Report on the Effect the Low Enriched Uranium Delivered Under the Highly Enriched Uranium Agreement Between the Government of the United States of America and the Government of the Russian Federation has on the Domestic Uranium Mining, Conversion, and Enrichment Industries and the Operation of the Gaseous Diffusion Plant

2008

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Introduction

The *Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Disposition of Highly Enriched Uranium Extracted from Nuclear Weapons* (HEU Agreement) was signed on February 18, 1993.

The HEU Agreement provides for the purchase over a 20-year period (1994–2013) of 500 metric tons (MT) of weapons-origin highly enriched uranium (HEU) from the Russian Federation (Russia). This uranium is converted to commercial-grade low enriched uranium (LEU) before it is delivered. The Russian LEU is sold in the U.S. nuclear fuel market to commercial nuclear power plants through USEC Inc., the U.S. Executive Agent for the commercial agreement. The LEU, in the form of uranium hexafluoride (UF_6), contains the equivalent of almost 400 million pounds of natural uranium concentrates (U_3O_8), 150 million kilograms of uranium (kgU) conversion services, and approximately 92 million separative work units (SWU) of uranium enrichment services. This is enough fuel to satisfy about eight years of domestic demand for uranium concentrates, conversion, and enrichment.

Since the 1995 initiation of shipments under the Agreement, USEC has received 352.2 MT of Russian weapons-grade HEU that had been converted to LEU by the end of 2008. That is the amount of material needed for the equivalent of 14,090 nuclear warheads according to International Atomic Energy Agency definitions.

The HEU Agreement is a key element of U.S. nonproliferation policy and serves mutual U.S. and Russian interests. The HEU Agreement provides incentives for Russia to blend down HEU from its nuclear warheads into LEU for use and sale as fuel in commercial nuclear power plants. The revenue stream from the HEU Agreement provides an ongoing financial incentive for Russia to reduce its HEU inventory derived from surplus nuclear weapons. The Agreement also provides a structured mechanism to permit the sale of Russian enrichment and uranium products into a historically restricted U.S. market.

Report Summation

The successful implementation of the HEU Agreement remains a high priority of the U.S. Government. The agreement also serves U.S. and Russian commercial interests. HEU Agreement deliveries are an important source of supply in meeting requirements for U.S. utility uranium, conversion, and enrichment. With higher and increasingly unstable market prices for uranium and declining uranium supply from secondary markets, HEU Agreement deliveries help to provide an adequate uranium supply at reasonable prices. In addition, the predictability of measured uranium product deliveries under the HEU Agreement has reduced uncertainty for U.S. producers and suppliers who are moving to expand uranium, conversion, and enrichment capacity to meet future demands from a potential increase in domestic nuclear power generation capacity.

While initial uranium deliveries under the HEU Agreement had a limited effect on the commercial nuclear fuel markets, actions subsequently taken by the U.S. Department of Energy (DOE) and Congress to avoid an adverse material market impact from future HEU Agreement deliveries have been effective. Successful implementation of the HEU Agreement to date is also attributable to the efforts of the U.S. and Russian Executive Agents for the Government-to-

Government Agreement (DOE and Rosatom, respectively), the Executive Agents for the commercial agreement (USEC and Techsnabexport), and the U.S. industry. Recognizing the vital importance of the nuclear fuel cycle to U.S. energy and national security, DOE will continue to work with Congress and industry to ensure the HEU Agreement's continued success in stabilizing increasingly tight nuclear fuels markets.

Purpose of Report

The 1996 United States Enrichment Corporation Privatization Act (Privatization Act), Public Law 104-134 (42 U.S.C. 2297h) requires the President to "report to the Congress not later than December 31 of each year on the effect the low-enriched uranium delivered under the Russian HEU Agreement is having on the domestic uranium mining, conversion, and enrichment industries, and the operation of the gaseous diffusion plants." The report must provide a description of Government actions taken or proposed to be taken to prevent or mitigate any adverse material impact on such industries or any loss of employment at the gaseous diffusion plants as a result of the HEU Agreement. Prior year reports are available on http://nuclear.energy.gov/publicInformation/nePICongressionalReports2.html

Implementation of the HEU Agreement

A contract implementing the terms of the HEU Agreement was signed on January 14, 1994, with the United States Enrichment Corporation, acting as the Executive Agent on behalf of the U.S. Government, and Techsnabexport (Tenex), as the Executive Agent for the Russian Federation. The terms provided for the sale of the enrichment component of the LEU resulting from the blended down HEU to USEC's customers. The contract also provides for the Russian Government to receive revenues from USEC based on an average of market indices for enrichment.

The 1999 Commercial Feed Agreement (Feed Agreement) provides revenue to Russia for the natural uranium and conversion components of the LEU delivered under the HEU Agreement. The Feed Agreement establishes an allocation of the natural uranium and conversion among Tenex and the Western Consortium (Cameco, Cogema, now part of AREVA NC, and Nukem). Section 3112 of the United States Enrichment Corporation Privatization Act sets an annual quota that restricts the total quantity of natural uranium imported into the United States for domestic end use. Natural uranium as UF_6 not purchased by Tenex or the Western Consortium is shipped to Russia. The Feed Agreement is important to the overall success of the HEU Agreement.

Status of Deliveries

Table 1 shows the estimated number of Russian warheads dismantled: HEU and LEU quantities

Table 1: Status of LEU Deliveries under the HEU Agreement

Contracted Year	Estimated Dismantled Warheads*	HEU (MTU)	LEU (MTU)	Natural UF_6 Uranium Concentrate Component (million lb U_3O_8)	Natural UF_6 Conversion Component (million kgU)	Uranium Enrichment Component (million SWU)
1995	244	6.1	186.0	4.8	1.9	1.1
1996	479	12.0	370.9	9.5	3.7	2.2
1997	534	13.4	358.5	10.2	3.9	2.4
1998	764	19.1	571.5	15.0	5.8	3.5
1999	970	24.3	718.7	19.0	7.3	4.5
2000	1,462	36.6	1,037.8	28.3	10.9	6.7
2001	1,201	30.0	904.3	23.7	9.1	5.5
2002	1,201	30.0	879.0	23.5	9.0	5.5
2003	1,203	30.1	906.0	23.7	9.1	5.5
2004	1,202	30.1	891.0	23.6	9.1	5.5
2005	1,206	30.1	846.0	23.3	9.0	5.5
2006	1,207	30.2	870.0	23.4	9.0	5.5
2007	1,212	30.3	840.0	23.3	9.0	5.5
2008	**1,204**	**30.1**	**834.0**	**23.1**	**8.9**	**5.5**
Total Delivered Through 2008	14,090	352.2	10,214.0	274.4	105.7	64.7
Total Expected over Life of Agreement	20,000	500	15,258.6	395.8	152.2	92.1

* Based on the International Atomic Energy Agency's definition of significant quantities (1987 IAEA Safeguards Glossary).
Values are subject to rounding errors

as well as the equivalent natural uranium, conversion services, and enrichment components that have been delivered to date; and projected totals through the remaining life of the HEU Agreement. The HEU Agreement allowed for as much as 30 metric tons of uranium (MTU) of HEU to be blended down to LEU for delivery in 1999. Only 24.3 MTU (14.7 MTU in calendar year 1999 and 6.6 MTU in 2000) of the 1999 order was actually delivered. As of December 31, 2008, 352.2 MTU of Russian HEU was converted to LEU and delivered to the United States. To reach the total goal of 500 MTU of HEU, no less than 30 MTU of deliveries are scheduled annually from 2009 through 2012. These deliveries, together with the undelivered 8.7 MTU from 1999 and a delivery of as much as 19.2 MTU in 2013, will reach the 500 MTU of HEU. A listing of milestones associated with the HEU Agreement is shown in Table 2.

Table 2: HEU Agreement Milestones

- February 18, 1993 – The HEU Agreement signed.
- January 14, 1994 – Executive Agents for the United States and Russia (USEC and Tenex) executed the Implementing Contract to the HEU Agreement.
- June 1995 – The first delivery of LEU that was derived from HEU arrived in the United States.
- April 26, 1996 – The United States Enrichment Corporation Privatization Act, P.L. 102-486, was signed by President Clinton. This Act, in part, established the annual amount of natural uranium that can be imported for sale within the United States.
- October 21, 1998 – President Clinton signed P.L. 105-277 that, in part, provided for the United States to purchase, for up to $325 million, the unsold natural uranium associated with the 1997 and 1998 deliveries of Russian LEU.
- March 24, 1999 – The Transfer of Source Material Agreement was signed by the United States and Russian Governments. In addition, the Western Consortium and Tenex signed a Commercial Feed Agreement. These agreements were instrumental in introducing the natural uranium component into the market in a non-disruptive manner.
- November 16, 2001 – The Western Consortium and Tenex signed an amendment to the Commercial Feed Agreement that exercised the Western Consortium's options to purchase the natural uranium for the period 2002 through 2013.
- June 19, 2002 – The U.S. and Russian Governments approved the latest amendment to the contract between USEC and Tenex that implements the HEU Agreement. Under this new amendment, a market-based pricing structure for the SWU is used for the remaining term of the HEU Agreement.
- June 16, 2004 – The Western Consortium and Russia announced an amendment to the Commercial Feed Agreement that ensures there is sufficient natural uranium in Russia to blend down the HEU to commercially usable LEU through the remaining term of the Agreement.
- September, 30, 2005 – The U.S. Departments of State and Energy, and the Russian Federation Ministry of Foreign Affairs, and Rosatom (now the Federal Atomic Energy Agency) issued a joint statement marking the successful midpoint of the implementation of the HEU Agreement.
- September 21, 2007 – A Federal Circuit Court dismissed a U.S. government appeal of an earlier ruling that SWU provided by the European company Eurodif was a service and therefore not subject to anti-dumping legislation.
- September 26, 2007 – The U.S. Court of International Trade (CIT) ruled in a suit by Tenex and the Ad Hoc Utilities Group that Russian Suspension Agreement limitations no longer applied to Russian-originated enrichment services, based on the Eurodif ruling. The Commerce Department was instructed by the CIT to rewrite its findings on the Suspension Agreement in light of the Eurodif findings. This ruling effectively permits the unrestricted import of conventional Russian enrichment services into the United States.
- November 27, 2007 – The United States and Russia initialed an agreement to amend the U.S.-Russian Suspension Agreement. The Agreement would allow Russia to import LEU equal to roughly 20 percent of U.S. uranium demand each year between 2014 and 2020, after the conclusion of the HEU Agreement. Smaller levels of imports above deliveries occurring under the HEU Agreement would be permitted during 2011 to 2013.
- February 1, 2008 – The United States and the Russian Federation signed the amended U.S.-Russian Suspension Agreement. The amendment permitted the Russian Federation to import as much as 20 percent of U.S. uranium product requirement during a period following the end of the HEU Agreement through 2020. After that period there would be no restrictions on uranium product imports into the United States from the Russian Federation.
- April 21, 2008 – The United States Supreme Court granted the United States petition for a writ certiorari in its appeal of the September 21, 2007 Eurodif decision.
- September 2008 – Congress passed and the President signed into law Pub. L. 110-329, Consolidated Security, Disaster Assistance, and Continuing Appropriations Act, 2009, which included an amendment to the Privatization Act that extended potential opportunities to the Russian Federation to continue to down-blend HEU to LEU after 2012 through 2020 in exchange for increased access to U.S. commercial uranium markets. Any implementation would require additional negotiations between the United States and the Russian Federation.
- November 4, 2008 – The United States Supreme Court heard oral arguments regarding the Eurodif case. A decision supporting the U.S. government position was issued in January 2009

Events Impacting the HEU Agreement During 2008

Russia met its 2008 commitment under the HEU Agreement with deliveries to USEC of 834 MTU of down-blended LEU derived from 30.1 MTU of HEU. The following discussion provides an overview of activities that have taken place during recent years.

During late 2008 USEC and Techsnabexport (Tenex) renegotiated the pricing methodology used for transactions conducted under the HEU Agreement. Details of the agreement were announced in February 2009 after the period covered by this report. Terms reached through these negotiations will extend to the 2013 conclusion of the HEU Agreement.

The Russian Uranium Suspension Agreement (Suspension Agreement), signed October 1992, suspended the investigation by the U.S. Department of Commerce (DOC) of Russia dumping uranium products into the U.S. market. The Suspension Agreement originally provided for a price-tied quota system for Russian produced uranium product imports. The only exception to restrictions under the Suspension Agreement was uranium down-blended under the HEU Agreement. Russia can sell uranium product into the United States under the HEU Agreement only to the designated agent of the U.S. government (USEC), which sells the enrichment component (called separative work units, or SWU) to its customers and returns the uranium component to Tenex. The uranium component can then be sold subject to an annual quota in the United States. No direct Russian sale of commercial uranium or SWU in the United States was permitted. During 2006, the U.S. International Trade Commission (ITC) and DOC conducted a "sunset" review of the Suspension Agreement that recommended that the Suspension Agreement remain unchanged. On July 18, 2006 the ITC ruled that terminating the Suspension Agreement would materially injure the domestic uranium industry. Tenex and the Ad Hoc Utilities Group (a group of U.S. utilities that generate power using nuclear energy) subsequently submitted separate complaints in the Court of International Trade (CIT) appealing the ruling. On September 21, 2007, the U.S. Court of Appeals in *Eurodif v. United States*, ruled that uranium enrichment is a service and therefore not subject to U.S. antidumping laws. On September 26, 2007, CIT ruled that, based on *Eurodif*, DOC must review the Russian Uranium Suspension Agreement. This effectively removed Russian enrichment from import limits set under the Suspension Agreement and opened the possibility that Russian SWU might gain unrestricted access to U.S. markets prior to the conclusion of the HEU Agreement. The U.S. Attorney appealed this ruling to the Supreme Court which agreed to hear the case in April 2008. Arguments were subsequently heard by the Court in November 2008. In January 2009, subsequent to the period covered by this report, the Court unanimously ruled in favor of the U.S. Government position that uranium enrichment is a good and not a service, for purposes of U.S. trade laws.

An agreement to amend the Suspension Agreement was signed by the United States on February 1, 2008. The amendment allows Russian uranium product imports into the United States equivalent to 20 percent of the U.S. LEU product market during the period 2014-2020, after the conclusion of the HEU Agreement. Smaller quantities of imported Russian LEU or the product equivalent would be permitted during the period 2011-2013. In September 2008 the U.S. Congress amended the Privatization Act to give the Russian Federation an opportunity to sell in the U.S. market additional down-blended weapons-grade HEU during 2014 through 2020. The volume permitted would be the equivalent of an additional 5 percent share of the U.S. uranium market, over and above the 20 percent of the U.S. market permitted in the amended Suspension Agreement. Additionally, the law specifies that enrichment will be included in this cap on Russian uranium imports, including amounts allowed under the amended Suspension Agreement. Thus, the effect of the *Eurodif* decision was overturned by legislation,

insofar as it applies to Russian uranium imports. The subsequent (2009) decision by the Supreme Court to overturn the *Eurodif* decision also applied to all enrichment imports, including those from Russia. Russia has not at this time taken up the offer to down-blend additional HEU under the amendment.

Effect of the HEU Agreement on Domestic Industries

The following sections discuss the supply and demand for the domestic uranium mining, conversion, and enrichment markets as well as prices.[*] The period covered ended on December 31, 2008.

Uranium markets experienced a fundamental shift in supply sources during 2008. Prior to 2008, a futures market for uranium had developed and there was an increase in the volume of uranium held by financial institutions that did not process uranium. This situation resulted in fluctuating prices at many stages of the fuel supply industry. Spot uranium prices peaked in mid-2007 partially due to these new market participants. Global economic difficulties, which became most evident during the latter portion of 2008, resulted in a withdrawal of many financial investors from the market. A substantial weakening in uranium prices occurred during the year. Nonetheless, spot uranium prices during 2008 remained above levels from as recently as three years before (December 2005) and well above the depressed levels that existed for more than a decade prior to 2005. Uranium supplies provided under the HEU Agreement were stable for the year as they have been since before 2000. While supply stability under the HEU Agreement has reduced the potential market fluctuations, the scheduled termination of the HEU Agreement during 2013 is playing a growing role in the decisions and strategies of market participants as that event approaches.

At the same time, the U.S. power generation industry had indicated hopes to expand its nuclear generating capacity significantly during the later years of the 2010 decade. At the conclusion of 2008 the U.S. Nuclear Regulatory Commission (NRC) anticipated receiving as many as 33 new reactor the calendar years 2007-2010. The majority of these applications have already been submitted. Several new large commercial reactor designs either had received NRC certification or were in the process of receiving certification, while potential applications for smaller reactor designs are becoming more apparent. Over the last several years, the U.S. uranium fuel industry has announced plans to expand its capacity in the mining, conversion, and enrichment markets in anticipation of demand and price increases for nuclear fuels. Interest in mining has, however, become more cautious worldwide with the recent declines in spot uranium prices.

Utilities can optimize their purchases of uranium and enrichment by taking into account the relative prices of uranium and enrichment. Many utilities have flexibility under existing enrichment contracts to vary the tails assay (within a contracted range) under which they purchase enrichment. The tails assay is the percent ^{235}U contained in the depleted uranium produced during the uranium enrichment process. At a lower tails assay, a utility can deliver less uranium feed to an enrichment supplier and will purchase additional enrichment. The net effect of higher uranium prices is an increase in enrichment demand and a decrease in demand for natural uranium. Should enrichment prices increase, the opposite effect could occur as utilities seek the most economical cost balance between uranium and enrichment purchases. The

[*] The reference for market prices provided in this section is the Ux Consulting Company, LLC. The reference for uranium production and demand information is Energy Resources International, Inc. and the Energy Information Administration of the U.S. Department of Energy.

lowering of tails assays selected by utilities has the potential of putting a strain on the capacity of enrichment suppliers.

Fuels supplied under the HEU Agreement have been a steady and predictable contributor to the fuel needs of almost half of the requirements of domestic nuclear power generators. This became particularly important during 2008 when the market for nuclear fuels became uncertain in an environment of unstable financial and commodities markets.

Uranium Mining

World nuclear uranium requirements during 2008 are estimated to have been about 159.1 million pounds U_3O_8. World uranium production from mines is estimated to have been 117.3 million pounds U_3O_8 during 2008, an increase of 8.3 million pounds U_3O_8 from about 109.0 million pounds U_3O_8 in 2007. Worldwide production from mines thus supplied almost 74 percent of requirements. Additional uranium supply from secondary market sources such as government and commercial inventories, re-enriched uranium tails, and reprocessed uranium, as well as the natural uranium component of the HEU Agreement, met the balance of uranium requirements. Uranium requirements in the United States for 2008 were 51.3 million pounds U_3O_8 equivalent compared to 45.5 million pounds U_3O_8 equivalent in 2007. Domestic uranium concentrate production is estimated to have decreased 14.6 percent to 3.9 million pounds U_3O_8 in 2008 from 4.5 million pounds U_3O_8 in 2007. The decrease in domestic concentrate production over the past several years follows a increase of U.S. uranium production from 2.2 million pounds U_3O_8 in 2003. The Department of Energy's Energy Information Administration reports that employment in the U.S. uranium production industry also increased 27 percent between 2007 and 2008.

Spot market uranium prices began 2008 at $90 per pound U_3O_8 representing an increase since the end of 2002 when prices were just over $10 per pound U_3O_8. The beginning 2008 price was, however, down from a $136 per pound U_3O_8 high in June 2007. Spot prices closed 2008 at $53 per pound U_3O_8 representing the general downward trend during the year. The price fluctuations reflect the recent slowdown of the global economy, the declining role of institutional investors in the uranium market, and the uncertainties in the market due to varying perceptions regarding longer-term fuel supplies associated with the end of the HEU Agreement in 2013. Additional uncertainties relate to continued delays in the timing of start up of uranium mines, most notably a very large mine targeted for Cigar Lake in Canada which has been delayed by several years due to flooding and uncertain economics. Also affecting uranium prices during the latter part of 2008 was the global financial crisis that became most apparent during and after September and October. Prices for a large number of commodities fell following this economic uncertainty, not just uranium prices.

In early October 2007, NRC received an application for an in situ recovery uranium recovery facility in Wyoming. This was the first application for a new uranium recovery facility that NRC had received since 1988, though applications for facility expansion and restarts had been received during the period. NRC anticipates receiving as many as 20 or more additional applications for new uranium recovery facilities in South Dakota, Wyoming, Arizona, and New Mexico by the end of fiscal year 2012. Additional projects are likely in other States, including Texas. One stimulus for the new mining ventures had been the high prices of uranium during 2007 and early 2008.

Following the initial implementation of the Feed Agreement, the measured sale of the Russian uranium to the Western Consortium and by Tenex has been an important source of uranium supply for U.S. commercial market amounting to almost half of domestic requirements. In spite

of declining supply availability from other secondary sources, the HEU Agreement deliveries have helped to provide a stable supply at reasonable prices.

Uranium Conversion Services

World requirements for UF_6 conversion during 2008 are estimated to be 58.4 million kgU as UF_6. Conversion services demand for 2008 in the United States is estimated to be 19.1 million kgU as UF_6. In 2007 the sole domestic U.S. conversion company, ConverDyn (Honeywell), announced that following a month-long shutdown for annual maintenance, it planned to expand its Metropolis, Illinois, conversion plant capacity from a present 15.0 million kgU as UF_6 to as much as 18.0 million kgU as UF_6 over a 5 to 10 year period. Annual production was approximately 12.0 million kgU of UF_6 during 2008. The net domestic gap between production and demand during 2008 was made up by a combination of the conversion services equivalent contained in the feed component of the uranium under the HEU Agreement and other commercial UF_6 sources located outside of the United States. Cameco's Port Hope, Ontario conversion facility has experienced a series of extended shut downs since 2007. The extent to which this shut down has affected markets will be clear only if and when the facility restarts. AREVA NC's Comurhex conversion facility is located in Tricastin, France. AREVA NC intends to replace the facility. The only other large conversion facilities worldwide are located in Russia.

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From a market perspective, the conversion component of the HEU Agreement is equivalent to almost 9 million kgU per year of production capacity, which is somewhat smaller in size than the largest existing conversion production facilities. Because the USEC Privatization Act does not restrict the sale of Russian conversion services entering the United States, the unfettered introduction of the 9 million kgU of conversion from HEU Agreement deliveries into the market initially impacted the conversion services market. However, with an already existing shortfall in production, the HEU Agreement has become an essential source of conversion supply, with the issue becoming replacing the supply after the conclusion of the HEU Agreement imports during 2013. Much of the impact of this event would depend on the status of conversion capacity in Port Hope, Canada, as well as future expansion of domestic and French conversion capacity.

Spot conversion service prices reached a low of $2.25 per kgU as UF_6 in July 2000, but they had increased over 322 percent to $9.50 per kgU as UF_6 at the end of 2007. The North American spot market price for conversion services declined during 2008 to $8.50 per kgU as UF_6 at the end of December 2008, a drop of 10.5 percent. This was a much less substantial decline than the decline in uranium prices during the same period, but conversion is a market with very few suppliers.

Uranium Enrichment

World demand for enrichment during 2008 is estimated to have been 45.6 million SWU, which is a 0.7 percent increase over the 2007 level of 45.3 million SWU. Overall world enrichment production and world demand for enrichment, including the LEU resulting from the HEU Agreement, are in very close balance. This is in part because technical considerations favor operating gas centrifuge enrichment facilities at nearly 100 percent capacity. The enrichment market is thus expected to have little or no excess supply capacity over the coming years as gas centrifuge capacity increases in proportion to demand and as gaseous diffusion based capacity is retired.

Demand for enrichment in the United States during 2008 is estimated to have been 12.6 million SWU, down from the 14.2 million SWU reported in 2007. The Paducah Gaseous Diffusion Plant (GDP), operated by USEC Inc. was the only domestic source of enrichment in the United States. Paducah produced about 6.5 million SWU in 2008 though nominal production capacity is estimated to be about 8.0 million SWU. The international character of the enrichment market is such that some of Paducah's enrichment is exported and additional enrichment is imported into the United States. The enrichment component of the HEU Agreement provides the equivalent of 5.5 million SWU per year. Most of the SWU purchased by USEC under the HEU Agreement are used to meet U.S. demand. The Energy Information Administration indicates that over 90 percent of the enrichment consumed in the United States is imported.

Spot prices for enrichment have increased noticeably since 2006. The spot price began 2006 at $114 per SWU and increased 40.4 percent to $143 per SWU at the beginning of 2008. Spot prices had risen to $160 per SWU by the end of December 2008. The price increase has been attributed to a lack of excess enrichment supply and to the high power costs of enrichment suppliers using GDP technology. Additionally, there has been an increase in demand for enrichment to compensate for higher uranium prices.

Plans for new enrichment technology deployment in the United States continue to grow. Louisiana Energy Services (LES) received a commercial license from NRC and in August 2006 began building its National Enrichment Facility in Eunice, New Mexico. The 3 million SWU per year enrichment plant will use the Enrichment Technology Company's (ETC) gas centrifuge technology and expects to begin initial production in 2009. This phase of the LES facility is expected to reach full capacity around 2013, approximately the time of the conclusion of the HEU Agreement. LES indicated in November 2008 that it is investigating doubling the size of the facility. The ETC technology is the same technology used in many of Urenco's European facilities. ETC is a 50-50 joint venture of AREVA NC and Urenco. Urenco is owned by the United Kingdom, Netherlands, and German Governments.

On August 23, 2004, USEC submitted a license application to NRC to build and operate its American Centrifuge Plant in Piketon, Ohio. USEC Inc. plans to deploy a 3.8 million SWU per year gas centrifuge enrichment plant by 2012 based on an updated version of DOE's gas centrifuge technology developed in the 1980s. Although subsequent to the reporting period for this report USEC Inc. indicated that it is slowing the rate of its investment activities, the projected start up would also be around the time of the conclusion of the HEU Agreement. NRC granted USEC its commercial license in April 2007. USEC initiated operations at its demonstration Lead Cascade facility at Piketon in late 2007. Development of the lead cascade continued through 2008 and USEC Inc. applied to the Department of Energy for a loan guarantee for the plant.

During 2008 the French company, AREVA NC, also announced plans to apply for a combined construction and operating license to build and operate a 3 million SWU per year gas centrifuge enrichment facility at Eagle Rock, Idaho. The AREVA NC plant would use ETC technology. Construction might begin in 2011. Initial production would be attained as early as 2014 with full capacity targeted for 2019.

In October 2006, GE Hitachi submitted a letter of intent to NRC indicating that GE Hitachi's affiliate Global Laser Enrichment (GLE) was investigating the licensing of a demonstration laser enrichment facility. Cameco joined the project as an investor in 2008. A test loop license application was submitted during June 2007. GLE has set an initial target capacity of at least

3.5 million SWU per year. Because laser enrichment technologies show promised efficiencies, but have yet to be commercially established, successful implementation of the facility could have major implications for the enrichment and uranium supply industries worldwide.

Overseas, AREVA NC has moved forward on announced plans to replace its existing enrichment plant in France with a new 7.5 million SWU per year facility that will use ETC's gas centrifuge technology. The new plant was slated to begin operation in 2009 and to achieve full production by 2016. The site of the new plant would be at AREVA NC's existing gaseous diffusion enrichment site in Tricastin, France.

Urenco is also expanding capacity at its three European enrichment plants that are expected to total 12.5 million SWU by 2012 located in Europe compared to 9.6 million SWU at the end of 2008. The importation of enrichment from the Russian Federation is limited by the HEU Agreement. A 2009 decision by the Supreme Court, the February 2008 amendment to the Suspension Agreement, and a law signed in September 2008 effectively permit some importation of Russian enrichment after the conclusion of the HEU Agreement, though under strictly defined terms and quantities during 2013-2020. Russia has announced it will not extend the current HEU Agreement past 2013, though U.S. law now would permit the negotiation of a similar agreement covering 2013 through 2020.

Enrichment buyers have been concerned about potential supply shortfalls after the conclusion of the 2013 HEU Agreement. The 2013 conclusion of the HEU Agreement clearly has encouraged new enrichment facility investments in the United States. The HEU Agreement deliveries remain important to the U.S. enrichment market as it accounts for approximately half of U.S. demand. This has given U.S. uranium markets a stable source of supply during the period covered by the HEU Agreement. The likely conclusion of the HEU Agreement in 2013 has permitted potential enrichment suppliers to target their proposed investments within the United States.

Actions Taken to Avoid Potential Adverse Impacts to the Nuclear Fuel Industry

Recognizing the vital importance of the nuclear fuel cycle to U.S. energy markets and national security, Congress, DOE, and industry have worked diligently to help avoid any adverse material impacts of the HEU Agreement deliveries upon commercial nuclear fuel markets. Historically, actions taken include:

- Congress provided, under the United States Enrichment Corporation Privatization Act, a graduated level of quotas that allowed the natural uranium component of the HEU Agreement to enter into the U.S. market in a measured and stable manner.

- The United States Enrichment Corporation Privatization Act also provided for the purchase and transfer of the 1995 and 1996 natural uranium component of the HEU Agreement deliveries to DOE. DOE has responsibly managed the uranium to avoid an adverse material impact to the market.

- Congress provided the authority and funding for DOE to purchase and hold until March 24, 2009, the 1997 and 1998 natural uranium component of the HEU Agreement deliveries to avoid over supplying the uranium and conversion markets.

- Russia and the Western Consortium have successfully implemented the Feed Agreement to ensure the reliable and stable supply of uranium and conversion into the market.

- USEC has ensured the successful introduction of the enrichment component of the HEU into the U.S. market under existing contracts to avoid adverse material market impacts.

- The U.S. and Russian Governments have actively monitored the progress of the HEU Agreement and the Feed Agreement as well as proposed amendments to help ensure avoidance of adverse market impacts.

- The HEU Agreement has been the only avenue for the entry of Russian uranium into U.S. markets. The Agreement will end during 2013. An amendment to the Suspension Agreement was signed by the United States and Russia in February 2008 that extends limits on Russian uranium product imports to 20 percent of the U.S. market during 2014-2020. Much smaller quantities of additional Russian uranium product would be permitted into the United States under the agreement during 2011-2013. This agreement thus allows for some continuity of Russian-origin uranium supplies beyond the termination of the HEU Agreement.

While the initial uranium deliveries under the HEU Agreement had a limited effect on the commercial nuclear fuel markets, mitigating actions subsequently taken by DOE and Congress to avoid an adverse market impact from future HEU Agreement deliveries have been effective. The successful implementation of the HEU Agreement to date is also attributable to the efforts of the U.S. and Russian Executive Agents for the Government-to-Government Agreement, the designated Executive Agents for the commercial arrangement, and the U.S. industry. Recognizing the vital importance of the nuclear fuel cycle to U.S. energy markets and national security, DOE will continue to work with Congress and industry to ensure the HEU Agreement's continued success.

Glossary

Blending or down-blend – The term used to describe the process whereby HEU is mixed with depleted, natural, or low enriched uranium to create LEU.

Cameco – A Canadian company that is the world's largest supplier of uranium and one of the largest suppliers of uranium conversion services. Cameco is one of the three members of the Western Consortium under the 1999 Commercial Feed Agreement.

AREVA NC – A division of the company, AREVA, includes the company formerly known as Cogema. The parent company AREVA is active in all phases of the nuclear fuel cycle including uranium, conversion, and enrichment services. AREVA NC (through its Cogema origins) is one of the members of the Western Consortium under the 1999 Commercial Feed Agreement.

Commercial Feed Agreement – An agreement between members of the Western Consortium and Russia whereby the natural uranium feed component associated with the Russian LEU delivered under the HEU Agreement after 1998 is purchased for resale in the commercial uranium market. Sales of this natural uranium in the United States are subject to quotas set forth in the United States Enrichment Corporation Privatization Act.

Conversion – The process whereby natural uranium in the form of an oxide is converted to UF_6.

Depleted uranium – Uranium containing less than the 0.71 percent ^{235}U. Found in natural uranium.

Enrichment Technology Company (ETC) – A 50-50 joint venture of Urenco and AREVA NC that develops and builds gas centrifuges used to enrich uranium.

Enriched uranium – Uranium that is greater than the 0.71 percent ^{235}U. (See uranium, natural uranium, and highly enriched uranium.)

Executive Agent – These are the commercial companies responsible for implementing the HEU Agreement on behalf of the Governments of the United States (USEC) and Russia (Tenex).

Fissile material – Any material fissionable by thermal (slow) neutrons. The three primary fissile materials are ^{233}U, ^{235}U, and plutonium-239.

Gas centrifuge - A uranium enrichment process that uses centrifuges to spin UF_6 as a gas at high speeds to separate ^{235}U isotopes from the ^{238}U isotopes based on their difference in atomic weight.

Gaseous diffusion – A uranium enrichment process where UF_6 as a gas is compressed through a series of membranes to increase the concentration of ^{235}U isotopes.

General Electric Hitachi (GEH) – An affiliate of General Electric (60 percent in the United States) and Hitachi (40 percent in the United States) that manages the nuclear power activities formerly held by the companies General Electric (United States) and Japan. This includes plans to develop laser-based enrichment facilities in the United States.

Highly enriched uranium (HEU) – HEU is uranium having greater than 20 percent ^{235}U. (See natural uranium component, enriched uranium, and depleted uranium.)

Kilogram of uranium (kgU) as UF_6– Equal to 2.6 pounds of U_3O_8.

Long-term price – In the context of this report, refers to the price paid for nuclear fuel materials and services that will be delivered more than one year after the contract is signed.

Low enriched uranium (LEU) – Uranium that is greater than 0.71 percent ^{235}U but less than 20 percent. Most nuclear power reactor fuel contains LEU having three to five percent ^{235}U.

Louisiana Energy Services (LES) – An affiliate of the European enrichment joint venture Urenco. LES is building a three million SWU gas centrifuge uranium enrichment plant in Eunice, New Mexico.

Metric ton of uranium (MTU) – One thousand kilograms of uranium.

Natural uranium component – The feed material provided to a uranium enricher for producing enriched uranium and uranium tails. The natural uranium feed component consists of U_3O_8 from the mining industry and U_3O_8 to UF_6 conversion.

Nuclear Regulatory Commission (NRC) – The Federal agency that is responsible for the licensing and regulation of nuclear safety, safeguards, and security of commercial nuclear facilities.

Nukem – A company that provides uranium and services in the international nuclear fuel market. Nukem is one of the members of the Western Consortium under the 1999 Commercial Feed Agreement.

Paducah Gaseous Diffusion Plant – The only operating uranium enrichment plant in the United States, located in Paducah, Kentucky.

Privatization Act - On April 26, 1996, the United States Enrichment Corporation Privatization Act, Public Law 104-134 (42 U.S.C. 2297h) was enacted.

Separative work units (SWU) – A unit of measurement used in the enrichment of ^{235}U.

Spot market price or spot price – In the context of this report, refers to the price paid for nuclear fuel materials and services delivered within one year of the purchase date.

Tails – UF_6 depleted in ^{235}U produced during the uranium enrichment process.

Techsnabexport (**Tenex**) – A company wholly owned by the Russian Government and controlled by the Federal Atomic Energy Agency, Russian Federation. Tenex acts is Russia's Executive Agent on the HEU Agreement.

Uranium – A radioactive, metallic element with the atomic number 92; one of the heaviest naturally occurring elements. Uranium has 14 known isotopes, of which ^{238}U is the most abundant in nature. ^{235}U is commonly used as a fuel for nuclear fission. (See natural uranium, enriched uranium, highly enriched uranium, and depleted uranium.)

Uranium hexafluoride (UF_6) – Uranium oxide (U_3O_8) is converted to UF_6 which can then be fed through a uranium enrichment process, traditionally gaseous diffusion or gas centrifuge.

USEC, Inc. – Currently the only domestic supplier of uranium enrichment located in the United States and operator of the Paducah Gaseous Diffusion Plant. USEC is also the U.S. Executive Agent on the HEU Agreement. The United States Enrichment Corporation, a formerly wholly owned government corporation, was privatized as a result of the United States Enrichment Corporation Privatization Act of 1996.

Western Consortium – A group of three Western uranium suppliers (Cameco, COGEMA, Nukem) that signed the 1999 Commercial Feed Agreement with Russia to buy and then market the natural uranium that remains in the United States under the HEU Agreement. Cogema is now a portion of the company AREVA NC.