

**Report on the Effect the Low Enriched Uranium  
Delivered Under the Highly Enriched Uranium  
Agreement Between the Government of the United  
States 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**

**2006**



Information Date: December 31, 2006

## **Introduction**

The *Agreement Between the Government of the United States 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) converted to commercial-grade low enriched uranium (LEU) from the Russian Federation (Russia). The Russian LEU is sold in the United States (U.S.) nuclear fuel market to commercial nuclear power plants through the U.S. Enrichment Corporation (USEC), the U.S. Executive Agent. The LEU, in the form of uranium hexafluoride (UF<sub>6</sub>), contains the equivalent of almost 400 million pounds of natural uranium concentrates (U<sub>3</sub>O<sub>8</sub>), 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 seven years of domestic demand for uranium concentrates, conversion services, and enrichment services.

On June 28, 2006, USEC announced<sup>1</sup> that 275 metric tons (MT) of Russian weapons-grade HEU, equivalent to 11,000 nuclear warheads, has been converted to LEU. This LEU could generate enough electricity to meet the country's demand for more than a year and contains the energy equivalent of 5.7 billion barrels of oil. As of December 31, 2006, 292 MT of Russian weapons-grade HEU, equivalent to 11,673 nuclear warheads, has been converted to LEU and delivered to the United States.

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

## **Report Summation**

The successful implementation of the HEU Agreement remains a high priority of the U.S. Government, as well as serving U.S. and Russian commercial interests. This year's report continues to show HEU Agreement deliveries as an important source of supply in meeting requirements for U.S. utility uranium, conversion and enrichment services. With higher market prices and declining supply from secondary markets, the HEU Agreement deliveries helped to provide an adequate supply at reasonable prices. In addition, U.S. producers and suppliers are moving to expand uranium, conversion and enrichment capacity in order to meet future demand.

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. Successful implementation of the HEU Agreement to date is also attributable to the efforts of the U.S. and Russian Executive Agents and the industry. Recognizing the vital importance of the nuclear fuel cycle to U.S. energy and national security; the Department will continue to work with Congress and industry to ensure the HEU Agreement's continued success.

---

<sup>1</sup> USEC News Release, June 28, 2006.

## Purpose of Report

The 1996 USEC 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 HEU Agreement is having on the domestic uranium mining, conversion, and enrichment industries, and the operation of the gaseous diffusion plants.” The report also must provide a description of government actions taken to prevent or mitigate any adverse impact on such companies or any loss of employment at the gaseous diffusion plants as a result of the HEU Agreement. Prior year reports are available by contacting the Department of Energy, Office of Nuclear Energy, 1000 Independence Avenue, S.W., Washington, D.C. 20585.

## Implementation of the HEU Agreement

A contract implementing the terms of the HEU Agreement was signed on January 14, 1994, with USEC, 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 provide 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 services.

The 1999 Commercial 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, and RWE Nukem) based upon a provision in the USEC Privatization Act. Section 3112 of the 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<sub>6</sub> not purchased by Tenex or the Western Consortium is shipped to a monitored inventory in 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 as

**Table 1: Status of LEU Deliveries under the HEU Agreement**

Contracted Year	Estimated Dismantled Warheads*	HEU (MTU)	LEU (MTU)	Natural UF <sub>6</sub> Uranium Concentrate Component (million lb U <sub>3</sub> O <sub>8</sub> )	Natural UF <sub>6</sub> Conversion Services Component (million kgU)	Uranium Enrichment Services 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
<b>2006</b>	<b>1,207</b>	<b>30.2</b>	<b>870.0</b>	<b>23.4</b>	<b>9.0</b>	<b>5.5</b>
Total Delivered Through 2006	11,673	292.0	8,539.7	228.0	87.8	53.4
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).

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 up to 30 MTU of HEU to be blended down to LEU for delivery in 1999. However, only 21.3 MTU (14.7 MTU in CY 1999 and 6.6 MTU in CY 2000) of the 1999 order was actually delivered. As of December 31, 2006, 292 MTU of Russian HEU was converted to LEU and delivered to the United States. To reach the total goal of 500 MTU of HEU, 30 MTU of deliveries are scheduled annually between 2007 and 2012. These deliveries, together with the undelivered 8.7 MTU from 1999 and a delivery of 19.5 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 USEC 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 nondisruptive 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 2004 – Deliveries of LEU reach the equivalent level of 9,000 nuclear warheads eliminated.
- August 2005 – LEU downblended from 250 MTU of HEU was delivered to the United States. This represents one-half of the 500 MT of HEU and is equivalent to 10,000 nuclear warheads eliminated.
- September, 30, 2005 - The U.S. Departments of State and Energy, and the Russian Federation Ministry of Foreign Affairs, and the Federal Atomic Energy Agency issued a joint statement marking the successful midpoint of the implementation of the HEU Agreement.
- June 28, 2006 – USEC announced that 275 MTU of HEU was converted to LEU. This is equivalent to 11,000 nuclear warheads.

## **Events Impacting the HEU Agreement During 2006**

Russia met its 2006 commitment under the HEU Agreement with deliveries to USEC of 870 MTU of LEU downblended from 30.2 MTU of HEU. However, in 2006 the Russian government expressed an interest to increase uranium sales in the United States and gain direct access to the U.S. commercial nuclear fuel market. The following provides an overview of these activities.

### Russian Uranium Suspension Agreement

The Russian Uranium Suspension Agreement, signed October 1992, suspended the investigation by the U.S. Department of Commerce (DOC) of Russia dumping uranium into the U.S. market. The Suspension Agreement avoided dumping duties of 115.8 percent on Russian uranium imported into the United States as recommended by DOC. However, Russia can only sell uranium product under the HEU Agreement and only to USEC which sells the SWU component to its customers and returns the uranium component to Tenex which can be sold per an annual quota in the United States. No direct Russian sale of commercial uranium or SWU in the United States is permitted. Grandfathered and match-sale contracts were originally allowed, but these contracts have since expired.

In 2006, the U.S. International Trade Commission (ITC) and DOC conducted a “sunset” review of the Suspension Agreement to determine whether termination of the Suspension Agreement is likely to lead to (1) a continuation or recurrence of dumping of Russian uranium products or (2) a continuation or recurrence of material injury to the U.S. uranium industry, including USEC. On May 30, 2006, DOC completed its review of the Suspension Agreement and recommended it remain unchanged. On July 18, 2006, by a four to one vote the ITC ruled that terminating the Suspension Agreement would materially injure the domestic uranium industry. As a result of the affirmative DOC and ITC findings, the Russian Uranium Suspension Agreement continues. The next sunset review will take place in 2011.

On August 7, 2006, Tenex and the Ad Hoc Utilities Group submitted separate complaints in the Court of International Trade that constitutes an appeal of DOC’s final results of the five-year sunset review. These complaints were still pending as of the end of 2006. In addition, the Russian government has publicly and officially informed the Department of Commerce and Department of Energy of its interest to gain direct access and sell its commercial uranium products in the U.S. nuclear fuel market. U.S. and Russian government officials have met several times during 2006 to discuss Russia’s interest with regard to the Suspension Agreement. Additional meetings are planned in 2007 to negotiate an amendment to the Suspension Agreement to address Russia’s concerns while protecting U.S. industry interests.

## **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.<sup>2</sup> In characterizing the nuclear fuel markets in 2006, it is important to recognize that the uranium, conversion and enrichment markets continue to experience a fundamental shift in supply sources. The shift comes as a result of increasing supply from primary production and a reduction of supply from government and commercial inventories (commonly called secondary supplies) available to the markets, and has resulted in higher prices (primarily in the uranium and conversion markets). As demand and price increase, U.S. producers and suppliers are moving to expand capacity in all three markets. During 2006, the trade press continued to report new exploration plans for uranium resources in a number of countries including the United States. The conversion suppliers are also contemplating expanded capacity. One company has been granted a

---

<sup>2</sup> The reference for market prices provided in this section is the Uranium Exchange Consulting Company, LLC. The reference for uranium production and demand information is Energy Resources International, Inc.

Nuclear Regulatory Commission (NRC) license to build new enrichment capacity in the United States and a second company anticipates being granted a license in May 2007. In order to better reflect this situation in commercial nuclear fuel markets, this report includes long-term market prices as well as spot prices.

Utilities are also expected to optimize their purchases of uranium, conversion and enrichment services by taking into account the higher price of uranium relative to the price of enrichment services. Many utilities have flexibility in their existing enrichment services contracts to vary the tails assay (within a contracted range) under which they purchase enrichment services. The tails assay is the percent  $^{235}\text{U}$  contained in the depleted uranium produced during the uranium enrichment process. At a lower tails assay, a utility will deliver less uranium feed to an enrichment supplier and will purchase additional enrichment services. The net effect will be an increase in enrichment demand and a decrease of uranium demand. Should enrichment prices begin to increase, the opposite effect would occur as utilities find the most economical cost level. The rapid lowering of tails assays selected by utilities has put a strain on enrichment suppliers. However, new contracts no longer allow much flexibility in tails selection by the utility. As a result, enrichment suppliers will be able to better forecast their future production requirements and determine the amount of new production capacity required.

As supply and demand remains closely in balance, investor buying and holding of uranium and  $\text{UF}_6$  could leave the market short of supply for nuclear plants. This has driven prices up to at least twice the cost of production in the case of uranium. The global growth in nuclear power generation stemming from new plants, plant upgrades, and license renewal is expected to further increase future demand in all three markets.

### Uranium Mining

World nuclear plant uranium demand during 2006 is estimated to be about 165 million pounds  $\text{U}_3\text{O}_8$ . World uranium production is estimated to be 102 million pounds  $\text{U}_3\text{O}_8$  during 2006, a decrease of 5 million pounds  $\text{U}_3\text{O}_8$  from the 2005 level of about 107 million pounds  $\text{U}_3\text{O}_8$ . Current worldwide production supplies almost two-thirds of demand. Additional uranium supply from secondary market sources such as government and commercial inventories, re-enriched uranium tails, and reprocessed uranium, as well as the HEU Agreement natural uranium component, are needed to meet the balance of uranium requirements. Uranium demand in the United States for 2006 is estimated to be 53 million pounds  $\text{U}_3\text{O}_8$ . Domestic uranium production in 2006 is estimated to increase from 3 million pounds  $\text{U}_3\text{O}_8$  reported<sup>3</sup> for 2005 to 4.4 million pounds  $\text{U}_3\text{O}_8$ . The increase in domestic production over the past several years also reflects an increase in uranium exploration, development and drilling. Employment in the U.S. uranium production industry also increased 52 percent between 2004 and 2005.<sup>4</sup>

Spot market uranium prices began the year at \$37.50 per pound  $\text{U}_3\text{O}_8$  but increased to a high of \$72.00 per pound  $\text{U}_3\text{O}_8$  by the end of December 2006. The uranium market has seen a dramatic rise in prices during 2006 driven in part by tightening supply and demand, investor interest in uranium as a market commodity, and the catastrophic October flood at the Canadian Cigar Lake mine. The Cigar Lake mine, with an anticipated production of 18 million pounds per year, was scheduled to start up early in 2008 but is expected to be delayed several years.

Since the initial implementation of the 1999 HEU Commercial Feed Agreement, the measured sale of the Russian uranium to the Western Consortium and Tenex has been an important source of supply for

---

<sup>3</sup> Energy Information Administration's U.S. uranium mine production reported on May 15, 2006.

<sup>4</sup> The Energy Information Administration (EIA) reports a 52 percent increase in employment for the U.S. uranium production industry from 2004 to 2005. (Employment in the U.S. Uranium Production Industry by State, May 15, 2006)

the U.S. commercial market. In spite of declining supply availability from other secondary sources, the HEU Agreement deliveries have helped to provide an adequate supply at reasonable prices.

### Uranium Conversion Services

World demand for UF<sub>6</sub> conversion during 2006 is estimated to be 63 million kgU as UF<sub>6</sub>. Conversion services demand for 2006 in the United States is estimated to be 20 million kgU as UF<sub>6</sub>. In 2006, world conversion production is estimated to be 44 million kgU as UF<sub>6</sub>. Conversion services production in the United States is estimated to be 11 million kgU as UF<sub>6</sub>. The gap between production and demand during 2006 was made up from a combination of the conversion services equivalent contained in the feed component of the uranium under the HEU Agreement and other commercial UF<sub>6</sub> sources.

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 comparable in size to any of the existing conversion production facilities. Since the USEC Privatization Act does not restrict the sale of Russian conversion services entering the United States, the unfettered introduction of the nine million kgU of conversion from HEU Agreement deliveries into the market initially impacted the conversion services market. However, with the already existing shortfall in production, the HEU Agreement has become an essential source of conversion supply.

During 2006, the North American spot market price of conversion services remained stable at \$11.50 to \$11.75 per kgU as UF<sub>6</sub>. Since reaching a low of \$2.25 per kgU as UF<sub>6</sub> in July 2000 the spot market price of conversion services has increased over 500 percent.

### Uranium Enrichment Services

World demand for enrichment services during 2006 is estimated to be 43.9 million SWU, which is a 4 percent increase from the 2005 level of 42.2 million SWU. As noted previously, the demand has increased as utilities have lowered tails assay by exercising contract tail assay flexibility options. In addition, some utilities have lowered tails beyond their economic optimums in order to conserve uranium and build inventory. Overall world enrichment production of 47.8 million SWU and world demand for enrichment services, including the LEU resulting from the HEU Agreement, has come into very close balance. The enrichment market is expected to have little or no excess supply for the foreseeable future.

Demand for the United States during 2006 is estimated to be nearly 14 million SWU, an 8 percent increase above the 13 million SWU reported in 2005. However, much of the increase in U.S. demand was due to the timing of deliveries. The USEC Paducah Gaseous Diffusion Plant (GDP) is the single source of enrichment services production in the United States. Its estimated production is about 5.5 million SWU per year or about 42 percent of domestic demand. The enrichment services component of the HEU Agreement provides the equivalent of 5.5 million SWU per year. Most of the SWU from the HEU Agreement purchased by USEC are used to meet U.S. demand. In this respect, assuming that the importation of uranium from Russia under the Russian Uranium Suspension Agreement remain in effect and imports from European enrichers do not materially increase, the HEU Agreement is likely to remain an essential source of supply through the remaining years of the Agreement.

Spot market prices for enrichment services have increased noticeably in 2006. The spot price began the year at \$116 per SWU and increased over 15 percent to \$135 per SWU by the end of December. The long term price exhibited similar behavior. The price rise is attributed to a lack of excess supply and the high power costs of enrichment suppliers using GDP technology.

Plans for new enrichment technology deployment in the United States are proceeding. Louisiana Energy Services (LES) received its commercial license from the NRC and began construction in

August on a three million SWU per year enrichment plant, the National Enrichment Facility, in Eunice, New Mexico. The plant will use Urenco's gas centrifuge technology and expects to begin initial production in 2009, reaching full capacity by 2013. LES received its NRC license 30 months after its initial application filing.

USEC is pursuing its plan to deploy a 3.5 million SWU per year gas centrifuge enrichment plant by the end of 2011. On August 23, 2004, USEC submitted a license application to the NRC to build and operate its American Centrifuge Plant (ACP) in Piketon, Ohio. NRC awarded USEC a commercial license in April 2007. The ACP will use an updated version of DOE's gas centrifuge machine developed in the 1980's.

In addition, AREVA is moving forward on announced plans to replace its existing enrichment plant with a new 7.5 million SWU per year plant that will use Urenco's gas centrifuge technology. To that end, AREVA has completed its purchase of a 50 percent share of Urenco's centrifuge manufacturing subsidiary, the Enrichment Technology Company (ETC). Delays in governmental approvals of AREVA's investment in the ETC did result in an approximately two year delay in the new plant's schedule. The new plant is now expected to begin operation in 2009 and achieve full production by 2018. The site of the new plant will be at the existing enrichment site in Tricastin, France.

Urenco is also expanding capacity at its European enrichment plants, which are expected to total 11 million SWU by the end of 2010. Russia, which is currently prohibited from making sales in the United States outside of the HEU Agreement, continues to push for direct commercial access to U.S. enrichment buyers. Russia has also reiterated that it will not extend the current HEU Agreement past 2013. Enrichment services buyers are concerned about potential supply shortfalls after 2013, and as a result have generally increased contracting lead times.

Overall, the uranium enrichment market in 2006 remained stable with supply and demand in close equilibrium and prices rising to about \$135 per SWU. The HEU Agreement deliveries remain important to the U.S. enrichment market as it accounts for approximately 42 percent of U.S. demand.

### **Actions Taken to Avoid Potential Impacts to the Nuclear Fuel Industry**

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

- Congress provided, under the USEC 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 USEC Privatization Act also provided for the purchase and transfer of the 1995 and 1996 natural uranium component of the HEU Agreement deliveries to the Department. The Department has responsibly managed the uranium to avoid an adverse material impact to the market.
- Congress provided the authority and funding for the Department to purchase and hold until March 24, 2009, the 1997 and 1998 natural uranium component of the HEU Agreement deliveries to avoid oversupplying the uranium and conversion markets.
- Russia and the Western Consortium have successfully implemented the Commercial 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 services component of the HEU into the U.S. market under existing contracts to avoid adverse market impacts.
- The U.S. and Russian Governments have actively monitored the progress of the HEU Agreement and the Commercial Feed Agreements as well as proposed amendments to help ensure avoidance of market impacts.
- U.S. and Russian Government officials met several times during 2006 to discuss Russia's interest to increase uranium sales to the United States with regard to the Russian Uranium Suspension Agreement. Discussions have continued into 2007.

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 and the industry. Recognizing the vital importance of the nuclear fuel cycle to U.S. energy and national security, the Department 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.

**COGEMA** – An AREVA subsidiary that is active in all phases of the nuclear fuel cycle including uranium, conversion and enrichment services. Cogema 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 USEC Privatization Act.

**Conversion** – The process whereby natural uranium in the form of an oxide is converted to UF<sub>6</sub>.

**Depleted uranium** – Uranium containing less than the 0.71 percent <sup>235</sup>U. Found in natural uranium.

**Enriched uranium** – Uranium that is greater than the 0.71 percent <sup>235</sup>U. (See uranium, natural uranium, and highly enriched uranium.)

**Executive Agent** – Under the HEU Agreement, 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 <sup>233</sup>U, <sup>235</sup>U, and plutonium-239.

**Gas centrifuge** - A uranium enrichment process that uses centrifuges to spin UF<sub>6</sub> as a gas at high speeds to separate <sup>235</sup>U isotopes from the <sup>238</sup>U isotopes based on their difference in atomic weight.

**Gaseous diffusion** – A uranium enrichment process where UF<sub>6</sub> as a gas is compressed through a series of membranes to increase the concentration of <sup>235</sup>U isotopes.

**Highly enriched uranium (HEU)** – Uranium having greater than 20 percent <sup>235</sup>U. (See natural uranium component, enriched uranium, and depleted uranium.) The Russian HEU that is down blended under the HEU Agreement has an enrichment level of about 90 percent <sup>235</sup>U.

**Kilogram of uranium (kgU)** – Equal to 2.6 pounds of U<sub>3</sub>O<sub>8</sub>.

**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 <sup>235</sup>U but less than 20 percent. Most nuclear power reactor fuel contains LEU having three to five percent <sup>235</sup>U.

**Louisiana Energy Services (LES)** - Limited and general partners consisting of Urenco, Exelon, Duke Power, Entergy, and Westinghouse. The partnership intends to build a three million SWU gas centrifuge uranium enrichment plant in Eunice, New Mexico, that will use Urenco's sixth generation gas centrifuge technology that is being used in Europe.

**Metric ton of uranium (MTU)** – Equal to 1,000 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 responsible for the licensing and regulation of nuclear safety, safeguards and security of commercial nuclear facilities.

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

**Portsmouth Gaseous Diffusion Plant** – A shutdown uranium enrichment plant located in Piketon, Ohio. The USEC American Centrifuge Plant is located at this site.

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

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

**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 6 months of the purchase date.

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

**Techsnabexport (Tenex)** – A company that is wholly owned by the Russian Government and controlled by the Federal Atomic Energy Agency, Russian Federation, that acts as 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, either diffusion or centrifuge.

**United States Enrichment Corporation (USEC)** – Currently the only domestic supplier of uranium enrichment services in the United States and operator of the Paducah Gaseous Diffusion Plant. USEC is also the U.S. executive agent on the HEU Agreement. USEC, a formerly wholly owned government corporation, was privatized as a result of the USEC Privatization Act of 1996.

**Western Consortium** – A group of three Western uranium suppliers (Cameco, COGEMA, RWE 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.