russian and Kazakhstan members of the Commission, respectively, equal in number, and each Party shall appoint its chairman.

The Commission shall be chaired by the national parts in turn. Each chairman shall be taking the lead of the Commission for one year.

The meetings of the Commission shall be held within the territory of the country of the presiding Party twice a year or more at the request of one of the Parties.

The decisions of commission shall be treated as recommendations and made by unanimous vote. As may be agreed with the IAEA the representative from the IAEA may participate in the work of the Commission in an advisory capacity.

Article 7

In accordance with the Laws of the Russian Federation and as may be agreed with the IAEA the Parties may accumulate natural and enriched

uranium reserves at the Center which can be used to perform obligations of the Center to institutional participants of the Center.

The amount of nuclear material transferred to reserves as well as conditions of accumulation for the reserve shall be reviewed within the Commission in advance.

Articles 8

The Parties shall cooperate with the IAEA on the Center's operations. The particular parameters of such cooperation are subject to individual agreements between the Parties and the IAEA.

Article 9

1. Under this Agreement the Russian Party, including its authorized initiating body, shall not transfer to the Center, or the Kazakhstan Party, including its authorized initiating body, as well as to the states which institutions are participants of the Center, and their individuals and legal entities, the technology of uranium enrichment as well as appropriate equipment, units, devices, materials, design and engineering solutions both in aggregate or in parts.

2. An access to the territory of the Federal State Unitary Enterprise "Angarsk Electrolysis Chemical Complex" of the representatives of institutional participants and the staff of the Center to do the Center's business as prescribed in the Articles of Association, including production and operating activities shall be allowed pursuant to the Laws of the Russian Federation and can be governed by the additional arrangements of executive bodies of the Parties.

Article 10

1. Exports and imports of nuclear materials for its processing by the Center and future use for the purposes of this Agreement shall be carried out in accordance with the Parties' obligations, arising of the Nuclear Weapons Non-Proliferation Treaty of July 1st, 1968 and other international agreements and arrangements, which participants are the Russian Federation and the Republic of Kazakhstan.

2. Nuclear materials, specified in the paragraph 1 of this Article, as well as nuclear materials produced on their basis and as a result of their use,

shall not be used for nuclear weapons production and production of other nuclear explosive devices or be used for any military purpose.

3. Nuclear materials specified in the paragraph 1 of this Article are subject to the IAEA safeguards within the territory of the Russian Federation, where applicable, under jurisdiction and responsibility of the Russian Federation pursuant to the Agreement between the International Atomic Energy Agency and the Union of Soviet Socialist Republics for the application of safeguards in the Union of Soviet Socialist Republics of February 21st, 1985, INFCIRC/327, and within the territory of the Republic of Kazakhstan, under jurisdiction and responsibility of the Republic of Kazakhstan pursuant to the Agreement between the International Atomic Energy Agency and the Republic of Kazakhstan for the application of safeguards in connection with the Nuclear Weapons Non-Proliferation Treaty of July 26th, 1994, INFCIRC/504 and Additional Protocol of February 6th, 2004.

Article 11

Each Party shall take all the appropriate measures provided in the laws of its state to ensure physical protection of the Center's facilities and nuclear materials intended for objectives of the Center's business, at levels not lower than those provided in the IAEA document "Physical Protection of Nuclear Material and Nuclear Facilities", INFCIRC 225/Rev.4, or its later revisions.

Article 12

The Parties shall provide each other with the information on the issues related to this Agreement pursuant to the laws of their countries.

The information classified as State Secret shall not be transferred under this Agreement.

The information transferred under this Agreement and classified as confidential by the executive bodies, authorized initiating bodies or the Center shall be clearly defined as confidential while transferring the same, and the documents containing the confidential information must be marked as "confidential".

The confidential information recipients shall use it pursuant to the arrangements between the sender and the recipient and the laws of their states.

The confidential information shall not be disclosed and transferred to the third parties without prior written consent of the disclosing Party.

Article 13

The Parties, including their authorized initiating bodies and the Center, shall take the measures to prevent unauthorized access to protected technologies and products related to performance of work under this Agreement and unauthorized transfer of such technologies and products to the third states, their individuals and legal entities as per international laws and laws of the states of the Parties.

Article 14

The disputes between the Parties, arising out of the interpretation and application of this Agreement, shall be settled by negotiations carried out between the Parties.

Article 15

This Agreement does not involve the rights and obligations of each Party, arising of other international agreements, whose parties are the Russian Federation and the Republic of Kazakhstan.

Article 16

Upon mutual consent of the Parties this Agreement may be amended with separate protocols.

Article 17

This Agreement shall enter into force from the date of receipt through diplomatic channels of the last written notification of performance by the Parties the intrastate procedures required for its entry into force. This Agreement shall made for a period of ten years and then automatically extended for the next ten-year periods unless either Party has notified the other Party in writing about its intention to terminate the same not later than one year prior to the expiry of the corresponding period.

The termination of this Agreement does not mean the termination of the Center as a legal entity. Further business of the Center shall be determined by international agreements, the Laws of the Russian Federation and the Articles of Association of the Center.

In the event of termination of this Agreement the provisions of paragraph 3 of Article 5 and Article 10 are binding on and applicable to the Parties until the enriched uranium produced by the Center as well as nuclear materials produced on its basis or as a result of its use have been fully consumed or become unsuitable for any nuclear use.

Done in duplicate in Astana on this day of [10] May 2007, each in Kazakh and Russian languages, both texts being equally authentic. In the event of different interpretation of the provisions of this Agreement the Russian text shall prevail.

APPENDIX C

LEU RESERVE AGREEMENT

Agreement between the Government of the Russian Federation and the International Atomic Energy Agency Regarding the Establishment on the Territory of the Russian Federation of a Physical Reserve of Low-Enriched Uranium and the Supply of Low-Enriched Uranium therefrom to the International Atomic Energy Agency for its Member States

(available at <http://eng.iuec.ru/docs/agreement/>)

WHEREAS the Government of the Russian Federation wishes to contribute to the further development of cooperation in the field of the peaceful use of atomic energy;

BEARING IN MIND that under its Statute, the IAEA is authorized to encourage and assist in the development and practical application of atomic energy for peaceful purposes throughout the world and arrange for the supply of nuclear material to the IAEA Member States to be used in accordance with the provisions of its Statute;

BEARING IN MIND the need to meet in an assured manner the demand for nuclear fuel for electricity generation of IAEA Member States;

BEARING IN MIND the initiative of the Director General of the IAEA on the creation of a reserve of low enriched uranium for the purposes of assured supply of low enriched uranium, for any Member State of the IAEA suffering a supply disruption unrelated to technical or commercial considerations;

BEARING IN MIND the proposal of the Government of the Russian Federation to establish, using its own resources, a guaranteed physical reserve for supply to third countries of low enriched uranium subject to notification by the IAEA;

NOW, THEREFORE, the Government of the Russian Federation and the IAEA hereby agree as follows:

Article I

1. The Government of the Russian Federation shall establish a guaranteed physical reserve of low enriched uranium of 120 tonnes in the form of uranium hexafluoride (UF_6) with an enrichment of 2.0% to 4.95%, of which at least one third has an enrichment of 4.95% (hereinafter referred to as "the guaranteed physical reserve of LEU").

2. Upon notification from the Director General of the IAEA, the Government of the Russian Federation shall deliver from the guaranteed physical reserve the LEU requested in such notification (hereinafter referred to as "the LEU") to the IAEA in St. Petersburg, for further supply to IAEA Member States, with respect to which the IAEA has drawn the conclusion that there has been no diversion of declared nuclear material and concerning which no issues are under consideration by the IAEA Board of Governors relating to the application of IAEA safeguards. The LEU could be transferred to any non-nuclear-weapon State only when the receiving State has brought into force an agreement with the IAEA requiring the application of safeguards on all its peaceful nuclear activities.

3. After delivery of the LEU, the Government of the Russian Federation and the IAEA shall enter into discussions on the replenishment of the guaranteed physical reserve to the quantity set out in paragraph 1 of this article.

4. The Russian Federation is the owner of the LEU. Ownership of the actual amount of the LEU delivered shall be transferred to the IAEA upon delivery of the LEU to the IAEA as provided for in paragraph 2 of this article.

5. Upon the IAEA becoming an owner of the LEU on the territory of the Russian Federation, the IAEA shall be able to automatically transfer its ownership of the LEU to the Consumer State (as defined in paragraph 8 below) immediately upon the IAEA so becoming owner, and the Government of the Russian Federation shall timeously create the necessary conditions for such transfer of ownership.

6. The delivered LEU shall meet the latest ASTM C-996 standard specification for UF6 enriched to less than 5% U-235, or any replacement of such standard specification.

7. Expenses relating to the storage and maintenance of the LEU shall be borne by the Government of the Russian Federation prior to the transfer of ownership to the IAEA of the actual amount of the delivered LEU as provided for in paragraph 4 of this article.

8. The LEU shall be used in accordance with the provisions of the Statute of the IAEA and this Agreement. The IAEA will, prior to the notification by the Director General as provided for in paragraph 2 of this article, conclude an agreement with the Government of the State to which the LEU will be supplied (the "Consumer State") which will include the following undertakings by the Consumer State:

(a) to not use the LEU, and any nuclear and special non-nuclear material produced through its use, to produce nuclear weapons or other nuclear explosive devices or to further any military purpose;

(b) to maintain physical protection measures for the LEU at levels not lower than that specified in INFCIRC/225/Rev.4, as revised from time to time;

(c) to use the LEU at nuclear power plants only to produce energy; the safety standards and measures for handling, storing and shipment set forth in IAEA document INFCIRC/18/Rev.l, as revised from time to time shall be applied to the LEU; and

(d) to not re-export or further enrich the LEU nor reprocess spent nuclear fuel (hereinafter referred to as "SNF") produced through the use of the LEU, unless otherwise agreed with the IAEA.

9. The Government of the Russian Federation and the IAEA may hold consultations with the Consumer State regarding the disposition of SNF produced from the LEU.

10. Upon receipt by the executive authority of a notification from the Director General of the IAEA for the withdrawal of the LEU, the Government of the Russian Federation shall make all the necessary arrangements for issuing timeously all authorizations and licenses that are necessary in accordance with the legislation of the Russian Federation for the import of international transport containers and the transit and transport of the LEU on the territory of the Russian Federation.

11. Upon receipt by the executive authority of a notification from the Director General of the IAEA for the withdrawal of the LEU, the Government of the Russian Federation shall make all necessary arrangements for issuing timeously all authorizations and licenses that are necessary in accordance with the legislation of the Russian Federation for the export of the LEU from the Russian Federation.

Article II

1. The Government of the Russian Federation appoints the State Atomic Energy Corporation "Rosatom" (hereinafter referred to as the "executive authority") to implement this Agreement on its behalf. The executive authority appoints the Open Joint Stock Company "International Uranium Enrichment Centre" (hereinafter referred to as the "authorized organization") to conclude a contract on its behalf for the supply of the LEU to the IAEA.

2. Prior to any change of the executive authority or the authorized organization, the Government of the Russian Federation shall notify the IAEA thereof through diplomatic channels and shall make all necessary arrangements for the continuous fulfillment of all rights and obligations arising from this Agreement and underlying contracts.

Article III

1. The IAEA shall secure payment for the LEU delivered. The price of the LEU delivered shall be the cost of the LEU at spot prices published by relevant known consulting companies averaged over a period preceding the LEU delivery. Currently, such spot prices include, amon other things, costs that are attributable to the transportation of international transport containers on the territory of the Russian Federation, loading of the LEU into the containers, packaging of the containers loaded with the LEU into protective shipping packages, insurance of the LEU, its transportation to seaport of St. Petersburg and loading on board of ship.

2. Payment for the LEU shall be effected by wire transfer made on the day of delivery of the LEU to the IAEA.

Article IV

1. Liability for nuclear damage caused by a nuclear incident associated with the storage, handling or transport of the LEU shall be governed by the

provisions of the Vienna Convention on Civil Liability for Nuclear Damage of 1963.

2. In case the Vienna Convention is not applicable, the owner of the LEU will assume liability for any damage caused by an incident associated with the storage, handling or transport of the LEU.

Article V

1. The guaranteed physical reserve of LEU, as defined in paragraph 1 of article I of this Agreement, shall be stored on the territory of the Russian Federation in a facility of the authorized organization that is under IAEA safeguards in accordance with the Agreement between the Union of Soviet Socialist Republics and the IAEA for the Application of Safeguards in the Union of Soviet Socialist Republics of 21 February 1985, (INFCIRC/327).

2. The costs for the application of safeguards pursuant to paragraph 1 of this article shall be borne by the Government of the Russian Federation.

Article VI

The Government of the Russian Federation shall ensure that the safety standards and measures for the handling, storage and shipment of the LEU as set forth in IAEA document INFCIRC/18/Rev. 1, as revised from time to time by Board of Governors of the IAEA, are applied.

Article VII

The Government of the Russian Federation agrees to the application of levels of physical protection during the handling, storage and shipment of the LEU and shall ensure that adequate physical protection measures are applied no lower than the levels set forth in the IAEA document "The Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC/225/Rev. 4 or subsequent versions adopted by the Government of the Russian Federation).

Article VIII

1. The Russian Federation shall not provide to the IAEA information constituting its State secrets.

2. Information transferred under this Agreement or generated as a result of its implementation which is viewed by Government of the Russian Federation or the IAEA as information regarding which there is a need to maintain confidentiality shall be clearly defined and marked as such.

3. The information mentioned in paragraph 2 of this article transferred under this Agreement or the contract mentioned in paragraph 1 of Article II of this Agreement shall be treated by the Government of the Russian Federation and the IAEA respectively in accordance with the legislation of the Russian Federation and the confidentiality regime of the IAEA. Such information shall be used only in accordance with this Agreement, and shall not be disclosed and transferred to a third party without the written consent of the Government of the Russian Federation and the IAEA.

Article IX

Any dispute between the IAEA and the Government of the Russian Federation related to the interpretation or implementation of this Agreement shall be settled by consultations between them.

Article X

1. This Agreement shall enter into force thirty days after receipt by the Director General of the IAEA of notification from the Government of the Russian Federation that the domestic procedures necessary for its entry into force have been completed and that at least one third of the guaranteed physical reserve of LEU mentioned in Article 1 of this Agreement has been established, and that guaranteed physical reserve is under IAEA safeguards in accordance with the Agreement between the Union of Soviet Socialist Republics and the IAEA for the Application of Safeguards in the Union of Soviet Socialist Republics of 21 February 1985 (INFCIRC/327).

2. This Agreement shall be concluded for an indefinite period. Either the Government of the Russian Federation or the IAEA may at any time give the other party written notification of its intention to terminate this Agreement. In such a case, this Agreement shall cease to be in force one year after receipt by the other party of such notification.

DONE in duplicate each in the Russian and English languages, both texts being equally authentic.

LEGAL FRAMEWORK FOR A STATE HOSTING AN IAEA LEU BANK

Zoryana Vovchok*

INTRODUCTION

The origins of an International Atomic Energy Agency (IAEA) low-enriched uranium (LEU) bank may be traced back to October 2003, when IAEA Director General Mohammed ElBaradei called for the creation of a new international framework for nuclear energy to assure to states supplies of civilian nuclear reactor technology and fuel, while strengthening the nuclear non-proliferation system through multilateral approaches.[1] In June 2007, the IAEA Director General submitted to the Board of Governors his report entitled *Possible New Framework for the Utilization of Nuclear Energy: Options for Assurance of Supply of Nuclear Fuel*.[2] This report proposed, among other things, a multi-layered reliable supply mechanism, based on the existing market, and supplier commitments, backed up by reserves of enriched uranium, which would support the expansion of nuclear energy and strengthen the nuclear non-proliferation system. In this context, it was envisaged that an international LEU bank under IAEA control would play an important role, as a supply of last resort. Such an LEU bank could be based on a physical stock of LEU or could be a virtual stock.[3]

In June 2009, the IAEA Director General submitted two proposals to the Board of Governors: one on the establishment of an IAEA-owned and -operated LEU bank (as originally proposed by the Nuclear Threat Initiative in September 2006),[4] and the other on an LEU reserve to be established by the Russian Federation at the International Uranium Enrichment Centre in Angarsk—both were meant for the use of IAEA member states experiencing supply disruptions not related to non-proliferation, commercial or technical considerations.[5] The second proposal was agreed on 27 November 2009, when the IAEA Board of Governors adopted a resolution by vote to

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* Only personal views are expressed in this paper, solely for purposes of discussion.

approve the "Request by the Russian Federation regarding its Initiative to Establish a Reserve of Low Enriched Uranium (LEU) for the Supply of LEU to the IAEA for its Member States" (the Physical Reserve Agreement).[6]

The proposal for the IAEA LEU bank was submitted to the IAEA Board of Governors on 26 November 2010 by member states of the European Union on the Board of Governors (Belgium, the Czech Republic, Denmark, France, Germany, Italy, the Netherlands, Portugal and the United Kingdom), Japan, the Republic of Korea, the Russian Federation, the United Arab Emirates and the United States of America.[7] The proposal was based on the June 2009 IAEA paper (GOV/2009/30) and was approved by the Board of Governors on 3 December 2010 by voting on a resolution on "Assurance on Nuclear Fuel Supply" submitted by the states noted above.[8]

The specific origins of the IAEA LEU bank concept go back to September 2006 when, at a Special Event on Multilateral Approaches to the Nuclear Fuel Cycle organized by the IAEA, Nuclear Threat Initiative (NTI) proposed to establish a stockpile of nuclear fuel, owned and managed by the IAEA, to serve as a back-up guarantee for nuclear fuel supply arrangements. The NTI's proposed financial contribution of US$ 50 million was contingent on the following two conditions that had to be met by 2008: 1) that the IAEA take the necessary actions to approve establishment of this stockpile of nuclear fuel; and 2) that one or more member states contribute an additional US$ 100 million in funding or an equivalent value of LEU to set up the stockpile. Every other element of the stockpile—its structure, location, and conditions for access—would be left to the IAEA and its member states to decide. Initially, the NTI noted that the pledged funds would be made available to the IAEA until 2008. Thus, the IAEA was expected to raise the required US$ 100 million and to have the Board of Governors take a decision to establish the LEU bank by that time. Due to lack of consensus on the matter in the Board of Governors, the Director General requested the NTI to extend the deadline to the end of September 2009, then to the end of September 2010 and finally to September 2011 for the IAEA member states to take the decision to establish an LEU bank. Member states have pledged in excess of US$ 100 million: Norway (US$ 5 million), the United States of America (US$ 49,540,000), the United Arab Emirates (US$ 10 million), the European Union (up to €25 million) and Kuwait (US$ 10 million). Both Norway and the United States have paid their contributions in full to the IAEA.[9] Kazakhstan has offered to provide a location for an IAEA LEU bank and underlined its readiness to

bear the costs of the bank (see below). Following the discussion of the bank proposal and in response to member states' requests for further information on the technical, financial and legal aspects of the bank, as well as of the potential location, the IAEA Secretariat commissioned two reports prepared by nuclear industry experts, Pacific Development Services Inc.[10] and Edlow International Company,[11] on cost and management of an IAEA LEU bank and on LEU transportation, respectively.[12]

The proposal for an IAEA LEU bank was approved by the Board of Governors on 3 December 2010. It refers to a Host State in which the IAEA LEU bank will be located.[13] In particular, in one of the Recommended Actions, the Board "request[ed] the Director General to consider proposals from any Member State interested to act as a Host State for the IAEA LEU bank on the basis foreseen in this document and to negotiate with it a draft Host State Agreement", in accordance with the elements set out in the proposal.[14] These elements include the application of IAEA safeguards to the LEU in the bank, as well as the application of safety standards and measures and physical protection measures by the Host State or States.[15] A Host State shall be a member state of the IAEA and, for effective operation of the LEU bank, it should preferably have a developed nuclear infrastructure. Paragraph 16 of the proposal envisaged some requirements for the Host State Agreement that will need to be concluded between the IAEA and a Host State, which shall be similar to the present IAEA Headquarters Agreement.[16] It shall provide for the safety and security and appropriate liability coverage of the storage facility and shall afford the necessary privileges and immunities to the Agency for the independent operation of the IAEA LEU bank, including the right to transport LEU to and from the bank, as determined by the Agency in accordance with the IAEA Statute. These and other requirements, such as the terms of (re-) licensing of cylinders and overpacks containing LEU, degree of access by representatives of a Host State to the bank, etc., will need to be addressed in the Host State Agreement.

There is an expectation that following the approval of the establishment of the IAEA LEU bank, there will be more offers from IAEA member states to host the bank. As of December 2010, there has been only one offer to host. On 18 May 2009 Kazakhstan circulated a position paper regarding the establishment of the IAEA fuel bank that referred to a 6 April 2009 declaration by President Nazarbayev that Kazakhstan could consider hosting the nuclear fuel bank on its territory.[17] This was confirmed in a

letter dated 28 December 2009 to the Director General.[18] Subsequently, the IAEA received a communication from Kazakhstan dated 11 January 2010 transmitting its position paper on the establishment of IAEA nuclear fuel banks.[19] Kazakhstan expressed its readiness to prepare with the IAEA a corresponding agreement and to discuss the practical issues of the project.

In order to select a Host State, the Secretariat will need to develop a set of detailed selection criteria and to solicit expressions of interest from member states. Some of the criteria would most probably address the legal framework of the Host State. Though the IAEA has had experience in developing Host State Agreements,[20] the matter of hosting the LEU bank brings numerous technical challenges that make this project unprecedented in IAEA practice.

The above-mentioned Physical Reserve Agreement concluded between the IAEA and the Russian Federation contains some elements related to hosting of the LEU reserve by the Russian Federation and reflects the obligations of the state hosting the reserve.[21] In course of the negotiation of the Physical Reserve Agreement, the IAEA Secretariat gained certain experience and knowledge of technical aspects and legal matters related to the establishment and operation of a physical stock of LEU, the application of safeguards, safety standards and measures, the physical protection measures of the Russian Federation, liability coverage, transportation requirements, and so forth. However, given that the concept of the Russian LEU reserve is different from that of the IAEA LEU bank—in that the Russian Federation is the owner of LEU stored at its own facility and on its own territory under its jurisdiction—the arrangements reached with the Russian Federation cannot be copied and applied to the IAEA LEU bank. In the case of the IAEA bank, the IAEA will be the owner of LEU that will be stored most probably at a non-IAEA facility on the territory of a Host State and most likely in line with the extraterritoriality principle.

Relying on the principal features of the IAEA LEU bank approved by the Board, this paper identifies some general requirements for the legal framework of a Host State. The paper provides an assessment of the necessary elements of state legislation as well as of the most important legal instruments, the implementation of which is indispensable for hosting the IAEA LEU bank, and explains the relevance of these legal documents. The paper also includes a brief assessment of Kazakhstan's legal framework

with respect to its adherence to the core legal instruments that would enable Kazakhstan to host the bank.

This is a first study on the legal framework of a state to host the IAEA LEU bank. Many of the elements are still to be addressed by the IAEA Secretariat. Currently, the Secretariat has no position on them. This paper may serve as background information for future discussions on the legal framework of a Host State, its role, the extraterritoriality of the IAEA LEU bank and the implications thereof, the development of Host State selection criteria, the preparation and negotiation of a Host State Agreement, the determination of safety and physical protection measures that shall be applied to the LEU, and so forth.

THE IAEA LEU BANK AND THE HOST STATE

In accordance with the proposal on an IAEA LEU bank approved on 3 December 2010 by the Board of Governors, the bank shall be a physical stock of LEU of standard commercial specification, with U-235 at enrichment levels ranging up to 4.95%.[22] The LEU is meant to be in the form of enriched uranium hexafluoride (UF_6). The IAEA will own the material in the LEU bank and will "be responsible for storing and protecting materials in its possession".[23] In order to meet these requirements, the IAEA will need to rely on a Host State Agreement, which it will negotiate and conclude with a state providing on its territory the physical location for the LEU bank. The Host State Agreement will provide for the general requirements for the Host State and, similarly to the IAEA Headquarters Agreement, will need to contain provisions on the following: the seat of the IAEA LEU bank; the extraterritoriality of the seat; protection of the seat; public services provided to the seat; recognition of a legal personality of the LEU bank and the IAEA, in particular its capacity to contract, acquire and dispose of movable and immovable property and to institute legal proceedings; regarding the property of the bank and the IAEA, envisaging that, wherever located and by whomsoever held, it shall enjoy immunity from search, requisition, confiscation, expropriation and any other form of interference, whether by executive, administrative, judicial or legislative action;[24] and so forth.

General requirements for the Host State's legal framework

In technical terms, a state willing to host the IAEA LEU bank must have an existing nuclear infrastructure and nuclear fuel cycle operations. The IAEA Secretariat recommends that the bank should be located at an existing enrichment or fabrication facility given that such facilities have the capability to empty and refill storage cylinders. This would be essential if any cylinder were to degrade to the point that its contents had to be transferred to another cylinder. The requirement to have a developed nuclear infrastructure implies that the state will have to have an appropriate legal framework to cover such operations—a nuclear regulatory system, adequate transportation, training for nuclear workers, and so forth. The legal framework establishes the duties and responsibilities of the various state organizations and institutions necessary for a successful nuclear power programme. The legal framework includes both the legislative framework and the regulatory framework.[25] The requirement to have nuclear fuel cycle operations means that the state has considerable experience and expertise in storage, handling and transportation of LEU.

The major components of the basic nuclear infrastructure of a Host State will have to be determined in its legal framework—both legislative and regulatory—that implements the state's obligations under these key relevant international agreements:[26]

- Comprehensive Safeguards Agreement (INFCIRC/153(Corr.));
- Additional Protocol (INFCIRC/540(Corr.));
- Convention on Early Notification of a Nuclear Accident (INFCIRC/335);
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (INFCIRC/336);
- Convention on Nuclear Safety (INFCIRC/449);
- Convention on the Physical Protection of Nuclear Material (INFCIR/274) and the Amendment to it (not in force);
- Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/500);
- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (INFCIRC/402);

- Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/566); and
- Convention on Supplementary Compensation for Nuclear Damage (INFCIRC/567).

In order to ensure the establishment and efficient operation of the LEU bank, the legislation of a Host State should cover comprehensively all aspects of nuclear law—nuclear safety, security (physical protection), safeguards and liability for nuclear damage. The legislation of a Host State should implement, or authorize implementation of, any international instruments to which the Host State is a party. The key international instruments listed above should be considered in addressing the principles of nuclear law:

- the safety principle (prevention and protection);
- the security principle (peaceful use of nuclear power);
- the responsibility principle (of the operator or licensee);
- the permission principle (review and authorization by regulatory body);
- the continuous control principle (right of inspection and access by the regulatory body);
- the compensation principle (extent of nuclear liability);
- the sustainable development principle (protection of the future);
- the compliance principle (with international and transboundary agreements, treaties and conventions);
- the independence principle (separation of regulatory body from nuclear implementation organizations);
- the transparency principle (clarity of the process and availability of information on all aspects of nuclear power to the applicants and to the public); and
- the international cooperation principle.[27]

The state's legislation thus shall address the following core issues:

- radiological safety and protection of the nuclear facility workers and the public;
- safe construction, commissioning and operation of the nuclear facility;

- secure and safe handling, transportation and storage of nuclear material;
- protection of the environment and mitigation of the impact of the establishment of nuclear facility;
- responsible and transparent export and import of nuclear material and equipment;
- responsible, open and effective communication of nuclear emergencies and accidents resulting in a potential threat to the environment and the public;
- safeguards; and
- nuclear liability and coverage.

In order to implement these principles, a Host State will need to adopt the following laws:

Law establishing powers of regulatory bodies
A Host State shall have established and well functioning nuclear regulatory legislation (based on relevant international conventions) and a regulatory body for the primary purpose of limiting, in a manner consistent with the state's international obligations, the risks to state security, and to the health and safety of persons and the environment that are associated with the possession, use, storage, handling and transportation of nuclear substances and related equipment.

Law on nuclear security
Special legal measures are required to protect and account for the types and quantities of nuclear material that may pose security risks. These measures must provide for the protection of nuclear material and nuclear facilities against both accidental and intentional diversion from the legitimate uses of these materials and technologies.

Law on radioactive materials and radiation
Radiation sources must be kept secure to prevent theft or damage and to prevent unauthorized persons from carrying out illegal activities with such sources. The Code of Conduct on the Safety and Security of Radioactive Sources[28] and the supplementary Guidance on Import and Export of Radioactive Sources[29] outlines a number of measures that should be taken to address this issue.

Law on nuclear liability

A Host State will need to have legislation on liability and compensation for third-party damage resulting from a nuclear incident. As for the purposes of the IAEA LEU bank, the IAEA will most likely require a Host State to be party to the 1963 Vienna Convention on Civil Liability for Nuclear Damage,[30] and will not require a Host State to be party to the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage.[31] It is necessary that the Vienna Convention be ratified by the Host State and be implemented through its nuclear liability law.

Non-proliferation legislation

The objective of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) is to ensure that nuclear material is not diverted from peaceful use to use in the production of nuclear weapons or other nuclear explosive devices. Through a number of international, regional and bilateral agreements, states have undertaken to accept the application of safeguards to nuclear material and activities under their jurisdiction or control. Safeguards and export and import control provisions may also warrant special foreign trade legislation, as they differ substantially from the safety and liability provisions of nuclear legislation.[32]

Legislation to implement international conventions and agreements

States must have legislation for ratification and entry into force of the international agreements that they have signed or adhered to.

Law on emergency notification of nuclear incidents

The Convention on Early Notification of a Nuclear Accident[33] establishes a notification system for nuclear accidents having the potential for international transboundary release that could be of radiological safety significance for another state. It requires states to report an accident's time, location, radiation release and other data essential for assessing the situation.

Law on safety of nuclear installations

The purpose of this law is to ensure that nuclear safety objectives are achieved in order to protect the workers, the public and the environment from harm by establishing and maintaining in nuclear installations effective measures against radiological hazards.

It is advisable that a potential Host State meet the following three core requirements:

1) A Host State shall be a member of the IAEA and conclude a privileges and immunities agreement with the IAEA

In order to ensure effective operation of the LEU bank, the IAEA would require a certain level of independence from the Host State for the management of the bank. By analogy with the privileges and immunities accorded to diplomats accredited by states, there must be the requisite privileges and immunities with respect to territorial jurisdiction of Host States as recognized in customary law.[34] There has not been any agreement on the content of customary law concerning the privileges and immunities of international organizations. The core principle is that officials of international organizations are immune from legal process in respect to all acts performed in their official capacity. As in the case of diplomatic immunities, international immunities are subject to waiver.[35]

As a member of the IAEA and a party to the IAEA Statute, a Host State will be bound by article XV of the Statute on privileges and immunities. In accordance with article XV(A), "The Agency shall enjoy in the territory of each member such legal capacity and such privileges and immunities as are necessary for the exercise of its functions". For this, the IAEA will need to enter into an agreement with the member state to define the legal capacity, privileges and immunities referred to. Under the Agreement on the Privileges and Immunities of the IAEA,[36] a Host State shall provide the agreed privileges and immunities to the IAEA (including of its property, funds and assets) and to its inspectors and other officials performing functions under this Agreement.

According to IAEA law and practice, only member states may accept and thereby become party to the Agreement.[37] Pursuant to section 39, the Agreement remains in force with respect to a state only as long as it is a member of the Agency. It is not possible to secure the direct participation in the Agreement of a non-member state of the IAEA. However, to the extent that the Agreement is incorporated by reference into some other treaty, to which both a state and the IAEA are parties and which remains in force even if that state is no longer a member of the IAEA (Project Agreements, for example), then the incorporated provisions of the Agreement also remain in force.[38] Therefore, it is advisable that the

IAEA Host State Agreement for hosting of the LEU bank shall refer to the Agreement on the Privileges and Immunities of the IAEA.

The IAEA has concluded a privileges and immunities agreement with several states, including Belgium, the Czech Republic, Denmark, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland and the United Kingdom. Several of these states have enrichment, conversion or fuel fabrication capacity. Russia also has a privileges and immunities agreement with the IAEA and related clauses are also reflected in the Russian safeguards agreement with the IAEA.[39] The relevant provision of the Agreement on the Privileges and Immunities of the IAEA is in section 8(b), which exempts the Agency:

> from customs duties and prohibitions and restrictions on imports and exports in respect of articles imported or exported by the Agency for its official use; it is understood, however, that articles imported under such exemption will not be sold in the country into which they were imported except under conditions agreed to with the Government of that country … .

Under the Agreement, there can be no limitation placed on the IAEA for the import or export of its property (unless the IAEA is planning on selling something in country, in which case the Agency would have to get the state's permission). The nuclear material in an IAEA LEU bank will be the property of the IAEA[40] and thus it will be considered for "official purposes". Therefore, it shall be immune from the jurisdiction of the Host State and shall not be subject to import or export restrictions.

The IAEA is likely to rely on privileges and immunities existing under the Agreement and will use them as the basis for further negotiations on privileges and immunities to be included in the Host State Agreement. Some of privileges and immunities provisions are also reflected in the IAEA Headquarters Agreement,[41] which will be used to prepare a Host State Agreement.

2) A Host State shall be a non-nuclear-weapon state party to the NPT

A Host State will need to be a party to the NPT, and as such it should be a non-nuclear-weapon state, which under article II of the NPT would have renounced any intention of developing nuclear weapons and have undertaken not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control

over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices. The laws, conventions and treaties for non-nuclear-weapon states are drafted in a way that the legislation of such states would be in line with their non-proliferation and security-related requirements.[42] Through the verification mechanism, which is one of the main premises of the NPT, all imports and domestic production of nuclear weapon-related materials in a non-nuclear-weapon state are to be subject to safeguards, pursuant to the NPT, in order to assure the non-proliferation of nuclear weapons.[43] Article III(1) of the NPT makes it mandatory for all non-nuclear-weapon states parties to conclude safeguards agreements with the IAEA[44] to enable the Agency to verify "the fulfillment of [their] obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices". The same article also mentions that "The safeguards required by this article shall be applied to *all* source or special fissionable material in *all* peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere" (emphasis added).

Besides being a party to the NPT, a Host State may also be a party to a nuclear-weapon-free zone treaty, if applicable. Such treaties require their states parties to conclude a Comprehensive Safeguards Agreements (CSAs) with the IAEA.[45]

3) A Host State shall have a CSA and the additional protocol in force

As mentioned above, international safeguards, as implemented by the IAEA, represent a key means of verifying the compliance of states with commitments not to use nuclear material or technology to develop nuclear weapons or other nuclear explosive devices.[46] The purpose of the IAEA safeguards is to promote peaceful uses of nuclear energy, deter and identify possible incipient nuclear weapon programmes and enable enforcement of IAEA Board of Governors and the United Nations Security Council resolutions on safeguards compliance. IAEA safeguards are also important in ensuring the security of the nuclear trade, advancing the renaissance of nuclear energy without furthering the danger of proliferation of nuclear weapons.

Besides from article III(1) of the NPT, the IAEA also derives its authority to establish, administer and apply safeguards from article III.A.5 of its Statute.[47] The agreements that non-nuclear-weapon states conclude with the IAEA as part of their obligations under article III of the NPT are based on INFCIRC/153(Corr.), which has been used as the basis for CSAs.[48] Paragraph 2 of this agreement also requires the IAEA "to ensure that the safeguards will be applied … on *all* source or special fissionable material in *all* peaceful nuclear activities within the territory of the State … for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices" (emphasis added). Thus these agreements have become known as *full-scope* or *comprehensive* safeguards agreements. Additionally, paragraph 3 of INFCIRC/153(Corr.) requests states to "co-operate to facilitate the implementation of the safeguards". This system is based on material accountancy and has proved reliable in providing assurances about the peaceful use of declared nuclear material and declared facilities (that is, that states' declarations are correct).[49]

The IAEA's safeguards system was strengthened in May 1997 by the Board of Governors approving the model Additional Protocol (AP) to the agreements between states and the IAEA for the application of safeguards.[50] The foreword to INFCIRC/540(Corr.) notes that the AP is available for adoption and implementation by all states with IAEA safeguards agreements. NPT non-nuclear-weapon states are obligated to accept all of the provisions of the AP, which is not a free-standing legal instrument and in itself it does not provide added legal authority. Rather, the AP provides the IAEA with some additional measures to ensure completeness of the information reported under safeguards agreements as provided in INFCIRC/153(Corr.) when applied in non-nuclear-weapon states party to the NPT.[51] The AP was meant to strengthen the IAEA's verification capacity, to provide the IAEA with broader information on peaceful nuclear activities, to offer IAEA inspectors broader access to nuclear sites and to provide assurances that there are no undeclared materials or activities.[52]

The technical objective of safeguards is "the timely detection of diversion of significant quantities of *nuclear material* from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection".[53] In order to exercise the required control over nuclear material and to facilitate cooperation with the IAEA in implementing the provisions of CSAs and APs, a Host State will have to have an adequate

state system for accounting and control,[54] which is an obligation under a CSA regardless of the amount of nuclear material or the extent of nuclear activities in a state. The system for accounting and control is needed to ensure the effective implementation of safeguards.

The verification by the IAEA of a Host State's compliance with its undertakings under a CSA must preclude undeclared nuclear material and activities in a state. This can be done through implementation of measures under APs, which strengthen the IAEA's capability to achieve this objective by obligating states to declare nuclear material in accordance with article 2 of the AP. Therefore, it would be preferable for a Host State to have an AP in force. With regard to the application of IAEA safeguards to the LEU bank, this will be done in accordance with the Host State Agreement. For example, in case of the Russian LEU reserve, the IAEA applies its safeguards to the LEU stored in the reserve[55] in accordance with the Agreement between the Union of Soviet Socialist Republics and the IAEA for the application of safeguards.[56]

Extraterritoriality of the IAEA LEU bank

As mentioned above, the Host State Agreement will be "similar to the present IAEA Headquarters Agreement, that shall provide for the safety and security and appropriate liability coverage of the storage facility and shall afford those privileges and immunities to the Agency that are necessary for the independent operation of the IAEA LEU bank".[57] The IAEA Headquarters Agreement provides for the extraterritoriality of the IAEA Headquarters seat in Vienna granted by Austria.

The concept of extraterritoriality is well established in international law. Extraterritoriality or diplomatic immunity in international law refers to the immunities enjoyed by foreign states or international organizations and their official representatives in the jurisdiction of the state in which they are present. Extraterritoriality exempts them, while within the territory of a foreign sovereign, from local judicial process, police interference, and other measures of constraint. Extraterritoriality applies, for example, to embassies, consulates, military bases, and can also extend to international organizations as entities and to their heads, legations and so forth. These places remain part of the sovereign territory of the host state and, although they are not subject to local law, local law enforcement institutions do have the duty of protecting facilities from outside disturbance.

Article III of the IAEA Headquarters Agreement envisages the recognition by the Host State of the extraterritoriality of the IAEA Headquarters seat, which should be under IAEA authority.[58] Under the Headquarters Agreement, the IAEA is authorized to make regulations, operative within its headquarters, for the purpose of establishing the conditions necessary for the full execution of its functions. The agreement excludes the application within the seat of such laws of the Host State that are inconsistent with the regulations of the IAEA and that are not authorized by this section.[59] Thus, there is a strong precedent for giving international organizations extraterritorial status and there should be, in principle, no legal barriers per se for the IAEA to negotiate extraterritorial status for one or more facilities hosting the LEU bank. The key question is whether extraterritoriality would really be necessary, worthwhile and practical in order to allow the bank to function effectively (this issue is discussed further in the following section). Extraterritorial status of an IAEA LEU bank could afford the Agency some advantages providing immunity to officials employed at the site. However, IAEA inspectors usually already possess such immunity when they are carrying out their responsibilities in a member state in accordance with a safeguards agreement.

It is expected that a Host State would maintain its responsibility for ensuring the safety and physical security of the LEU in the IAEA bank. For the cases of non-nuclear-related liability and regarding the applicability of the general civil law of the Host State to the bank for this purpose, a Host State Agreement may include a clause based on the IAEA Headquarters Agreement, section 46, under which a Host State shall not incur by reason of the location of the IAEA LEU bank within its territory any international responsibility for acts or omissions of the IAEA or of its officials acting or abstaining from acting within the scope of their functions, other than the international responsibility.

Application of safety and physical protection measures and nuclear security requirements by a Host State

The application of physical protection and safety measures has always been the responsibility of states and their authorities. However, pursuant to the proposal on the establishment of the IAEA LEU bank as noted above, the Agency is to take responsibility for storing and protecting materials in its possession. The IAEA will exercise this responsibly through a Host State Agreement, by which it will ensure that the LEU is safeguarded against

natural and other hazards; unauthorized removal or diversion; damage or destruction, including sabotage; and forcible seizure and that the safety standards and measures, and physical protection measures are applied to the LEU in the bank by the Host State.[60] Thus, the Host State of an IAEA LEU bank will have to be responsible for applying safety and physical protection measures to the LEU in the bank in accordance with the Host State Agreement and its obligations under international law, as well as its own laws and regulations.

Nuclear safety measures

Nuclear safety measures are needed to protect site personnel, the public and the environment from undue radiation hazards.[61] In substance, nuclear safety, which covers all elements necessary to prevent damage and to mitigate its consequences, if any, is broader than radiation protection, which does not cover the protection of environment.[62] Nuclear safety is often regarded by scholars as a part of the core of nuclear law.[63] However, the "essential and co-existing components necessary to establish an international nuclear safety regime have been identified as soft law and good practices, a national legal framework and international norms".[64]

The IAEA Statute authorizes the Agency to establish safety standards to protect health and minimize danger to life and property—standards that the IAEA must use in its own operations, and which a state can apply by means of its regulatory provisions for nuclear and radiation safety. The status of the IAEA safety standards derives from the IAEA's Statute, which authorizes the IAEA to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property, and to provide for their application.[65] As mentioned above, article III.A.6 of the Statute makes the safety standards binding on the IAEA in relation to its own operations and also on states in relation to IAEA-assisted operations making use of materials made available by the Agency or those that are under the IAEA's control or supervision. The IAEA safety standards, supplemented by international conventions, bilateral agreements, industry standards and detailed national requirements, establish a consistent basis for protecting people and the environment.

Regulating nuclear and radiation safety is a state responsibility, and many member states have adopted the IAEA's safety standards for use in their regulations. For the contracting parties of the various international safety conventions, IAEA standards provide a consistent, reliable means of ensuring the effective fulfilment of obligations under the conventions. The so-called Safety Fundamentals[66] apply primarily to those nuclear installations in which the stored energy or the energy developed in certain situations could potentially result in the release of radioactive material. In addition to nuclear power plants, such installations may include research reactors and facilities, fuel enrichment, manufacturing and reprocessing plants, and certain facilities for radioactive waste treatment and storage. According to the Safety Fundamentals, the general nuclear safety objective is to protect individuals, society and the environment from harm by establishing and maintaining in nuclear installations effective defences against radiological hazards.[67] States operating nuclear installations need to apply the fundamental principles set out in this publication.[68] Thus, the Safety Fundamentals clarify governmental, legislative and regulatory responsibilities on the one hand and the responsibilities of the operating organization on the other, covering them in section 3 on the "Legislative and Regulatory Framework".[69] It is recommended that the Host State follow the Safety Fundamentals, which, among other things, require states to establish a legislative and statutory framework for the regulation of nuclear installations and request a clear separation of responsibilities between the regulatory body and the operating organization.

In the case that a prospective Host State offers to house the IAEA LEU bank at an operating nuclear power plant site, the state will also have to be party to the Convention on Nuclear Safety.[70] The Convention applies to the safety of nuclear installations (article 3), which means any land-based civil nuclear power plant, including storage, handling and treatment facilities for radioactive materials located on the same site and directly related to the operation of the nuclear power plant (article 2(i)).[71]

In its Project and Supply Agreements,[72] the IAEA requires states to follow the IAEA's Safety Standards and Measures,[73] which define safety standards as standards, regulations, rules or codes of practices established to protect man and the environment against ionizing radiation and to minimize danger to life and property; and safety measures as any action, condition or procedure to ensure the observance of safety standards.[74] The Safety Standards and Measures also define the safety standards that are

established by the IAEA under the authority of the Board of Governors and which comprise the IAEA's basic safety standards for radiation protection;[75] the IAEA's specialized regulations providing for safety prescriptions relating to particular fields of operation; and the IAEA's codes of practice, which establish the minimum requirements which must be fulfilled for particular activities to ensure adequate safety.[76]

Pursuant to the Physical Reserve Agreement approved the Board of Governors in November 2009, Russia as an LEU supplier state requires a consumer state to apply to delivered LEU the Agency's Safety Standards and Measures for handling, storing and shipment set forth in document INFCIRC/18/Rev.1, as revised from time to time.[77] The Russian Federation, as a Host State, also took an obligation to ensure the application of the Safety Standards and Measures.[78]

In the case of the IAEA LEU bank, the material in it will be owned by the IAEA and it will have to ensure through a Host State Agreement the application of the Safety Standards and Measures.[79] Therefore, the IAEA may request the Host State to apply safety measures in accordance with INFCIRC/18/Rev.1, as revised from time to time. According to the IAEA Safety Standards and Measures, all responsibility for safety shall be assumed by the state and the IAEA shall incur no liability whatsoever.[80] In accordance with this document, the IAEA may subsequently evaluate the effectiveness of the safety measures through its safety missions, which the IAEA may send to the state, in agreement with it. Therefore, the Host State Agreement will most likely have to provide for such safety missions to verify the effectiveness of the safety measures applied by the Host State to the IAEA LEU bank.[81] It would be appropriate for the IAEA to request in advance from a potential Host State a statement of the safety standards that it proposes to apply in connection with the bank. Given that the Agency's Safety Standards and Measures envisage that a state requesting assistance by or through the IAEA shall provide the Agency with such a statement,[82] the IAEA may request the states expressing interest in hosting the LEU bank to do the same.

Safety measures in transport

As mentioned above, the Statute authorizes the IAEA to establish safety standards to protect health and minimize danger to life and property and the Agency must use these standards in its own operations by

ensuring that the state in question can apply them through its regulatory provisions for nuclear and radiation safety. A key publication for the application of transport regulations in a state is the IAEA document *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety*,[83] which establishes the basic requirements for the necessary legal and governmental infrastructure and discusses in detail the legislative and governmental responsibilities of a state and the responsibilities, functions, organization and activities of a regulatory body. This document should be used in conjunction with the *International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources*[84] and the *Regulations for the Safe Transport of Radioactive Material*.[85] The objective of this publication on legal and governmental infrastructure is to specify requirements related to the legal and governmental infrastructure for, among other things, the safe transport of radioactive material, indispensable to achieving the objectives and applying the principles of the IAEA Safety Fundamentals.[86] The prime responsibility for safety shall be assigned to the operator, which has to ensure safety in the siting, design, construction, commissioning, operation, decommissioning, close-out or closure of its facilities (including, as appropriate, rehabilitation of contaminated areas); and in activities in which radioactive materials are used, transported or handled.[87]

For the release and delivery of LEU from the IAEA bank, which will involve numerous transportation-related steps, the Host State will have to implement relevant regulations for the safe transport of LEU and the Host State Agreement will have to contain provisions on the legal aspects of international transport of nuclear materials.[88]

In regards to transport regulations (as laid out in *Regulations for the Safe Transport of Radioactive Material*, mentioned above), the IAEA developed these regulations[89] in accordance with its statutory functions in response to the request made in 1959 by the United Nations Economic and Social Council to develop safety standards for the transport of radioactive material. Before that, the United Nations had already started the development of standards for the safe transport of all dangerous goods.[90] Now nine classes of dangerous goods are established and radioactive materials are identified as Class 7, regardless of the degree of chemical or radiological hazard.[91]

In approving these regulations as part of the IAEA's Safety Standards, the Board of Governors also recommended them to state authorities and

international organizations to serve as a basis for regulating the transport of radioactive materials.[92] The IAEA Transport Regulations are recommended international standards for the safe transport of radioactive material and as such they are not binding on any state. However, processes are now in place that have made the requirements of the IAEA transport regulations essentially binding for international transport of radioactive material on a worldwide basis for all modes of transport. To a great extent they have also become binding for domestic transport of radioactive materials in many states around the world.

These transport regulations belong to the IAEA Safety Standards and establish the requirements that must be met by states to ensure the protection of people and the environment, both now and in the future. The requirements are governed by the objective and principles of the IAEA Safety Fundamentals. These regulations apply to the transport of radioactive material by all modes on land, water, or in the air, including transport which is incidental to the use of the radioactive material.[93] Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material. These include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage (including in-transit storage), unloading and receipt at the final destination of radioactive material and packages. The regulations require application of measures ensuring that radioactive material is kept secure in transport so as to prevent theft or damage and to ensure that control of the material is not relinquished inappropriately.[94] The transport regulations are supplemented by other publications, including *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material*,[95] *Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material*,[96] *Compliance Assurance for the Safe Transport of Radioactive Material*,[97] *The Management System for the Safe Transport of Radioactive Material*[98] and *Radiation Protection Programmes for the Transport of Radioactive Material*.[99]

The IAEA transport regulations, being incorporated into the UN Recommendations on the Transport of Dangerous Goods (UN TDG), became applicable to international transport of radioactive material.[100] Initially the requirements of the regulations were incorporated into the UN TDG by reference only, without any detail. However, since 2001 the UN TDG have incorporated all the detailed requirements of the regulations.

The international regulations for transport of dangerous goods by air and by sea apply globally. The International Civil Aviation Organization (ICAO) publishes its regulations,[101] which are mandatory for all its member states. In addition, the International Air Transport Association (IATA) publishes its regulations,[102] which are used by airlines. They incorporate all the requirements of the ICAO regulations as well as additional operator variations.

However, as LEU being transported to and from the IAEA bank will most probably not be moved by air, compliance of a potential Host State with these instruments will not be required by the IAEA. The LEU will most likely by transported by road, rail or sea. Therefore, it is important to ensure the application of safety standards in transport through the International Maritime Dangerous Goods (IMDG) Code[103] of the International Maritime Organization (IMO) for the transport by sea of LEU. Many of the detailed requirements of the IMDG Code have become mandatory for all IMO member states since 1 January 2004. There is a variety of international regulations for road and rail transport. The UN Economic Commission for Europe's Inland Transport Committee publishes regulations for transport of dangerous goods by road (the ADR),[104] and the Intergovernmental Organisation for International Carriage by Rail publishes the regulations for transport of dangerous goods by rail (the RID).[105]

The requirements of the UN TDG have been incorporated into the ICAO regulations, the IMDG Code, the ADR and the RID. Given that the UN TDG reflect the IAEA transport regulations, this means that the IAEA safety requirements for transport are indirectly mandatory for transport of dangerous goods by water, road and rail.

Therefore, for transport of the LEU to and from the IAEA bank, a Host State will need to apply the IAEA transport regulations and the IAEA will need to ensure such application through the Host State Agreement.

Physical protection measures and nuclear security requirements

Nuclear material and nuclear facilities could be targets of opportunity for terrorists and other criminals aiming to acquire nuclear weapons through the theft and smuggling of dangerous materials.[106] In the early 1970s, the IAEA became involved in nuclear security efforts. The Director General convened a panel of experts to consider ways to secure nuclear material

and facilities, resulting in 1975 in recommendations for the physical protection of nuclear material.[107] Recognizing the need for cooperation among states to ensure adequate physical protection of potentially hazardous material, IAEA member states adopted the Convention on Physical Protection of Nuclear Facilities, Material and Transports (CPPNM) in 1979.[108] The CPPNM remains the only legally binding instrument with specific provisions for the protection of nuclear materials.

In December 2003 the IAEA Advisory Group on Nuclear Security defined nuclear security as "the prevention and detection of and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities".[109] Nuclear security includes the physical protection measures for nuclear material and nuclear facilities as physical protection can be understood from consideration of the provisions of the CPPNM and the Amendment to the CPPNM. Physical protection supports nuclear non-proliferation objectives and contributes to strengthening safety measures.[110] Physical protection provides for measures against the theft or unauthorized use of nuclear material and against the sabotage of nuclear material and facilities by individuals or groups of persons.[111] The primary responsibility for establishing and operating an appropriate physical protection regime for nuclear material and facilities rests entirely with the state where the material is located. The physical protection of nuclear material constitutes a set of legal, administrative and technical measures, including physical barriers needed to protect such material.

Given this, a Host State will have to take primary responsibility for nuclear security with regard to the material stored in the IAEA LEU bank and to the bank itself. The Host State will have to implement relevant legal and guidance instruments and ensure an appropriate regulatory framework. For this the Host State would follow the above-mentioned IAEA regulations contained in the document *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety: Requirements*, which advises the regulatory body not only on safety matters but also on physical protection and safeguards.[112] The document defines the requirements for the legislative and governmental mechanisms of states to make adequate infrastructural arrangements for physical protection, where these influence safety.[113]

There is no single international instrument that addresses nuclear security comprehensively, but there are numerous instruments that shall be implemented by a state through its national and regulatory framework to ensure adequate protection of nuclear material and facilities.[114] The legal framework for nuclear security embodies legal instruments relating to safety, security and safeguards and brings to together both binding and non-binding instruments adopted under both IAEA and other auspices. Safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security.[115] The most relevant international instruments for nuclear security include both binding and non-binding instruments. Legally binding instruments include the CPPNM, the Amendment to the CPPNM, the Convention on Early Notification of a Nuclear Accident, Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the International Convention for the Suppression of Acts of Nuclear Terrorism, and UN Security Council resolutions 1373 (2001), 1456 (2003), 1540 (2004) and 1673 (2006). The following non-binding instruments are also internationally accepted and were developed under the IAEA auspices: INFCIRC/225 on the Physical Protection of Nuclear Material and Nuclear Facilities, the Code of Conduct on the Safety and Security of Radioactive Sources (2004), and the Guidance on the Import and Export of Radioactive Sources (2005). Additional non-binding instruments in the area of nuclear security are the Nuclear Suppliers Group (NSG) Guidelines and the IAEA Security Series.[116] This paper will address the content of some of these documents to underline their importance for a Host State for the establishment of nuclear security and physical protection measures with regard to the IAEA LEU bank.

Convention on the Physical Protection of Nuclear Material

Ideally, a Host State should be a party to the CPPNM, which, besides being one of the 13 counter-terrorism instruments, is the only internationally legally binding undertaking in the area of physical protection of nuclear material. The objective of the CPPNM is to achieve and maintain worldwide effective physical protection of nuclear material and nuclear facilities used for peaceful purposes, to prevent and combat offences relating to such material and facilities worldwide, and to facilitate cooperation among states parties to those ends.[117] The CPPNM is important due to its threefold scope of application establishing measures related to the prevention,

detection and punishment of offenses relating to nuclear material. It covers the physical protection of nuclear material during international transport (and during storage incidental to such transport),[118] the criminalization of offences, and international cooperation and information exchange. The CPPNM classifies three categories of nuclear material to which different levels of protection shall be applied.[119] States parties of the CPPNM therefore cannot authorize international transport of nuclear material unless they have received assurances that such material will be protected at the required levels during transport.[120] The CPPNM's levels of protection shall also be applied to nuclear material in transit within the territory of states parties, and when passing through international waters or airspace.[121] In the case of theft, robbery or any other unlawful taking of nuclear material or of credible threat thereof, states parties shall, upon request of any state party, provide cooperation and assistance in the recovery and protection of such material.[122] Currently, the regime of physical protection includes basic guidelines for the establishment of national physical protection systems which were developed within the IAEA, in particular as contained in *The Physical Protection of Nuclear Material and Nuclear Facilities*,[123] and the Physical Protection Objectives and Fundamental Principles.[124]

The CPPNM is very important for the operation of the IAEA LEU bank as the LEU will be transported to and from the bank internationally and appropriate levels of protection will have to be applied to the transported and stored material.

Amendment to the Convention on the Physical Protection of Nuclear Material

The Amendment to the CPPNM has not yet entered into force.[125] Therefore, for the purpose of hosting the IAEA LEU bank, a Host State shall be a party to the CPPMN and may consider being a party to the Amendment , though this would not be obligatory.

The CPPNM states parties agreed to amend the CPPNM to strengthen its provisions, to extend its scope to cover the physical protection of nuclear material in peaceful domestic use, storage and transport and of nuclear facilities, and to make it legally binding for the states parties to protect such nuclear material and nuclear facilities. As mentioned above, the objectives of the amended CPPNM are to achieve and maintain worldwide physical protection of nuclear material and facilities used for peaceful

purposes, to prevent and combat offences relating to such material and facilities worldwide and, in order to achieve these goals, to facilitate cooperation among states parties.[126] The Amendment obligates the states parties to establish and implement a physical protection regime inclusive of the Physical Protection Objectives and covering the Physical Protection Fundamental Principles.[127] In accordance with the Amendment, the physical protection regime is to protect nuclear material against theft and other unlawful taking, to ensure the implementation of measures to locate and recover missing or stolen nuclear material, to protect nuclear material and facilities against sabotage and mitigate or minimize its radiological consequences.[128] The Amendment also introduces expanded cooperation between and among states for locating and recovering stolen or smuggled nuclear material, mitigation of any radiological consequences of sabotage, and prevention and combating of related offences.

Given that the Amendment provides for a range of physical protection measures indispensable for ensuring proper security of the LEU in the IAEA bank and of the bank itself, a Host State of the bank shall be party to the Amendment when it enters into force. For the implementation of its undertakings under the Amendment, a Host State will have to establish and maintain an appropriate legislative and regulatory framework for physical protection, shall establish or designate a competent authority responsible for its implementation, and shall take other appropriate administrative measures necessary for the physical protection of such material and facilities.[129]

Nuclear Terrorism Convention

Through the adoption of the Amendment to the CPPNM and of the International Convention for the Suppression of Acts of Nuclear Terrorism (the Nuclear Terrorism Convention),[130] the international community has recognized the need to strengthen the existing international legal regime in the area of physical protection.[131] Both instruments recognize and increase the IAEA's role in the area of physical protection. The Nuclear Terrorism Convention covers "radioactive material", which includes not only nuclear material, but also other radioactive material, and therefore it has a broader scope than the CPPNM and its Amendment. The Nuclear Terrorism Convention seeks to prevent and punish acts of nuclear terrorism that involve radioactive material. Therefore, the Convention is primarily a criminal law instrument defining certain acts as criminal offences and

obliges states parties to establish their jurisdiction over such offences, to make them punishable under domestic law and to provide for extradition or prosecution of alleged offenders. In terms of nuclear security and physical protection relevant to the IAEA LEU bank, article 8 of the Nuclear Terrorism Convention obligated states parties to adopt appropriate measures to ensure the protection of radioactive material taking into account relevant IAEA recommendations and functions.

Assistance Convention

The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (the Assistance Convention)[132] strengthens the international response to a nuclear accident or radiological emergency, including terrorist or other malicious acts, by providing a mutual assistance mechanism with a view to minimizing the consequences of such accidents or emergencies and protecting life, property and the environment against the effects of radioactive releases. The Assistance Convention provides an international framework to facilitate prompt requests for and provision of assistance in the event of a nuclear accident or radiological emergency and to promote, facilitate and support cooperation among states parties to that end. The Assistance Convention may be applied provisionally, if a state, prior to entry into force, declares that it will apply this Convention provisionally (article 15). A state party that needs assistance in the event of an emergency may call for such assistance from any other state party, directly or through the IAEA, or from the Agency or other intergovernmental organization (article 2(1)). In this regard, an accident or emergency does not have to originate within the territory of the requesting state or its jurisdiction (article 2). Article 2 of the Convention has been criticized for not placing a requirement to provide assistance to a state upon its request.[133] In terms of information management, the requesting state shall protect any confidential information made available to it in connection with the assistance and shall use it only for the agreed-upon assistance (article 6(1)).

Early Notification Convention

Pursuant to the Convention on Early Notification of a Nuclear Accident (the Early Notification Convention),[134] in case of an accident that may result in an international transboundary release of radioactive material as defined in article 1, the state party concerned shall notify, directly or

through the IAEA, those states that are or may be physically affected and the IAEA of the nuclear accident, its nature, the time of its occurrence and its exact location where appropriate and shall provide such affected states, directly or through the Agency, and the Agency with such available information relevant to minimizing the radiological consequences in those affected states (article 2). The type and extent of information to be provided is specified in article 5.[135] Article 1 is regarded as a loophole in the Convention as it leaves to the discretion of the state where an accident has occurred to determine and decide whether a release of radioactive material resulting from an accident, involving facilities or activities or of persons or legal entities under its jurisdiction or control, will have transboundary effects of radiological safety significance for another state. In case of an accident, if the state decides that there will be no such effect, there is no obligation for it to provide notification of the accident.[136] Probably not to limit the application of the Convention only to the decisions of the state where an accident has occurred, the parties of the Convention agreed to include article 3 on other nuclear accidents, under which the states parties may provide notifications in the event of nuclear accidents other than those specified in article 1, with a view of minimizing the radiological consequences. Information on nuclear incidents may help states to identify a nuclear security event and would allow them to take necessary measures to respond to it. Therefore, the Host State of the IAEA LEU bank would need to be a party to the Early Notification Convention.

Physical Protection of Nuclear Material and Nuclear Facilities

The above-mentioned non-binding IAEA document on the Physical Protection of Nuclear Material and Nuclear Facilities[137] originated as "Recommendations for the Physical Protection of Nuclear Material" prepared by a panel of experts and published by the IAEA in 1972, before the adoption of the CPPNM.[138] Since then, the document has been revised several times taking into account the CPPNM and relevant state practice as well as technological progress.[139] The latest revision, INFCIR/225/Revision 5 (STI/PUB/1481), includes a chapter on specific recommendations related to sabotage of nuclear facilities and nuclear material. Given that the document included nuclear facilities into its scope, the title of this document was changed to "The Physical Protection of Nuclear Material and Nuclear Facilities".[140] These recommendations represent a broad consensus of states on the requirements for the physical protection of nuclear material and facilities. While the recommendations

are not mandatory, they acquire a binding nature when included into the IAEA Project and Supply Agreements and the Revised Supplementary Agreement for the Provision of Technical Assistance by the IAEA.[141] In this way, the IAEA obligates states to apply the physical protection measures to nuclear material, equipment and materials related directly to the assistance provided by or through the IAEA.

The objective of the recommendations is to achieve effective physical protection against the theft or unauthorized diversion of nuclear material and against the sabotage of nuclear facilities by individuals or groups. Therefore, it provides for application of physical protection to nuclear material in use, storage and transport, whether domestic or international, and whether peaceful or military, and to nuclear facilities. The document provides recommendations on the elements of the state's system of physical protection of nuclear material and nuclear facilities and on the requirements for the state's legislation in this field. It also specifies requirements for physical protection against unauthorized removal of nuclear material in use and storage and against sabotage of nuclear facilities and nuclear material during use and storage and for physical protection of nuclear material during transport. As does the CPPNM, it includes a table of categorization of nuclear material for determining the appropriate level of physical protection measures that should be accorded.[142] In determining the levels of physical protection in a facility, the state's competent authority may specify parts of the facility that contain material of a different category and that are therefore protected at a different level than the rest of the facility. On the other hand, consideration may need to be given to adding together the total amount of material contained in a number of buildings at the facility to determine the appropriate protection arrangements for this group of buildings.[143]

The recommendations are applied by states by way of referencing in bilateral or multilateral agreements the procedures and technical measures that are to be followed in the framework of nuclear cooperation. Although responsibility for establishing and operating a comprehensive national physical protection system for nuclear material and facilities rests entirely with each state, international cooperation is needed when the effectiveness of physical protection in one state depends on the taking by other states of adequate measures to deter or defeat hostile actions against nuclear facilities and nuclear material, particular when nuclear material is subject to international transport.

As mentioned above in the section on the application safety measures, "the Agency shall be responsible for storing and protecting materials in its possession by ensuring, through any Host State Agreement, that the LEU is safeguarded against natural and other hazards, unauthorized removal or diversion, damage or destruction, including sabotage, and forcible seizure".[144] Such responsibility of the IAEA is envisaged also in article IX.H of the IAEA Statute. The IAEA will have to ensure through a Host State Agreement the application by the state of the physical protection measures to the LEU in the IAEA LEU bank.[145] Therefore, to meet this requirement a Host State Agreement will make reference to the latest version of INFCIRC/225 for the application of the physical protection measures.

Such a requirement was also included in the Physical Reserve Agreement concluded between the IAEA and the Russian Federation. In accordance with article VII, Russia undertook the obligation to ensure the application of physical protection measures at levels not lower than those envisaged in INFCIRC/225 and agreed to provide physical protection during the handling, storage and shipment of the LEU.

The Code of Conduct on the Safety and Security of Radioactive Sources[146] has been strengthened to take account the terrorist event of 11 September 2001. The Code provides guidance on measures for the protection of persons, society and the environment from harmful effects of possible accidents and malicious acts involving radioactive sources.[147] Part III of the Code defines the basic principles for legislation and regulation, the regulatory body, and import and export of radioactive sources. With regard to physical protection measures, paragraph 22(b) of the Code envisages the requirement for the state's regulatory body to ensure "that arrangements are made for secure protection of radioactive sources". Though the Code is not binding, many states communicated to the IAEA their support for the Code after it was published in 2004.

Civil liability for nuclear damage

Under the basic principles of nuclear liability and compensation regimes, the operator of a nuclear installation is held strictly and exclusively liable. The nuclear liability conventions do not hold the operator liable for damage to property on site and do not envisage the right to compensation for damage to the nuclear installation itself or to any property on the site that is used or to be used in connection with such installation. Therefore,

the owners of nuclear installations are obligated to assume risks of loss of or damage to their own property, as well as to that of contractors whose property is on site. Therefore they try to include the cost of this risk in the cost of the installation and in the price of their supply contracts.[148]

Liability principles include options for limiting or not limiting liability in amount, limiting claims in terms of time, the congruence of liability and coverage in cases of limited liability, the equal treatment of victims, and the exclusive jurisdiction of the courts of one country. State legislation and international conventions that conform to these principles are deemed to be "risk adequate".[149] States that have enacted nuclear liability legislation and are parties to the conventions number, unfortunately, only about 60; other states do not have special nuclear liability laws.[150]

There are numerous international conventions in this area:

- 1963 Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/500) (in force since 1977);
- 1997 Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/566) (in force since 2003);
- 1997 Convention on Supplementary Compensation for Nuclear Damage (INFCIRC/567) (not in force);
- Optional Protocol Concerning the Compulsory Settlement of Disputes (INFCIRC/500/Add.3);
- 1960 Paris Convention on Nuclear Third Party Liability in the Field of Nuclear Energy (in force since 1968);
- 1963 Brussels Supplementary Convention to the Paris Convention (in force since 1974);
- 2004 Protocols amending the Paris Convention on Nuclear Third Party Liability and the Brussels Supplementary Convention (not in force); and
- 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (as amended) (INFCIRC/402) (in force since 1992).

Only those Conventions that are in force may be considered for the purpose of the Host State Agreement. Most likely, the IAEA will require a Host State to be party to the 1963 Vienna Convention, given that the Convention

was concluded under IAEA auspices, the instruments of ratification and accession are deposited with the Director General of the IAEA, and the Convention itself is deposited with the Director General.[151] The Vienna Convention has the same basic purpose as the Paris Convention, which is the harmonization of state legislation relating to third-party liability for nuclear damage. The Vienna Convention does not cover the issue of state responsibility or liability for nuclear damage and makes it clear in article XVIII that the Convention "shall not be construed as affecting the rights, if any, of a Contracting Party under the general rules of public international law in respect of nuclear damage". The Vienna Convention is "self-excluding" and its contracting parties may either incorporate the Convention into the domestic legal system allowing in such way its direct application, or may adopt national legislation specifically implementing the Convention.[152] Unlike the Paris Convention, the Vienna Convention does not expressly limit its scope to nuclear incidents or nuclear damage in the territories of the contracting parties, unless the national legislation of the liable operator provides for this. Pursuant to article I.1(d) of the Vienna Convention, the Host States will be the installation state.

The IAEA has already put in practice reference to the Vienna Convention in its agreement with the Russian Federation on the LEU reserve. Thus, the Physical Reserve Agreement in article IV, paragraph 1, envisages that "Liability for nuclear damage caused by a nuclear incident associated with the storage, handling or transport of the LEU shall be governed by the provisions of the Vienna Convention on Civil Liability for Nuclear Damage of 1963".

Under article I.1(c) of the Vienna Convention, an "operator" of a nuclear installation means the entity designated or recognized by the installation state as the operator of that installation. While a "nuclear installation" is defined in article I.1(j) and refers to land-based nuclear reactors excluding those that are used as equipment providing power for sea or air transport. The definition also includes factories using nuclear fuel for the production of nuclear material, or processing or reprocessing irradiated nuclear fuel, as well as any facility where nuclear material is stored. The Convention excludes facilities where nuclear material is stored as an incidental part of its carriage, for example, on a railway station platform. However, in accordance with the Convention, the installation state may determine that several nuclear installations of one operator, which are located at the same site, shall be considered as a single nuclear installation (article I.1(j)).

Therefore, a Host State, as the installation state, will have to address the above-mentioned aspects in the Host State Agreement with the IAEA. In accordance with the IAEA Safety Requirements on "Legal and Governmental Infrastructure for Nuclear Radiation, Radioactive Waste and Transport Safety", which establish all the legal and governmental requirements for the entire range of facilities and activities, the legislation of the operator shall define liabilities in respect to nuclear damage.[153]

Under article II.1 of the Vienna Convention, the operator is exclusively liable both if the nuclear accident occurs at its own nuclear installation or if the incident occurs in the course of transport of nuclear material to and from the installation. Pursuant to article II.2, the installation state may provide by legislation that a carrier of nuclear material be designated or recognized as operator in the place of the operator concerned. However, such substitution must be requested by the carrier and have the consent of the concerned operator. In the case of transport of LEU, the operator's liability excludes the liability of the carrier which, under common law, would otherwise be liable. Article II.5 of the Vienna Convention adds that no entity other than the operator shall be liable for nuclear damage, if not provided otherwise in the Convention, but envisaged that such requirement shall not affect the application of any international convention in the field of transport in force or open for signature, ratification or accession at the date on which the Convention is opened for signature. The international agreements in the field of transport are understood to mean international agreements dealing with third-party liability for damage involving means of transport and international agreements dealing with bills of lading. A claimant suffering damage caused in the course of transport may claim liability against the operator under the Vienna Convention or against the carrier under the existing international agreements in the field of transport.[154]

In the case of transporting LEU from the IAEA bank, the operator of the bank will be liable as a sending operator, until another operator assumes liability in accordance with the applicable supply agreement or contract.

Article IV, paragraph 2, of the Physical Reserve Agreement provides that, in the case that the Vienna Convention is not applicable, the owner of the LEU will assume liability for any damage caused by an incident associated with the storage, handling or transport of it. This provision was relevant for the Physical Reserve Agreement because the LEU is owned

by the Government of the Russian Federation until ownership of the LEU is transferred through the IAEA to a consumer state at the sea port of St Petersburg in Russia (article I.5). However, with regard to the IAEA LEU bank, this provision would not be supported by the IAEA neither in a Host State Agreement, nor in the transport and transit agreements with other counterparts because the IAEA is the owner of the LEU in the bank.[155] In accordance with the proposal for the establishment of the IAEA LEU bank, the IAEA will transfer the ownership of the LEU only at the time when it delivers the LEU from the bank "to the Government or to its designated representative" at an agreed place.[156] Therefore, in such transactions the operator shall be liable. In the case that a receiving state is not party to the Vienna Convention, the sending operator—the operator of the IAEA LEU bank—shall be liable until the material has been unloaded from the means of transport by which it arrived in the territory of that state. Therefore, it is very important that the Host State is party to the Convention, as the operator of the IAEA LEU bank will have to carry liability during the transportation of LEU from the bank to a state that is not party to the Convention.

A study on the transport of LEU for the IAEA LEU bank made by the Edlow Company finds that the routes for the transportation of LEU should preferably go through states with well defined nuclear liability regimes, or at least through states that have commercial liability insurance.[157] Most fuel fabricators, to which the LEU from the IAEA bank would be shipped, are party to the Paris, Brussels or Vienna Conventions, which provide for a nuclear liability insurance regime. Some states, which are not party to the Paris Convention, have their own well established nuclear liability regimes, including Japan, the Republic of Korea and the United States of America.[158]

Application of safety and physical protection measures by a Host State and the extraterritoriality of the IAEA LEU bank

Extraterritoriality of the IAEA LEU bank may be problematic for the application of various measures by a Host State. Under the extraterritoriality principle, the territory for the storage of the IAEA LEU bank will be exempt from the jurisdiction of the Host State. However, as mentioned above, a Host State will be responsible for the application of safety and physical protection to LEU that is not under its jurisdiction. In accordance with

the above-mentioned documents, states apply such measures to nuclear material that is under their jurisdiction.

Given that, the IAEA will not be able to apply such measures and it will have to arrange through a Host State Agreement that the measures will be applied by the Host State. In order to enable such a mechanism to work, the IAEA will have to limit the extraterritoriality of the LEU bank by allowing the Host State's jurisdiction for such purposes.

The issue of extraterritoriality may also arise in case of nuclear damage caused by the LEU stored in the IAEA bank. For the purposes of the Host State Agreement, the Host State will have to be the installation state, providing a location at a nuclear facility for hosting the IAEA LEU bank. Under the conventions on civil liability for nuclear damage, an operator of a nuclear facility is strictly liable for nuclear damage. The IAEA, not being the operator of the facility, would be indemnified from such liability. However, if the claimants have to prove a causal link between a certain nuclear incident and the damage suffered, and also to prove negligence on the part of the operator, a court hearing a lawsuit for compensation for nuclear damage caused to victims in a third state would need to obtain access to the site of the IAEA LEU bank for the purpose of fact-finding. Given the extraterritoriality of the IAEA LEU bank, this may not be possible.

KAZAKHSTAN AS A POTENTIAL HOST STATE OF THE IAEA LEU BANK

As of December 2010, only the Republic of Kazakhstan has offered to host the IAEA LEU bank.[159] Kazakhstan expressed its readiness to prepare with the IAEA a Host State Agreement and to discuss the practical issues of the project.

As mentioned above, a potential Host State needs to have a nuclear infrastructure and an appropriate legal framework to be able to host the IAEA LEU bank. It is important to underline at this stage that the IAEA Secretariat has not yet taken a position on the criteria for the selection of a Host State. Therefore, this assessment of Kazakhstan as a potential Host State is based on the criteria assumed by the author as explained in this paper.

In terms of nuclear infrastructure, Kazakhstan shall preferably have a conversion or fabrication facility to host the IAEA LEU bank. As mentioned above, such facilities must have the capability to empty and refill storage cylinders. This would be essential if any cylinder were to degrade to the point that its contents had to be transferred to another cylinder. Currently, Kazakhstan operates conversion plants producing pure uranium oxide (U_3O_8) and one plant is under construction.[160] Kazakhstan has a major plant making nuclear fuel pellets and aims eventually to sell value-added fuel rather than just uranium and it aims to supply 30% of the world fuel fabrication market by 2015.[161] Given the presence of these facilities, Kazakhstan has the necessary technical capability to host the IAEA LEU bank.

In terms of legal framework, Kazakhstan meets the general requirements for a Host State of being a member of the IAEA and a party to the privileges and immunities agreement with the IAEA, being a non-nuclear-weapon state party to the NPT, and having a Comprehensive Safeguards Agreement and an Additional Protocol in force. Kazakhstan became a member of the IAEA on 14 February 1994 and the Agreement on the Privileges and Immunities of the IAEA entered into force for Kazakhstan on 9 April 1998. It acceded to the NPT on 14 February 1994.[162] Kazakhstan's Comprehensive Safeguards Agreement entered into force on 11 August 1995[163] and its Additional Protocol on 9 May 2007. In addition, on 13 January 2008, Kazakhstan ratified the Treaty on a Nuclear-Weapon-Free Zone in Central Asia, which entered into force on 21 March 2009. Kazakhstan has a Comprehensive Safeguards Agreement-required state system of accounting for and control of nuclear material, represented by the nuclear regulatory body Kazakhstan Atomic Energy Committee, which is, however, not functionally independent from the Ministry of Fuel and Mineral Resources. Therefore, the Committee should be further improved to fully meet the Comprehensive Safeguards Agreement requirement and to become an effective IAEA counterpart for the implementation of integrated safeguards.

The following agreements entered into force for Kazakhstan on the following dates:

- Convention on the Physical Protection of Nuclear Material (CPPNM)—2 September 2005;

- Convention on Early Notification of a Nuclear Accident—9 April 2010;
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency—9 April 2010;
- Convention on Nuclear Safety—8 June 2010; and
- International Convention for the Suppression of Acts of Nuclear Terrorism—31 July 2008.

However, as of May 2011, the following agreements have not yet entered into force for Kazakhstan:

- Vienna Convention on Civil Liability for Nuclear Damage;
- Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage;
- Amendment to the CPPNM;
- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention; and
- Convention on Supplementary Compensation for Nuclear Damage.

Though the Code of Conduct on the Safety and Security of Radioactive Sources is not binding, it is supported by many states; Kazakhstan has not expressed to the IAEA its support for the Code.

On 29 March 2011, the IAEA received Kazakhstan's instrument of accession to the 1963 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage. These two instruments will enter into force for Kazakhstan on 29 June 2011.

CONCLUSIONS

The legal framework of a future Host State of the IAEA LEU bank is still to be defined by the IAEA Secretariat. The proposal for an IAEA LEU bank approved by the Board of Governors on 3 December 2010 does not provide a great amount of detail with regard to the Host State that could have made it possible to identify clearly at this stage the selection criteria and requirements for nuclear infrastructure and legal framework.

The Board only envisaged that the Host State will have to apply the safety standards and measures and the physical protection measures to the LEU in the bank and that such application will have to be ensured by the IAEA. Another requirement is that the Host State will have to be an IAEA member state and have a developed nuclear infrastructure.

More specific discussions of the legal framework of a Host State will take place once the IAEA Secretariat has established the selection criteria. Nevertheless, though such information is not available at the moment, this paper aims to anticipate such discussions and identify the main features of the legal framework of a Host State by relying on the currently available studies made by the IAEA to advise states on the development of a national infrastructure for nuclear power.[164] Some other elements of the legal framework of a Host State are identified in the Physical Reserve Agreement establishing the Russian LEU reserve and in the IAEA Headquarters Agreements. Both those agreements were used as points of reference in this paper.

This paper identified the main requirements for the legal framework of a Host State of the IAEA LEU bank. In order to ensure the establishment and efficient operation of the bank, the legislation of a Host State should cover comprehensively all aspects of nuclear law—nuclear safety, security (physical protection), safeguards and liability for nuclear damage. A Host State will need to adopt the set laws that were outlined in the paper. It is advisable that for the purpose of hosting the IAEA LEU bank, a Host State shall be a member of the IAEA and conclude a privileges and immunities agreement with the IAEA, shall be a non-nuclear-weapon state party to the NPT and shall have a Comprehensive Safeguards Agreement and an Additional Protocol in force.

It is expected that a Host State will need to apply the safety and physical security measures to the LEU in the IAEA bank. It is recommended that the Host State follow the IAEA Safety Fundamentals, which, among other things, require states to establish a legislative and statutory framework for the regulation of nuclear installations and request a clear separation of responsibilities between the regulatory body and the operating organization. In the case that a state offers to host the IAEA LEU bank at an operating nuclear power plant site, the state will also have to be party to the Convention on Nuclear Safety. The IAEA may request the Host State to apply safety measures in accordance with INFCIRC/18/Rev.1 given that the

IAEA has already made reference to it in the Physical Reserve Agreement with the Russian Federation on the LEU reserve. According to the Agency's Safety Standards and Measures, all responsibility for safety shall be assumed by the state and the IAEA shall incur no liability whatsoever. The Host State Agreement will most likely have to provide for safety missions sent by the IAEA to verify the effectiveness of the safety measures applied by the Host State to the LEU bank. It would be appropriate for the IAEA to request, in advance, from a potential Host State a statement of the safety standards that it proposes to apply in connection with the IAEA LEU bank.

For the transport of the LEU to and from the IAEA bank, a Host State will need to implement relevant regulations for the safe transport of LEU, apply the IAEA transport regulations and the IAEA will need to ensure such application through the Host State Agreement, which will need to contain provisions on the legal aspects of the international transport of nuclear materials.

The Host State will have to implement relevant legal and guidance instruments and ensure an appropriate regulatory framework for nuclear security and physical protection of the LEU stored in the IAEA bank and of the bank itself. Ideally, a Host State should be party to the CPPNM, which is the only internationally legally binding undertaking in the area of physical protection of nuclear material. Given that the Amendment to the CPPNM provides for a range of physical protection measures indispensable for ensuring proper security of LEU in the IAEA bank and of the bank itself, a Host State shall be party to the Amendment to the CPPNM when it enters into force. For the implementation of its undertakings under the Amendment to the CPPNM and the CPPNM itself, a Host State will have to establish and maintain an appropriate legislative and regulatory framework for physical protection, shall establish or designate a competent authority responsible for its implementation, and shall take other appropriate administrative measures necessary for the physical protection of such material and facilities. For this the Host State will have to follow the IAEA Safety Requirements for the Legal and Governmental Infrastructure for Nuclear Radiation, Radioactive Waste and Transport Safety, which advise the regulatory body not only on safety matters, but also on physical protection and safeguards implementation. A Host State Agreement will make reference to the latest revision of INFCIRC/225 for the application of the physical protection measures to the LEU in the IAEA bank.

In accordance with the Nuclear Terrorism Convention, a Host State will have to adopt appropriate measures to ensure the protection of radioactive material taking into account relevant IAEA recommendations and functions.

In terms of nuclear liability, the IAEA most likely will require a Host State to be party to the Vienna Convention on Civil Liability for Nuclear Damage, given that the Convention was concluded under IAEA auspices and the IAEA has already made reference to it in the Physical Reserve Agreement with the Russian Federation on the LEU reserve.

This paper provided a brief assessment of the legal framework of Kazakhstan as a potential Host State. This assessment did not analyse the state's nuclear legislation, but only its status under the necessary international legal instruments. Currently, Kazakhstan meets the general requirements for a Host State of being a member of the IAEA and a party to the privileges and immunities agreement with the IAEA, being a non-nuclear-weapon state party to the NPT and having a Comprehensive Safeguards Agreement and an Additional Protocol in force. It has brought into force required agreements in the field of nuclear safety and security, while the Vienna Convention on Civil Liability for Nuclear Damage and Protocol thereto will soon enter into force for Kazakhstan. The recent adherence to the two instruments strengthens the legal framework of Kazakhstan vis-à-vis the IAEA LEU bank and improves its chances to be selected as a candidate location by the IAEA.

Notes

Introduction
Yury Yudin

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2 Ibid., pp. 4–5.

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Anton Khlopkov

1 For information on these proposals see Y. Yudin, *Multilateralization of the Nuclear Fuel Cycle: Assessing the Existing Proposals*, UNIDIR, 2009.
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3 See World Nuclear Association, "World Nuclear Power Reactors & Uranium Requirements", <http://world-nuclear.org/info/reactors.html>.
4 A. Khlopkov, "The Angarsk Project: Enrichment vs. Proliferation", *Indeks Bezopasnosti*, vol. 14, no. 3, 2008, p. 39 (in Russian).
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6 T. Rauf, Z. Vovchok and V. Gutkov, "Nuclear Fuel Banks: An Idea Whose Time Has Come", *Yaderny Klub*, no. 1, 2010, p. 24 (in Russian).
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34 In June 2006 six states having commercial uranium enrichment facilities on their territory (France, Germany, the Netherlands, Russia, the United Kingdom and the United States) proposed a two-tier system of assurances of supply of enrichment services in the event of a failure of market mechanisms. Under the proposal, as "basic assurances" the suppliers of enriched uranium would agree to stand in for each other in the event of disruption of supply to customers in states that have "chosen to obtain supplies on the international market and not to pursue sensitive fuel cycle activities"; see IAEA, *Communication Dated 31 May 2006 Received from the Permanent Missions of France, Germany, the Netherlands, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America*, document GOV/INF/2006/10, 1 June 2006.

35 Final Document of the 2010 NPT Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, document NPT/CONF.2010/50 (Vol.I), 4 June 2010, para. 57.

36 Argentina, Brazil, Cuba, Egypt, Malaysia, Pakistan, South Africa and Venezuela voted against the proposal; India, Kenya and Turkey abstained. See "IAEA Adopts Resolution on Russian Initiative to Set Up Guaranteed LEU Reserve", *Nuclear.ru*, 27 November 2009, <www.nuclear.ru/rus/press/nuclear_cycle/2114614/> (in Russian).

37 Resolution of the Government of the Republic of Kazakhstan of 6 February 2007, no. 85, "On Signing the Agreement between the Government or the Republic of Kazakhstan and the Government of the Russian Federation on the Creation of the International Uranium Enrichment Center", <http://ru.government.kz/docs/p070085_20070206.htm> (in Russian).

38 See Y. Yudin, *Multilateral Approaches To the Nuclear Fuel Cycle. Assessing of the Existing Proposals*, UNIDIR, 2009, p. 46.

Legal framework for a state hosting an IAEA LEU bank
Zoryana Vovchok

1 M. ElBaradei, "Towards a Safer World", *The Economist*, 16 October 2003.

2 IAEA document GOV/INF/2007/11, 13 June 2007 (restricted).

3 See T. Rauf and Z. Vovchok, "Fuel for Thought", *IAEA Bulletin*, vol. 49, no. 2, 2008, pp. 62–63; and T. Rauf and Z. Vovchok, "A Secure Nuclear Future", *IAEA Bulletin*, vol. 51, no. 1, 2009, pp. 10–13.

4 IAEA document GOV/2009/30, 20 May 2009 (restricted).

5 Another proposal was by Germany on the establishment of a Multilateral Enrichment Sanctuary Project (IAEA document GOV/2009/32, 22 May 2009 (restricted)). See also T. Rauf and Zoryana Vovchok, "A Secure Nuclear Future", *IAEA Bulletin*, vol. 51, no. 1, 2009, pp. 10–13; and T. Rauf and Z. Vovchok, "Assurance of Supply: A New Framework for Nuclear Energy", *Innovations*, vol. 4, no. 4, 2009, pp. 193–201.

6 IAEA, *Request by the Russian Federation Regarding its Initiative to Establish a Reserve of Low Enriched Uranium (LEU) for the Supply of LEU to the IAEA for its Member States*, document GOV/2009/81, 27 November 2009. On 27 November 2009, the IAEA Board of Governors authorized the Director General to conclude and subsequently implement the Agreement Between the Government of the Russian Federation and the International Atomic Energy Agency Regarding the Establishment on the Territory of the Russian Federation of a Physical Reserve of Low Enriched Uranium and the Supply of Low Enriched Uranium therefrom to the International Atomic Energy Agency for its Member States (the Physical Reserve Agreement, attachment 1 to IAEA document GOV/2009/76, 11 November 2009 (restricted)). On 29 November 2010, Russia informed the IAEA that it had met all necessary conditions for the entry into force of the Physical Reserve Agreement and that the full amount of the guaranteed reserve had been placed in the storage facility of the International Uranium Enrichment Center.

7 IAEA document GOV/2010/67, 26 November 2010 (restricted); and IAEA document GOV/2010/67/Add.1, 1 December 2010 (restricted). The following member states not then on the Board of Governors supported the proposal for the establishment of an IAEA LEU bank: member sates of the European Union (Austria, Bulgaria, Cyprus, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Poland, Romania, Slovakia, Slovenia, Spain and Sweden), Kazakhstan, Kuwait and Norway.

8 IAEA document GOV/2010/68, 29 November 2010 (restricted); and IAEA document GOV/2010/68/Add.1, 1 December 2010 (restricted). The resolution was adopted as GOV/2010/70.

9 See T. Rauf and Z. Vovchok, "A Secure Nuclear Future", *IAEA Bulletin*, vol. 51, no. 1, 2009, pp. 10–13.

[10] "Practical and Technical Aspects of an IAEA Low Enriched Uranium Bank", 27 October 2010.

[11] "Transport Costs to Transport Low Enriched Uranium for an IAEA Nuclear Fuel Bank (INFB)", 1 November 2010.

[12] See IAEA document 2010/Note 51, 29 October 2010. The findings of the two studies were presented to IAEA member states at a briefing on "Practical and Technical Aspects of an IAEA Low Enriched Uranium Bank", which took place at IAEA Headquarters on 8 November 2010.

[13] See IAEA document GOV/2010/67, 26 November 2010 (restricted); and IAEA document GOV/2010/67/Add.1, 1 December 2010 (restricted).

[14] IAEA document GOV/2010/67, 26 November 2010, para. 22(d) (restricted).

[15] Ibid., para. 15; see also articles III.A.6 and IX.I of the IAEA Statute and IAEA, *The Agency's Safety Standards and Measures*, document INFCIRC/18/Rev.1, April 1976.

[16] IAEA, *The Texts of the Agency's Headquarters Agreement with Austria and Related Agreements*, document INFCIRC/15/Rev.1, 12 December 1975.

[17] IAEA, *Communication Dated 18 May 2009 Received from the Permanent Mission of Kazakhstan to the Agency Enclosing a Position Paper Regarding the Establishment of IAEA Nuclear Fuel Banks*, document INFCIRC/753, 19 May 2009.

[18] See IAEA, *Communication Dated 11 January 2010 Received from the Permanent Mission of the Republic of Kazakhstan to the Agency Enclosing a Position Regarding the Establishment of IAEA Nuclear Fuel Banks*, document INFCIRC/782, 15 January 2010.

[19] Ibid.

[20] See, for example, IAEA, *Agreement for the Establishment in Cairo of a Middle Eastern Regional Radioisotope Centre for the Arab Countries*, document INFCIRC/38, 18 October 1962; IAEA, *The Text of the Agreement between the Agency and the Government of Italy Concerning the Establishment of an International Centre for Theoretical Physics at Trieste*, document INFCIRC/51, 10 December 1963; IAEA, *The Text of the Agreement between the Agency and the Government of Italy Concerning the Seat of the International Centre for Theoretical Physics*, document INFCIRC/114, 12 June 1968; IAEA, *The Text of the Agreement of 16 May 1986 between the Government of Monaco and the Agency Concerning the International Laboratory of Marine Radioactivity and the Privileges and Immunities of the Agency within the Principality*, document INFCIRC/337, March 1987; IAEA, *The Text of an Agreement between the International Atomic Energy Agency and the Federal Government of the Republic of Austria Regarding the Laboratories at Seibersdorf*, document INFCIRC/15/Rev.1/Add.2, July 1990.

[21] The Agreement Between the Government of the Russian Federation and the International Atomic Energy Agency Regarding the Establishment on the Territory of the Russian Federation of a Physical Reserve of Low Enriched Uranium and the Supply of Low Enriched Uranium therefrom to the

International Atomic Energy Agency for its Member States (the Physical Reserve Agreement, attachment 1 to IAEA document GOV/2009/76, 11 November 2009 (restricted)).

22 IAEA document GOV/2010/67, 26 November 2010, para. 11 (restricted).

23 Ibid., para. 15.

24 See IAEA, *Agreement Between the International Atomic Energy Agency and the Republic of Austria Regarding the Headquarters of the International Atomic Energy Agency*, document INFCIRC/15/Rev.1, 12 December 1975, art. VIII, § 20.

25 IAEA, *Milestones in the Development of a National Infrastructure for Nuclear Power*, document STI/PUB/1305, 2007, p. 28.

26 Ibid., p. 29.

27 IAEA, *Handbook on Nuclear Law*, document STI/PUB/1160, 2003, pp. 5–11.

28 IAEA, *Code of Conduct on the Safety and Security of Radioactive Sources*, document IAEA/CODEOC/2004, 2004.

29 IAEA, *Guidance on the Import and Export of Radioactive Sources*, document IAEA CODEOC/IMP-EXP/2005, March 2005.

30 See IAEA, *Vienna Convention on Civil Liability for Nuclear Damage*, document INFCIRC/500, 20 March 1996. The Convention was opened for signature on 21 May 1963 and entered into force on 12 November 1977.

31 See IAEA, *Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage*, document INFCIRC/566, 22 July 1998. The Protocol was opened for signature on 29 September 1997 and entered into force on 4 October 2003.

32 IAEA, *Handbook on Nuclear Law*, document STI/PUB/1160, 2003, p. 17.

33 See IAEA, *Convention on Early Notification of a Nuclear Accident*, document INFCIRC/335, 18 November 1986. The Convention entered into force on 27 October 1986.

34 See the 1961 Vienna Convention on Diplomatic Relations.

35 I. Brownlie, *Principles of Public International Law*, 7th ed., 2008, p. 681.

36 See IAEA, *Agreement on the Privileges and Immunities of the International Atomic Energy Agency*, document INFCIRC/9/Rev.2, 26 July 1967; and IAEA, *Agreement Relating to the Headquarters of the International Atomic Energy Agency*, document INFCIRC/15/Rev.1, 12 December 1975.

37 P. Szasz, *The Law and Practice of the International Atomic Energy Agency*, IAEA document STI/PUB/250, 1970, pp. 339–40.

38 Ibid.

39 See IAEA, *The Text of the Agreement of 21 February 1985 Between the Union of Soviet Socialist Republics and the Agency for the Application of Safeguards in the Union of Soviet Socialist Republics*, document INFCIRC/327, July 1985, art. 10. The Agreement was signed on 21 February 1985 and entered into force on 10 June 1985.

[40] "The Agency shall be the owner of the LEU in the IAEA LEU bank and the LEU shall be under its control and in its formal legal possession"; see IAEA document GOV/2010/67, 26 November 2010, para. 15 (restricted).

[41] See IAEA, *The Texts of the Agency's Headquarters Agreement with Austria and Related Agreements*, document INFCIRC/15/Rev.1, 12 December 1975, e.g. §§ 25, 26, 38, 39.

[42] IAEA, *Basic Infrastructure for a Nuclear Power Project*, document IAEA-TECDOC-1513, June 2006, p. 50.

[43] L. Rockwood, "Safeguards and Nonproliferation: The First Half-Century from a Legal Perspective", *Journal of Nuclear Materials Management*, vol. 35, no. 4, 2007, p. 9.

[44] See IAEA, *The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, document INFCIRC/153(Corr.), June 1972.
Comprehensive Safeguards Agreements are concluded by non-nuclear-weapon states party to the NPT. These are agreements governed by international law. They are concluded between the IAEA and a state or states (and, in some instances, regional organizations, such as the European Atomic Energy Community or the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials). Safeguards agreements are drafted by the IAEA Secretariat on the basis of the model agreement reproduced in INFCIRC/153, negotiated with the other parties to the agreement, approved by the Board of Governors of the IAEA, and signed by the Director General of the IAEA and by the Head of State, Head of Government or Foreign Minister of the state party (or other representative with full power to do so). Safeguards agreements enter into force either upon signature or upon receipt by the IAEA of written notification that the state's requirements for entry into force have been met. The difference in procedure of the entry into force depends on the state's domestic law. See L. Rockwood, "The IAEA's Strengthened Safeguards System", *Journal of Conflict and Security Law*, vol. 7, no. 1, 2002, p. 123; and L. Rockwood, "Safeguards and Nonproliferation: The First Half-Century from a Legal Perspective", *Journal of Nuclear Materials Management*, vol. 35, no. 4, 2007, pp. 8–10.

[45] The Agency, through its safeguards system, verifies compliance in the context of different nuclear-weapon-free zone treaties in the states with CSAs in force. The Treaty for the Prohibition of Nuclear Weapons in Latin America (the Treaty of Tlatelolco, concluded in 1967, before the NPT) requires states parties to conclude CSAs with the IAEA (articles 13, 16(1)(a)). So do the other treaties, including the 1985 South Pacific Nuclear Free Zone Treaty (Treaty of Rarotonga), the 1995 Treaty on the South-East Asia Nuclear Weapon Free Zone (Treaty of Bangkok), the 1996 African Nuclear-Weapon-Free Zone Treaty (Pelindaba Treaty) and the 2006 Treaty on a Nuclear-Weapon-Free Zone in Central Asia (Treaty of Semipalatinsk, which also requires states parties to conclude the Additional Protocol to safeguards agreements).

[46] IAEA, *Handbook on Nuclear Law*, document STI/PUB/1160, 2003, p. 121.

47 Article III.A.5: "The Agency is authorized … To establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy".

48 IAEA, *The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, document INFCIRC/153(Corr.), June 1972; IAEA, *The Standard Text of Safeguards Agreements in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, document GOV/INF/276, 22 August 1974 (also GOV/INF/276/Mod.1 of 21 February 2006 and GOV/INF/276/Mod.1/Corr.1 of 28 February 2006); For more on INFCIRC/153 see L. Rockwood, "The IAEA's Strengthened Safeguards System", *Journal of Conflict and Security Law*, vol. 7, no. 1, 2002, p. 123; and L. Rockwood, "Safeguards and Nonproliferation: The First Half-Century from a Legal Perspective", *Journal of Nuclear Materials Management*, vol. 35, no. 4, 2007, p. 10.

49 R. Hooper, Richard, "The Changing Nature of Safeguards", *IAEA Bulletin*, vol. 45, no. 1, 2003, p. 7.

50 IAEA, *Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards*, document INFCIRC/540(Corr.), September 1997.

51 Article 1 of the AP determines the manner in which it should be implemented in conjunction with the safeguards agreement. See L. Rockwood, "The IAEA's Strengthened Safeguards System", *Journal of Conflict and Security Law*, vol. 7, no. 1, 2002, pp. 128–34.

52 Ibid., pp. 124–26.

53 IAEA, *The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, document INFCIRC/153(Corr.), June 1972, para. 28.

54 Ibid., para. 7: "The Agreement should provide that the State shall establish and maintain a system of accounting for and control of all *nuclear material* subject to safeguards under the Agreement"; see also paras. 31 and 32.

55 Article V of the Physical Reserve Agreement (attachment 1 to IAEA document GOV/2009/76, 11 November 2009 (restricted)).

56 See IAEA, *The Text of the Agreement of 21 February 1985 between the Union of Soviet Socialist Republics and the Agency for the Application of Safeguards in the Union of Soviet Socialist Republics*, document INFCIRC/327, July 1985.

57 IAEA document GOV/2010/67, 26 November 2010, para. 16 (restricted).

58 IAEA, *The Texts of the Agency's Headquarters Agreement with Austria and Related Agreements*, document INFCIRC/15/Rev.1, 12 December 1975, article III, § 7(a).

59 Ibid., § 8(a).

60 IAEA document GOV/2010/67, 26 November 2010, para. 16 (restricted).

61 IAEA, *Fundamental Safety Principles*, document STI/PUB/1273, 2006; IAEA, *Safety of Nuclear Power Plants: Operation*, document STI/PUB/1096, 2000.

62 N. Pelzer, "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Nuclear Accident Contribute to Improving Nuclear Law?", in *International Nuclear Law in the Post-Chernobyl Period*, Nuclear Energy Agency and Organization for Economic Cooperation and Development, 2006, p. 86.

63 Ibid., p. 84.

64 Ibid., p. 88.

65 IAEA Statute, arts. III.A.6 and XII.

66 See IAEA, *The Safety of Nuclear Installations*, document STI/PUB/938, 1993.

67 Ibid., para. 203.

68 Ibid., para. 209.

69 Ibid., paras. 301–307.

70 The Convention on Nuclear Safety was adopted on 17 June 1994 and entered into force on 24 October 1996. For the text of the Convention see IAEA, *Convention on Nuclear Safety*, document INFCIRC/449, 5 July 1994. As of May 2011, there are 72 states parties and 65 signatories.

71 Article 2(i) continues: "Such a plant ceases to be a nuclear installation when all nuclear fuel elements have been removed permanently from the reactor core and have been stored safely in accordance with approved procedures, and a decommissioning programme has been agreed to by the regulatory body".

72 Examples of Project and Supply Agreements can be found in IAEA, *The Texts of Instruments Connected with the Agency's Supply of Uranium to Japan*, document INFCIRC/3, 15 April 1959 (and INFCIRC/3/Mod.2); IAEA, *The Texts of the Instruments Connected with the Agency's Assistance to Finland in Establishing a Research Reactor Project*, document INFCIRC/24, 24 January 1961 (and INFCIRC/24/Add.1–4); IAEA, *The Texts of the Instruments Connected with the Agency's Assistance to the Congo (Leopoldville) in Continuing a Research Reactor Project*, document INFCIRC/37, 15 February 1963 (and INFCIRC/37/Add.1 and 2); IAEA, *The Texts of the Instruments Connected with the Agency's Assistance to Finland in Establishing a Sub-critical Assemblies Project*, document INFCIRC/53, 10 February 1964; IAEA, *Project and Supply Agreement*, document INFCIRC/526, October 1996; and IAEA, *Agreement Among the Government of the Republic of Poland, the Government of the Russian Federation and the International Atomic Energy Agency for Assistance in Securing Nuclear Fuel for a Research Reactor*, document INFCIRC/642, 14 April 2005. See also P. Szasz, *The Law and Practice of the International Atomic Energy Agency*, IAEA document STI/PUB/250, 1970, pp. 411–34.

73 The IAEA Safety Standards and Measures were first approved by the Board of Governors on 31 March 1960 as the Agency's Health and Safety Measures (INFCIRC/18) in view of implementation of articles III.A.6 and XII of the Statute. The Health and Safety Measures were revised in 1975 on the basis of

the experience gained from applying those measures to projects carried out by member states under agreements concluded with the IAEA. The revised document was approved by the Board of Governors on 25 February 1976; see IAEA, *The Agency's Safety Standards and Measures*, document INFCIRC/18/Rev.1, April 1976.

74 Ibid., para. 1.1.

75 IAEA, *International Basic Safety Standards for Protecting Against Iionizing Radiation and for the Safety of Radiation Sources*, document STI/PUB/996, 1996.

76 IAEA, *The Agency's Safety Standards and Measures*, document INFCIRC/18/Rev.1, April 1976, para. 1.2.

77 Article I.8(c) of the Physical Reserve Agreement (attachment 1 to IAEA document GOV/2009/76, 11 November 2009 (restricted)).

78 Ibid., art. VI.

79 IAEA document GOV/2010/67, 26 November 2010, para. 15 (restricted); see also the IAEA Statute, articles III.A.6 and IX.I; and IAEA, *The Agency's Safety Standards and Measures*, document INFCIRC/18/Rev.1, April 1976.

80 Ibid., para. 4.1.

81 Ibid., para. 2.4.

82 Ibid., paras. 3.1(b) and 4.6.

83 IAEA, *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety: Requirements*, document STI/PUB/1093, 2000.

84 IAEA, *International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources*, document STI/PUB/996, 1996.

85 IAEA, *Regulations for the Safe Transport of Radioactive Material*, 2009 ed., document STI/PUB/1384, 2009.

86 IAEA, *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety: Requirements*, document STI/PUB/1093, 2000, para. 1.3.

87 Ibid., para. 2.3.

88 Ha Vinh P., "Legal Aspects of the International Transport of Radioactive Materials", *IAEA Bulletin*, vol. 21, no. 6, 1979, pp. 13–18.

89 The IAEA published the first edition of the regulations in 1961 for application to the national and international transport of radioactive material by all modes of transport. The regulations were updated in 1964, 1967, 1973, 1985, 1996, 2005 and 2009. See IAEA, *Regulations for the Safe Transport of Radioactive Material*, 2009 ed., document STI/PUB/1384, 2009. See also "Transport Safety" at <www-ns.iaea.org/tech-areas/radiation-safety/transport.htm>.

90 The first version of the *Recommendations on the Transport of Dangerous Goods: Model Regulations* was prepared by the United Nations Economic and Social Council's Committee of Experts on the Transport of Dangerous Goods and was published in 1956.

[91] *Recommendations on the Transport of Dangerous Goods: Model Regulations*, UN document ST/SG/AC.10/1/Rev.16 (Vol. I), 16th rev. ed., 2009, chapter 2.7.

[92] Ha Vinh P., "Legal Aspects of the International Transport of Radioactive Materials", *IAEA Bulletin*, vol. 21, no. 6, 1979, p. 14.

[93] IAEA, *Regulations for the Safe Transport of Radioactive Material*, 2009 ed., document STI/PUB/1384, 2009, para. 106.

[94] These regulations apply to LEU in the form of uranium hexafluoride (UF_6); ibid., para. 403, table 1. Therefore the regulations will be applicable to the transport of LEU to and from the bank.

[95] IAEA, *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material*, document STI/PUB/1325, 2008.

[96] IAEA, *Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material*, document STI/PUB/1119, 2002.

[97] IAEA, *Compliance Assurance for the Safe Transport of Radioactive Material*, document STI/PUB/1361, 2009.

[98] IAEA, *The Management System for the Safe Transport of Radioactive Material*, document STI/PUB/1352, 2008.

[99] IAEA, *Radiation Protection Programmes for the Transport of Radioactive Material*, document STI/PUB/1269, 2007.

[100] The UN TDG are drawn up by the United Nations Economic and Social Council's Committee of Experts on the Transport of Dangerous Goods. They are recommended international standards and therefore not binding. However, they are incorporated into mandatory international regulations for transport of dangerous goods by air, water, road and rail. See United Nations Economic Commission for Europe, *Recommendations on the Transport of Dangerous Goods: Model Regulations*, UN document ST/SG/AC.10/1/Rev.16 (vols. I and II), 2009.

[101] See ICAO, *Technical Instructions for the Safe Transport of Dangerous Goods by Air*, 2011–2012 ed.

[102] See IATA, *Dangerous Goods Regulations*, 52nd ed., 2011.

[103] See International Maritime Organization, *International Maritime Dangerous Goods Code*, 2010 ed.

[104] United Nations Economic Commission for Europe, *European Agreement Concerning the International Carriage of Dangerous Goods by Road*, UN document ECE/TRANS/215 (vols. I and II), 2010.

[105] Intergovernmental Organisation for International Carriage by Rail, *Regulations Concerning the International Carriage of Dangerous Goods by Rail*, 2011 ed.

[106] National Nuclear Security Administration, *International Safeguards: Challenges and Opportunities for the 21st Century*, US Department of Energy, 2007, p. 45.

[107] For the latest version see IAEA, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)*, document STI/PUB/1481, 2011.

[108] The CPPNM was adopted in Vienna on 26 October 1979, signed at Vienna and at New York on 3 March 1980, and entered into force 8 February 1987. As of November 2010, there are 145 states parties (including EURATOM) and 45 signatories. See IAEA, *Convention on the Physical Protection of Nuclear Material*, document INFCIRC/274/Rev.1, May 1980.

[109] See IAEA document GOV/2005/50, para. 2. This definition was initially proposed by the IAEA Advisory Group on Nuclear Security in 2002. See also C. Stoiber, "Nuclear Security: Legal Aspects of Physical Protection, Combating Illicit Trafficking and Nuclear Terrorism", in *International Nuclear Law: History, Evolution and Outlook*, Organization for Economic Cooperation and Development, 2010, p. 219.

[110] See "Physical Protection Objectives and Fundamental Principles" (GOV/2001/41), para. 104, p. 1, attached to IAEA, *Measures to Improve the Security of Nuclear Materials and Other Radioactive Materials*, document GC(45)/INF/14, 14 September 2001.

[111] M. Vez Carmona, "The International Regime on the Physical Protection of Nuclear Material and the Amendment to the Convention on the Physical Protection of Nuclear Material", *Nuclear Law Bulletin*, no. 76, 2005, p. 31.

[112] IAEA, *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety: Requirements*, document STI/PUB/1093, 2000, para. 3.4(6), p. 8.

[113] Ibid., para. 2.2(9), p. 4.

[114] C. Stoiber, "Nuclear Security: Legal Aspects of Physical Protection, Combating Illicit Trafficking and Nuclear Terrorism", in *International Nuclear Law: History, Evolution and Outlook*, Organization for Economic Cooperation and Development, 2010, p. 220.

[115] IAEA, *Regulations for the Safe Transport of Radioactive Material*, 2009 ed., document STI/PUB/1384, 2009, p. viii.

[116] C. Stoiber, "Nuclear Security: Legal Aspects of Physical Protection, Combating Illicit Trafficking and Nuclear Terrorism", in *International Nuclear Law: History, Evolution and Outlook*, Organization for Economic Cooperation and Development, 2010, pp. 221–22.

[117] Amendment to the CPPNM, art. 1A, in IAEA, *Nuclear Security—Measures to Protect Against Nuclear Terrorism*, document GC(49)/INF/6, 6 September 2005.

[118] CPPNM, art. III.

[119] CPPNM, annex II.

[120] CPPNM, art. IV(1) and (2).

[121] CPPNM, art. IV(4).

[122] Ibid., art. V(2).

[123] For the latest version see IAEA, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)*, document STI/PUB/1481, 2011.

124 IAEA, *Measures to Improve the Security of Nuclear Materials and Other Radioactive Materials*, document GC(45)/INF/14, 14 September 2001.

125 The Amendment was agreed in July 2005. Pursuant to article 20 of the Amendment, it shall enter into force for each state party that deposits its instrument of ratification, acceptance or approval of the amendment on the 30th day after the date on which two thirds of the states parties have deposited their instruments of ratification, acceptance or approval with the depositary. As of December 2010, only 42 states of 145 parties to the CPPNM have ratified the Amendment to the CPPNM. See IAEA, *Nuclear Security—Measures to Protect Against Nuclear Terrorism*, document GC(49)/INF/6, 6 September 2005.

126 Amendment to the CPPNM, art. 1A.

127 M. Vez Carmona, "The International Regime on the Physical Protection of Nuclear Material and the Amendment to the Convention on the Physical Protection of Nuclear Material", *Nuclear Law Bulletin*, no. 76, 2005, p. 43.

128 Article 2A(1)(a)–(d).

129 Article 2A(2)(a)–(c).

130 Adopted by the UN General Assembly on 13 April 2005, and entered into force on 7 July 2007. As of 1 December 2010, there are 76 states parties and 115 signatories. See General Assembly, *International Convention for the Suppression of Acts of Nuclear Terrorism*, UN document A/RES/59/290, 15 April 2005.

131 IAEA document GOV/2005/50, para. 3.

132 IAEA, *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency*, document INFCIRC/336, 18 November 1986; entered into force on 26 February 1987.

133 N. Pelzer, "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Nuclear Accident Contribute to Improving Nuclear Law?", in *International Nuclear Law in the Post-Chernobyl Period*, Nuclear Energy Agency and Organization for Economic Cooperation and Development, 2006, pp. 79–80.

134 IAEA, *Convention on Early Notification of a Nuclear Accident*, document INFCIRC/335, 18 November 1986. The Convention entered into force on 27 October 1986.

135 N. Pelzer, "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Nuclear Accident Contribute to Improving Nuclear Law?", in *International Nuclear Law in the Post-Chernobyl Period*, Nuclear Energy Agency and Organization for Economic Cooperation and Development, 2006, pp. 79–80.

136 Ibid., p. 80.

137 IAEA, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)*, document STI/PUB/1481, 2011.

138 M. Vez Carmona, "The International Regime on the Physical Protection of Nuclear Material and the Amendment to the Convention on the Physical Protection of Nuclear Material", *Nuclear Law Bulletin*, no. 76, 2005, p. 32.

[139] The recommendations were revised by a group of experts in cooperation with the IAEA Secretariat, and the revised version was published in 1975. The document was subsequently revised four times in 1977, 1989, 1993 and 1997. See also O. Jankowitsch-Prevor, "The Normative Role of International Atomic Energy Agency, Legal Basis and Legal Sources", in *International Nuclear Law: History, Evolution and Outlook*, Organization for Economic Cooperation and Development, 2010, p. 25.

[140] M. Vez Carmona, "The International Regime on the Physical Protection of Nuclear Material and the Amendment to the Convention on the Physical Protection of Nuclear Material", *Nuclear Law Bulletin*, no. 76, 2005, p. 32.

[141] Ibid.

[142] Ibid.

[143] For the latest version see IAEA, *Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)*, document STI/PUB/1481, 2011, para. 4.8.

[144] IAEA document GOV/2010/67, 26 November 2010, para. 15 (restricted).

[145] Ibid.

[146] See IAEA, *Code of Conduct on the Safety and Security of Radioactive Sources*, document IAEA/CODEOC/2004, 2004.

[147] C. Stoiber, "Nuclear Security: Legal Aspects of Physical Protection, Combating Illicit Trafficking and Nuclear Terrorism", in *International Nuclear Law: History, Evolution and Outlook*, Organization for Economic Cooperation and Development, 2010, p. 225.

[148] J. Schwartz, "Liability and Compensation for Third Party Damage Resulting from a Nuclear Incident", in *International Nuclear Law: History, Evolution and Outlook*, Organization for Economic Cooperation and Development, 2010, p. 340.

[149] For comprehensive descriptions and analyses of the international nuclear liability regime see N. Pelzer, *Main Features of the Revised International Regime Governing Nuclear Liability—Progress and Standstill*, Organization for Economic Cooperation and Development, 2010, pp. 355–86; N. Pelzer, "Modernizing the International Regime Governing Nuclear Third Party Liability", *Zeitschrift für Europäisches Umwelt- und Planungsrecht*, vol. 3, no. 5, 2005, pp. 212–23; and J. Schwartz, *Liability and Compensation for Third Party Damage Resulting from a Nuclear Incident*, Organization for Economic Cooperation and Development, 2010, pp. 307–54.

[150] N. Pelzer, "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Nuclear Accident Contribute to Improving Nuclear Law?", in *International Nuclear Law in the Post-Chernobyl Period*, Nuclear Energy Agency and Organization for Economic Cooperation and Development, 2006, p. 85.

[151] See arts. XXII, XXIV(2) and XXIX of the 1963 Vienna Convention on Civil Liability for Nuclear Damage.

[152] IAEA, *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage—Explanatory Texts*, document STI/PUB/1279, 2007, p. 7.

[153] IAEA, *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety: Requirements*, document STI/PUB/1093, 2000, para. 2.4.11, p. 5.

[154] IAEA, *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage—Explanatory Texts*, document STI/PUB/1279, 2007, p. 11.

[155] "The Agency shall be the owner of the LEU in the IAEA LEU bank and the LEU shall be under its control and in its formal legal possession"; see IAEA document GOV/2010/67, 26 November 2010, para. 15 (restricted).

[156] Article II(1) of the Model Supply Agreement (attachment 1 to IAEA document GOV/2010/67, 26 November 2010 (restricted).

[157] Edlow International Company, "Transport Costs to Transport LEU for an IAEA Nuclear Fuel Bank (INFB)", 1 November 2010, p. 8.

[158] Ibid., p. 5.

[159] See IAEA, *Communication Dated 18 May 2009 Received from the Permanent Mission of Kazakhstan to the Agency Enclosing a Position Paper Regarding the Establishment of IAEA Nuclear Fuel Banks*, document INFCIRC/753, 19 May 2009; and IAEA, *Communication Dated 11 January 2010 Received from the Permanent Mission of the Republic of Kazakhstan to the Agency Enclosing a Position Regarding the Establishment of IAEA Nuclear Fuel Banks*, document INFCIRC/782, 15 January 2010.

[160] World Nuclear Association, "Uanium and Nuclear Power in Kazakhstan", <http://www.world-nuclear.org/info/inf89.html>. In June 2008, Cameco and Kazatomprom announced the formation of a new company, Ulba Conversion LLP, to build a 12,000t/year uranium hexafluoride conversion plant at the Ulba Metallurgical Plant in Ust-Kamenogorsk.

[161] This is the Ulba LEU fuel pellet fabrication plant in Ust-Kamenogorsk. See World Nuclear Association, "Uranium and Nuclear Power in Kazakhstan", <www.world-nuclear.org/info/inf89.html>.

[162] Some 1,300 nuclear warheads were destroyed after independence.

[163] IAEA, *Agreement of 26 July 1994 Between the Republic of Kazakhstan and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, document INFCIRC/504, March 1996.

[164] IAEA, *Milestones in the Development of a National Infrastructure for Nuclear Power*, document STI/PUB/1305, 2007.

ABBREVIATIONS

AECC	Angarsk Electrolysis Chemical Complex
AP	Additional Protocol to the Comprehensive Safeguards Agreement
CPPNM	Convention on Physical Protection of Nuclear Facilities, Material and Transports
CSA	Comprehensive Safeguards Agreement
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods
IUEC	International Uranium Enrichment Center
LEU	low-enriched uranium
NFC	nuclear fuel cycle
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NTI	Nuclear Threat Initiative
SWU	separative work unit
UN TDG	UN Recommendations on the Transport of Dangerous Goods