

Effect of U.S./Russia Highly Enriched Uranium Agreement

2001

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U.S. NUCLEAR REGULATORY COMMISSION

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Report to Congress on the Effects of the U.S. / Russia HEU Agreement on the Domestic Nuclear Fuel Industries

Executive Summary:

Background - The U.S. / Russia HEU Purchase Agreement (HEU Agreement) provides for the United States to purchase from the Russian Federation 500 metric tons of highly enriched uranium (HEU) converted to low-enriched uranium over twenty years (1993-2013). HEU from dismantled nuclear warheads is blended down by Russia to commercial grade, low-enriched uranium under the terms of this Agreement. The HEU Agreement serves mutual U.S. and Russian interests. It is a key element of U.S. nonproliferation policy and provides a structured basis for Russia to participate in U.S. nuclear fuel markets.

The low-enriched uranium derived from the HEU Agreement is comprised of uranium, conversion and enrichment services components. Pursuant to Section 3112 (b) (10) of the USEC Privatization Act (Privatization Act), this document meets the requirement for the President to report to Congress each year on the effect the low-enriched uranium delivered under the terms of the HEU Agreement is having on the domestic uranium mining, conversion, and enrichment industries, and on the operation of the gaseous diffusion plants (which USEC Inc. operates under a lease agreement with DOE). To meet an additional requirement of Section 3112 (b) (10) of the Privatization Act, this report presents the actions taken or proposed to be taken by the President to prevent or mitigate any material adverse impact on these industries or any loss of employment at the gaseous diffusion plants as a result of the HEU Agreement.

Since the deliveries started under the HEU Agreement in 1995, HEU equivalent to over 5,000 nuclear warheads has been converted to low-enriched uranium. In 2001, USEC Inc., the U.S. Executive Agent, purchased all scheduled deliveries as provided in the implementing contract and the HEU Agreement.

FY 2001 Activity - The Administration, like Congress, is concerned about the state of the domestic uranium, conversion and the enrichment industry. Over the past year, the Department has been working diligently to assess these vital industries and work with Congress and private industry to bring about measurable progress towards reliable, competitive and assured U.S. supply of nuclear fuel services. To help mitigate the impact of the events of the past year, the Department has: (1) established, within the Office of Nuclear Energy, Science and Technology, the Office of Nuclear Fuel Cycle Security;¹ (2) preserved the Portsmouth enrichment plant capability by placing it in cold standby; and (3) sponsored discussions with industry to explore the deployment of new enrichment technology in the United States in the near term.

¹ The recommendation to establish the Office of Nuclear Fuel Cycle Security was included in the December 2000, *Report to Congress on Maintenance of Viable Domestic Uranium, Conversion and Enrichment Industries*.

In this respect, the Department has placed high priority on sustaining and, if possible, increasing the benefits derived from the HEU Agreement that converts nuclear weapons related HEU into low-enriched uranium for use in commercial nuclear power reactors. The Department has also placed priority on facilitating an economically viable, competitive, and reliable domestic nuclear fuel industry. The aging Paducah Gaseous Diffusion Plant is increasingly uncompetitive with gas centrifuge plants currently operating in the European Union and Russia. The Department recognizes the important past and present role of the U.S. gaseous diffusion uranium enrichment plants, both to national security and to the local economies, and is committed to a productive future transition at those sites that recognizes the skills of the trained and experienced workforce and the important contribution those communities have made to the Nation's energy and national security.

Impact on U.S. Industry - DOE concludes that there has not been an adverse impact on the domestic uranium and conversion industries caused by the deliveries under the HEU Agreement because the majority of the Russian-origin natural uranium component deliveries have either been purchased by the U.S. Government or returned to Russia and, therefore, removed from the market. The commercial agreement on natural uranium hexafluoride feed deliveries reached between Tenex and the Western consortium in November 2001 will prove pivotal in lessening the potential market impact of the HEU Agreement on the domestic mining and conversion industry through 2013, as well as providing stability in revenues received by Russia from sales of the natural uranium and conversion components. The impacts on uranium and conversion market prices are expected to be minimized, as the natural uranium and conversion components will be entering the market through new and existing contracts of the Western Consortium.

The market price for uranium, conversion and enrichment services increased by at least 25% during 2001. For the uranium and conversion services markets, secondary sources, such as supply from the HEU Agreement, will be required to fill the gap between demand and existing domestic production capacity in the future.

USEC Inc.'s closure of the Portsmouth Gaseous Diffusion Plant due to loss of market share was caused by a combination of several factors, including the highly competitive enrichment market, the cost reductions required to remain competitive, management policies and actions of USEC Inc., as well as the availability of enriched uranium from the HEU Agreement. The reduction of production capacity brought about by the closure of the Portsmouth plant, and antidumping and countervailing duties investigations of European Union imports by Department of Commerce and the U.S. International Trade Commission resulted in an increase in market price for enrichment services during 2001. The increase in the market price of enrichment services during 2001 helped increase the ability of USEC Inc.'s Paducah operation to continue contributing to the market.

The aging U.S. gaseous diffusion plants are increasingly uncompetitive with gas centrifuge plants operating in the European Union and Russia. Additional increases in gaseous diffusion production costs are anticipated as fixed-price power contracts are replaced with market-based contracts, and capital expenditures are required to abate freon losses and maintain the fifty year

old plant equipment. Without a reliable and competitive advanced technology option, the U.S. faces a significant risk of losing its domestic uranium enrichment industry to foreign competition.

In addition, the HEU Agreement deliveries remain very important to meeting utility uranium enrichment requirements reliably and economically by (1) leveraging higher cost production from the aging and power intensive gaseous diffusion plant and (2) helping ensure competitive enrichment supply is available until new cost competitive enrichment technology can be commercially deployed.

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 United States to purchase from the Russian Federation 500 metric tons of highly enriched uranium (HEU) converted to commercial grade, low-enriched uranium over twenty years (1993-2013). The HEU is blended down to commercial grade, low-enriched uranium under the terms of this Agreement.²

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 take fissile material from its nuclear warheads and blended down into low-enriched uranium for use and sale as commercial reactor fuel. The revenue stream from the Agreement helps provide an ongoing incentive for stabilizing the security of Russia's inventory of HEU derived from surplus nuclear weapons. The HEU Agreement also provides a structured basis for Russia to participate in uranium markets.

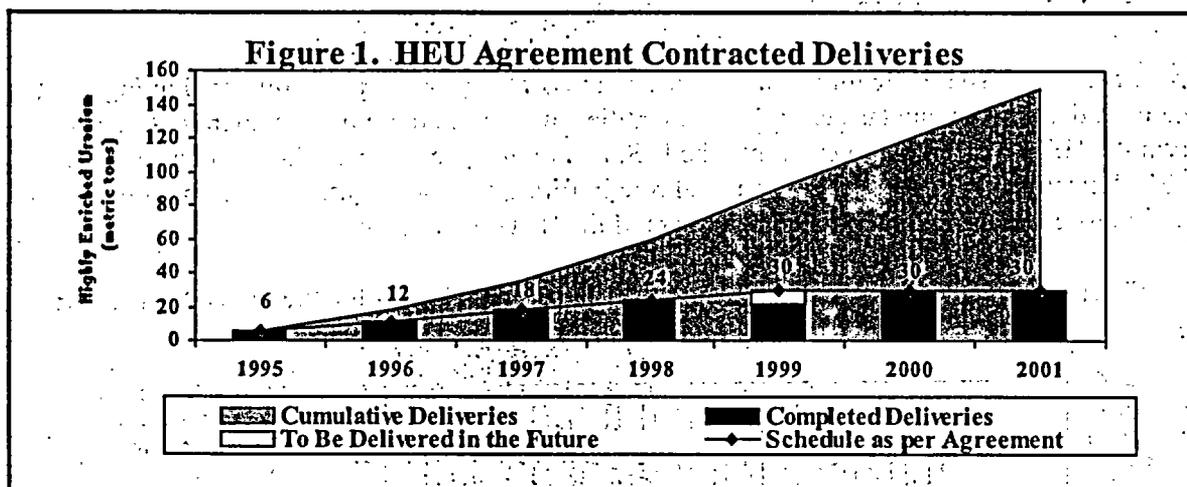
The quantities of HEU actually blended down and delivered under the HEU Agreement in each year through 2001 compared to the annual quantities contracted for in advance are shown in Figure 1. Of the 30 metric tons of HEU that were scheduled to be blended down and delivered in 1999, 21.3 metric tons have been completed. Delivery of the remaining 8.7 metric tons (for the remaining 1999 deliveries) has not been finalized but is expected to be completed at a future date.³ Deliveries of low-enriched uranium from 30 metric tons of HEU were delivered during 2000 and 2001. Deliveries during 2000 were interrupted when a non-nuclear Swiss company named NOGA filed a lawsuit against Russia to attach Russian government assets within the U.S. As a result of this suit, Executive Order 13159 was issued on June 21, 2000, to avoid such attachments. On June 11, 2001, President Bush extended this Executive Order in order to assure continued deliveries under the HEU Agreement. Deliveries of low-enriched uranium from 30 metric tons of HEU are scheduled to continue from 2002-2012, and from 20 metric tons in 2013 (to reach 500 metric tons total).

² The low-enriched uranium resulting from the HEU Agreement represents the equivalent of almost 400 million pounds of natural uranium and 92 million separative work units, enough to satisfy about 9 years of demand for uranium and separative work units in the United States. Because the uranium is in the form of natural uranium hexafluoride, it also represents over 150,000 metric tons of conversion services.

³ This remaining quantity reflects the interruption of deliveries from Russia in 1998 due primarily to complications arising from the inability of Russia to sell the natural uranium and conversion components of the low-enriched uranium.

A contract implementing the HEU Agreement was signed on January 14, 1994, with USEC Inc.'s predecessor, the United States Enrichment Corporation, acting as Executive Agent on behalf of the United States, and Techsnabexport (Tenex) representing the Russian Federation. Tenex is majority-owned by the Russian Ministry of Atomic Energy.

On April 26, 1996, the President signed the USEC Privatization Act (Privatization Act), P.L. 104-134 (42 U.S.C. 2297h), which addressed several issues in connection with the HEU Agreement. First, the Privatization Act directed the purchase of the natural uranium feed component contained in the 1995 and 1996 deliveries (Section 3112(b)(1)).⁴ Second, the



Privatization Act set quotas for sales of the natural uranium feed component into the U.S. commercial nuclear fuel market (Section 3112(b)(5)). Finally, the Privatization Act established a monitoring and reporting requirement (Section 3112 (b) (10)). The Privatization Act requires the President to:

1. Monitor the performance of the U.S. Executive Agent (USEC Inc.) under the HEU Agreement; and,
2. Report to Congress each year on the effect that the low-enriched uranium delivered under the terms of the HEU Agreement is having on the domestic mining, conversion, and enrichment industries and on the operation of the gaseous diffusion plants (which USEC Inc. operates under a lease agreement with DOE), including actions taken or proposed to be taken by the President to prevent or mitigate any material adverse impact on these industries or any loss of employment at the gaseous diffusion plants as a result of the Agreement.

⁴ In addition, Public Law 105-277 provided \$325 million to purchase from Russia the natural uranium and conversion components contained in the 1997 and 1998 deliveries.

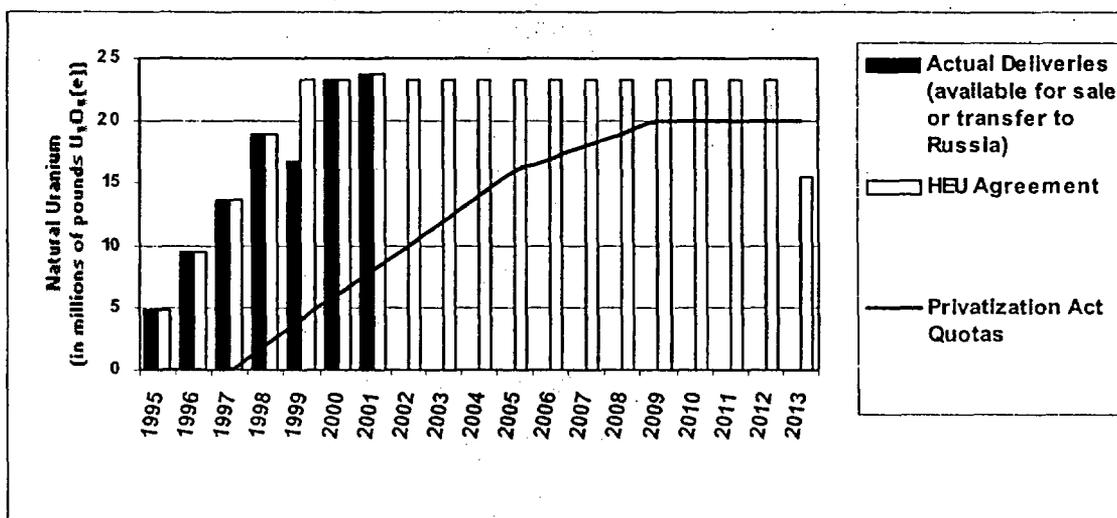
Purpose:

The purpose of this report is to meet the requirement in Section 3112 (b) (10) of the Privatization Act to report to Congress by (1) analyzing the effect of the deliveries under the HEU Agreement on the nuclear fuel industries and employment at the gaseous diffusion plants and (2) by describing actions taken to prevent or mitigate any material adverse impact. The report summarizes the implementation of the HEU Agreement, the events impacting the HEU Agreement which occurred in 2001, and the impacts to date on each of the industry components.

Implementation of the HEU Agreement:

Quantities of Russian Uranium Sales under the HEU Agreement - As reflected in Figure 2, the Privatization Act quotas permit large quantities of natural uranium component deliveries from the HEU Agreement to enter into the U.S. market in future years. The uranium from the HEU Agreement is expected to play a vital role in filling the uncommitted uranium requirements of domestic utilities over the remaining years of the HEU Agreement.

Figure 2. Status of the Natural Uranium Feed Deliveries Under the HEU Agreement



Current Status of Deliveries - This section of the report provides the current status of deliveries under the HEU Agreement, the relationship of those deliveries to quantities of Russian uranium allowed to be sold into the U.S. pursuant to the Privatization Act, and events that impacted the HEU Agreement during 2001.

Table 1 shows the estimated number of warheads dismantled, quantities of HEU and low-enriched uranium contained in the warheads, and their equivalent natural uranium, conversion services, and separative work units (enrichment component) delivered to date.

Table 1. Status of Deliveries Under the HEU Agreement

Contracted Year	Estimated Dismantled Warheads	Highly Enriched Uranium HEU (MTU)	Low-enriched uranium LEU (MTU)	Natural UF ₆ Feed Component (Million lbs. U ₃ O ₈ (c))	Natural UF ₆ Conversion Component (Million kgU)	Separative Work Units (SWU) (Million SWU)
1995	244	6.1	186.0	4.8	1.8	1.1
1996	480	12.0	371.0	9.5	3.7	2.2
1997	536	13.4	358.5	10.2	3.9	2.4
1997 Delivered in CY1998	184	4.6	121.5	3.5	1.3	0.8
1998	580	14.5	450.0	11.5	4.4	2.7
1998 Delivered in CY1999	380	9.5	274.5	7.4	2.9	1.8
1999	588	14.7	444.0	11.7	4.5	2.7
1999 ⁵ Delivered in CY2000	264	6.6	180.0	5.0	1.9	1.2
2000	1,200	30	858	23.3	9.0	5.5
2001 Delivered in CY2001	1,200	30	904.2	23.7	9.1	5.5
Total Delivered through 2001	5,654.8	141.4	4,147.7 ⁶	110.6 ⁷	42.5 ⁹	25.9

Events Impacting the HEU Agreement During 2001:

⁵ The HEU Agreement allowed for up to 30 MTU of HEU to blend 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. The remaining 8.7 MTU of HEU may be scheduled for blending down in future years.

⁶ Minor fluctuations in quantities of LEU are due to product assay differences.

⁷ Minor fluctuations in quantities of natural uranium are due to product assay differences.

Reaching Agreement on Future Deliveries - Under the terms of the contract implementing the HEU Agreement, USEC Inc. and its Russian counterpart must agree upon the prices and delivery schedule for enriched uranium shipped from Russia. The most recent agreement on terms for price and delivery schedule expired December 31, 2001. The two sides have recently negotiated new terms for 2002 and beyond, which must be approved by the Governments of the United States and Russian Federation. Governmental review of these new terms is expected to be completed in April 2002.

While the HEU Agreement is an integral element of U.S. nonproliferation policy, the maintenance of an economical and reliable domestic enrichment industry is vital to U.S. energy security. The enrichment process is currently the most technology-intensive step in the process of transforming uranium into fuel to produce electricity. Having greater than a 20 percent share, energy generated from 103 nuclear reactors is the second leading source of electricity in the United States. As discussed in the *National Energy Policy*, nuclear energy can be expected to remain an integral part of a diverse and sustainable U.S. energy portfolio for many years to come.

For this reason, in parallel with the discussions between USEC and its Russian counterpart, the Administration has conducted a wide-ranging review, led by the NSC. This review was designed to assure that the U.S. was implementing the HEU Agreement in a manner that is both effective and compatible with a viable, long-term domestic nuclear fuel industry. The result of this review, will be reflected in both the terms for future deliveries of enriched uranium and in other policy and program initiatives that will be announced during 2002.

Status of the Commercial Feed Agreement - In spite of the fact that the market price did not rise above the floor price of the Commercial Feed Agreement until October 2001, the Western Consortium⁸ and Russia have worked together to ensure substantial new sales of the natural uranium and conversion components of the HEU Agreement.

In November 2001, the Western Consortium and Tenex signed a new amendment to the Commercial Feed Agreement originally signed in March 1999. Under the terms of the amendment, the members of the Western Consortium committed to exercise their options to purchase quantities of natural uranium at least equal to their respective quota shares each year for the period 2002 through 2013. The quotas are approximately 53 million pounds for both Cameco and COGEMA, and 18 million pounds for RWE NUKEM. Tenex, Russia's executive agent, has

⁸ The Western Consortium is comprised of uranium suppliers Cameco, COGEMA and RWE NUKEM. The parties to the Commercial Feed Agreement, are the Russian Federation and the Western Consortium. The Commercial Feed Agreement provides the Western Consortium with the option to purchase the natural uranium and conversion components of the HEU Agreement deliveries from 1999 through 2013.

retained to sell, through its agent, Globe Nuclear Services and Supply, approximately 82 million pounds over the time period.⁹

This amendment to the Commercial Feed Agreement has assured substantial new revenues to Russia while ensuring reliable and non-threatening entry of Russian uranium into the commercial market. This Agreement has also proven to be invaluable in stabilizing and continuing the HEU Agreement.

Effects on Markets and Industries:

During 2001, the nuclear fuel markets strengthened considerably with spot market prices for uranium, conversion and enrichment services each increasing by more than 25 percent. In this respect, the implementation of the HEU Agreement did not noticeably impact the domestic nuclear fuel cycle. The following sections discuss the state of the domestic uranium mining, conversion services and enrichment services markets.

Uranium Mining

As illustrated in Figure 3, the uranium mining industry has historically had significant fluctuations in price. Based on optimistic commercial projections for uranium requirements, the price of uranium (measured in \$/pound U_3O_8) reached a high of \$43.23 in the early 1980s. As quickly as the price increased, it began its descent as the expected number of new commercial nuclear reactors declined. Also during the 1980s, U.S. utilities began to purchase considerable amounts of lower-cost uranium from foreign producers, particularly Canada and Australia. These new lower-cost producers have had the most profound effect on the price of uranium. While a temporary spike pushed the price up to \$16.50 in 1996, the average annual price of natural uranium has been around \$10 throughout the 1990s. The price spike of 1996 occurred when significant demand came to the market and many short-term contracts were signed, in part, as a result of the Nuexco bankruptcy¹⁰. By the end of 1996, however, the uranium price began to decline as it became evident that worldwide supply was sufficient to meet demand. The average spot market price in 2001 was about \$8.76 per pound. Prices increased from \$7.10 per pound at the beginning of the year to \$9.60 per pound at the end of 2001.

World uranium production increased 12% during the year 2000, to about 91 million pounds compared to 81 million pounds during 1999. Uranium output in the Western world grew by 13% from 62 million pounds in 1999 to over 70 million pounds in 2000. The increase can primarily

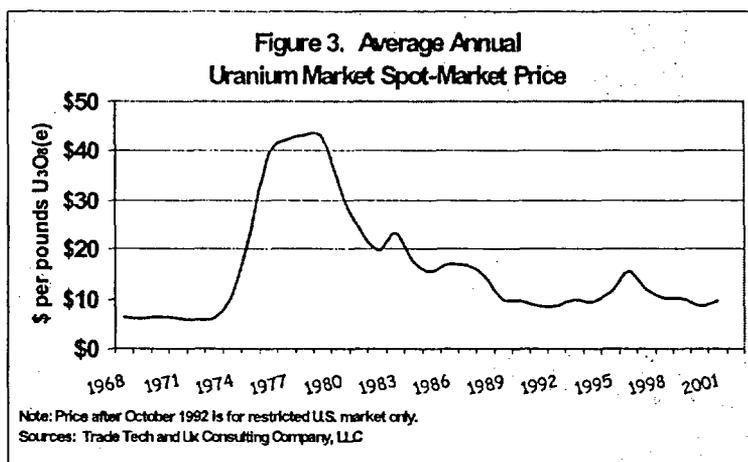
⁹ Data information provided from Cameco press release of November 26, 2001.

¹⁰ Nuexco, a trader/broker of uranium, primarily from the former Soviet Union, defaulted on several uranium contracts thus forcing those utilities to find alternate supplies with short lead time. Nuexco filed for Chapter 11 bankruptcy protection in February 1995 due to its inability to pay debts of \$400-\$500 million owed to Russia, China and the United Kingdom (Uranium Institute News Briefing 95/9, February 28, 1995).

be attributed to expanded capacity at Olympic Dam (Canada) and increased production from Ranger (Australia), as well as new production capacity at McArthur River and McClean Lake in Canada.¹¹

Even as Western uranium production increases, world uranium production can currently satisfy just over 50 percent of world requirements. Consequently, the natural uranium component from the HEU Agreement, as well as other secondary supplies, such as from the reprocessing of spent fuel in the European Union and tails enrichment in Russia, have been and are expected to play a key role in filling the production shortfall.

U.S. Uranium Production - U.S. uranium production totaled about 4 million pounds in 2000,



the lowest level since 1994. U.S. production in 2000 was equivalent to about 8 percent of the uranium loaded into U.S. commercial nuclear power reactors during the same year.¹² Even though the market price has increased by 33 percent since December 2000, U.S. production through 2001 was only 2.63 million pounds, approximately 15 percent less than 2000.¹³ The HEU Agreement may have contributed but was not the primary cause of the U.S.

uranium producer difficulties in maintaining market share; that difficulty is primarily the result of competition from low-cost producers with access to high-grade uranium deposits, especially in Australia and Canada, and secondary supply other than from the HEU Agreement. U.S. uranium producers have experienced declining market share since the 1980s. For example, at the same time that the spot-market price reached its highest level since the late 1980s, U.S. uranium production in 1996 was equivalent to just 14 percent of the uranium loaded into U.S. commercial nuclear power reactors during the same year.¹⁴

¹¹ *The Ux Weekly*, 26 March, 2001, page 1.

¹² Energy Information Administration, *Uranium Industry Annual 2000*, May 2001.

¹³ Energy Information Administration, www.eia.gov. (November 23, 2001).

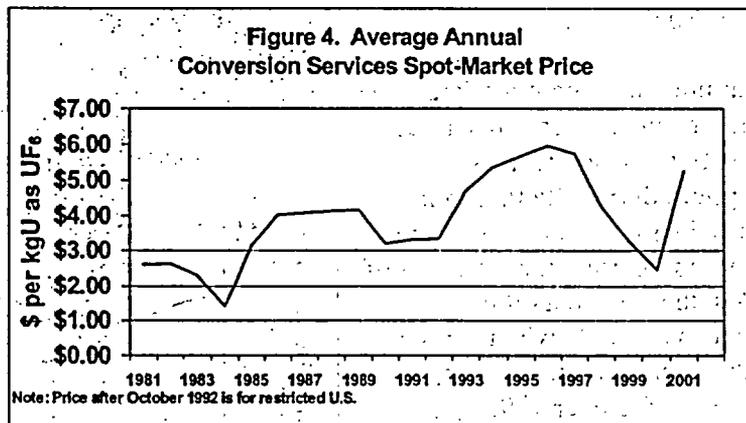
¹⁴ Energy Information Administration, *Uranium Industry Annual 1999*, May 2000.

Natural Uranium Feed under the HEU Agreement - To date, the domestic uranium industry has been only minimally impacted by the natural uranium feed component¹⁵ related to the HEU Agreement. Up until 1999, the vast majority of the natural uranium component deliveries were either returned to Russia or purchased by the U.S. government.¹⁶ Since 1999, the portion that was not returned to Russia has been purchased by the Western Consortium under the Commercial Feed Agreement. The amount of uranium feed that can be sold by the Western Consortium for end use in the U.S. market is limited by the Privatization Act. In 2001, the Consortium's share of the quota that could be sold for end use in the U.S. was approximately four million pounds U₃O₈.

Conversion Services

The conversion services market, like the uranium market, suffered a decline in price during the late 1990s. As seen in Figure 4, the price for conversion services was fairly stable from the late 1980s through the early 1990s. However, with the announcement of the closure of the Sequoyah Fuels' Facility in the early 1990s¹⁷, the price moved upward and maintained close to \$6 per kilogram through 1997. After 1997, the price began its quick decline to around \$2.35 in August 2000. In late 2000, the declining trend reversed and the price for conversion services rose to around \$3.50 per kilogram. The causes of the post-1997 decline in price included sales of existing UF₆ inventories, draw-down of utility inventories, and to a lesser degree, the marketing of the natural uranium and conversion components from the HEU Agreement.

During the first nine months of 2001, the price of conversion services rose by 38% to \$5.25 per kilogram. This price increase can be attributed to an overall change in the supply/demand situation. During early 2001, British Nuclear Fuels Limited (BNFL), a European converter, announced that it will cease its conversion



¹⁵ The natural uranium feed component consists of U₃O₈ from the mining industry and U₃O₈ to UF₆ conversion services.

¹⁶ The Russian uranium feed component was purchased between the years 1995 and 1998 by the U.S. government to facilitate continuation of the HEU Agreement.

¹⁷ The Sequoyah Fuels' Facility at Gore, Oklahoma was permanently closed in November 1992. ConverDyn was formed to fulfill Sequoyah's existing portfolio of conversion services contract commitments, administer existing Allied Signal contracts and undertake all new contracting for conversion services.

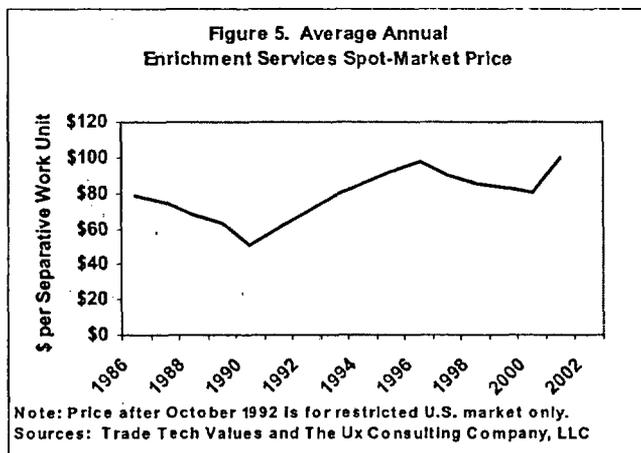
operations after March 2006. For the years 2001-2006, BNFL sold its uncommitted capacity to Cameco, another major Western converter. Prior to BNFL's announcement, supply of conversion services nearly balanced with demand. However, with the closure of BNFL's plant, the worldwide capacity will decrease by almost 10 percent. Conversion services coming from secondary sources, such as the HEU Agreement, will become important in filling the void caused by the capacity shortfall. Therefore, the price of conversion services is not expected to experience any near-term downward pressure.

Conversion Services under the HEU Agreement - Like the domestic uranium industry, the domestic conversion industry has been only minimally impacted by the HEU Agreement to date because the vast majority of the conversion component deliveries have been removed from the market (either purchased by the U.S. Government or returned to Russia). Future impact will be minimized as a result of the recent agreement, mentioned in the previous section of this report, between the Western Consortium and Russia to purchase their portion of the conversion component from 2001 through 2013 deliveries under the HEU Agreement.

The U.S. Congress, during 2001, considered several provisions regarding the nuclear fuel industry.¹⁸ The FY 2002 Energy and Water Appropriations Act provided \$400,000 for the Department to contract with the nation's sole remaining uranium converter, ConverDyn, for the purpose of performing research and development to improve the environmental and economic performance of U.S. conversion operations.

Uranium Enrichment

The uranium enrichment market, like the uranium and conversion services market suffered from depressed market prices during 2000. Figure 5 illustrates the market price over the past 15 years. During the later half of the 1980s, the spot-market price declined considerably when Russia began to export enrichment services to the U.S. In October 1992, the Department of Commerce signed an agreement with Russia which limited the import of enrichment services



¹⁸ In the December 2000, *Report to Congress on Maintenance of Viable Domestic Uranium, Conversion and Enrichment Industries*, and prior to the BNFL announcement to cease conversion operations, the Department recommended that Congress "consider promptly limited financial assistance to ConverDyn. ... The payment provisions of this initiative would help ensure the maintenance of the only U.S. supplier of conversion services and incentivize new production and sales."

from Russia. The market price for uranium enrichment then began its rebound during the early to mid-1990s.

After 1996, the enrichment market once again began to decline. The primary reasons for the downward turn in the market price was global overcapacity, liquidation of inventories, including deliveries under the HEU Agreement, and increased competition among suppliers. The price for enrichment services decreased because enrichment suppliers sought to undercut their competitors to maintain or increase market share.

The availability of enrichment supply, however, is expected to decline in the coming years with the rationalization of production capacity and draw-down of inventories built up since the mid-1990s. USEC Inc., as the only domestic enrichment supplier, currently meets its contractual requirements through both production from the Paducah Gaseous Diffusion Plant, low-enriched uranium inventories and use of the enrichment component purchased under the HEU Agreement. With the tightening of world supply and the closure of the Portsmouth Gaseous Diffusion Plant by USEC Inc. in May 2001, the reliability of U.S. supply capability has become an important energy security issue. A significant disruption in either the remaining production capacity at the Paducah Gaseous Diffusion Plant or a disruption in deliveries under the HEU Agreement could adversely impact the ability of USEC Inc. to meet its commitments to U.S. and foreign customers. European producers could increase exports to the U.S. in a supply disruption, but their reserve margins and ability to increase production quickly is very limited.

The decline in market price for enrichment services reversed rather dramatically during 2001 as a result of two events. First, USEC Inc. ceased enrichment production at the Portsmouth Gaseous Diffusion Plant in June 2001. This move decreased worldwide nameplate enrichment capacity by 16 percent. The second action that impacted the enrichment market during 2001 occurred when the Department of Commerce and the U.S. International Trade Commission decided to conduct investigations in response to the filing of petitions by USEC Inc. in December 2000 seeking the imposition of antidumping and countervailing duties on imports from European Union enrichers. As a result of these investigations, the Department of Commerce announced, on December 14, 2001, an affirmative antidumping duty determination on imports of low-enriched uranium from Eurodif SA (Eurodif) and affirmative countervailing duty determinations on imports from Eurodif and Urenco, Ltd. (Urenco).¹⁹ The determinations indicated the imposition of the following duties: 32.78% for the Eurodif in France and 2.26% for Urenco in Germany, the Netherlands, and the United Kingdom. The U.S. International Trade Commission issued a final injury determination in January 2002. These trade actions have resulted in uncertainty in the market, and have increased prices to levels not previously seen in the spot

¹⁹ The antidumping and countervailing duties trade remedies are designed to offset the amount of unfair competitive advantage attributable to foreign price discrimination or subsidization. Antidumping duties offset material injury to a U.S. industry resulting from sales at less than the price charged for a comparable product in the seller's domestic market or a surrogate market or at less than the seller's cost of production. Countervailing duties offset material injury to a U.S. industry caused by unfair subsidization of a specific industry or company by a foreign government.

market. The spot market price of separative work units (SWU) at the end of December 2000 was \$84, and by the end of April 2001 the price had increased to \$105/SWU, an increase of 25 percent in just five months. By the end of 2001, however, the spot price had decreased to a level of \$99/SWU.

Status of USEC Inc. - USEC Inc.'s loss of market share during recent years can be attributed to an overall global overcapacity for production of uranium enrichment, aggressive competitor pricing, unfavorable currency exchange rates, and, significantly, the higher cost per separative work unit at the U.S. gaseous diffusion enrichment plants. As a result of this loss of market share, USEC Inc. announced in June of 2000 that the Portsmouth Gaseous Diffusion Plant would cease operations in 2001.²⁰ In February 2001, USEC Inc. announced that it would reduce its overhead costs by 20% by reducing the number of consultants, cutting up to 50 staff positions and consolidating office space. USEC Inc.'s fiscal year 2001 gross profit declined 34.8% compared to its profit reported in fiscal 2000. USEC Inc. projects future "cash flow from operations after capital expenditures in fiscal 2002 in the range of negative \$30 [million] to \$50 million as it pays severance benefits and other costs from ceasing uranium enrichment operations at the Portsmouth plant and continues to prudently adjust SWU inventory."²¹

The Department believes that the earlier than anticipated cessation of plant operations at Portsmouth has serious domestic energy security consequences, including the inability of the U.S. enrichment supplier to meet all of its enrichment customers contracted fuel requirements, in the event of a supply disruption from either the Paducah plant production or the HEU Agreement deliveries. The energy security concerns are due, in large part, to the lack of available replacement for the inefficient and non-competitive gaseous diffusion enrichment plants. These concerns highlight the importance of identifying and deploying an economically competitive replacement domestic enrichment capability in the near term.

As a hedge against the potential of supply disruption, brought about by the decrease in domestic capacity from the Portsmouth plant closure, the Department has placed a portion of the Portsmouth plant (3.0 million SWU) into cold standby. Additionally, the Department is working with industry to stimulate the near term deployment of competitive replacement enrichment technology in the U.S.

While the supply of low-enriched uranium made available through the HEU Agreement partially contributed to the closure of the Portsmouth Gaseous Diffusion Plant, USEC Inc. currently benefits from its role as the U.S. Executive Agent for the HEU Agreement. By utilizing lower cost SWU from the HEU Agreement to leverage higher cost production from the aging and power intensive Paducah Gaseous Diffusion Plant, USEC Inc. is reliably and economically

²⁰ Cessation of enrichment operations at the Portsmouth GDP reduced, for the first time, domestic enrichment production capacity to a level below domestic nuclear utility requirements.

²¹ USEC Inc. *2001 Annual Report* to stockholders, Fiscal 2002 Outlook, p. 24.

meeting domestic utility requirements as well as requirements of U.S. allies. The HEU Agreement also contributes to the assurance of competitive enrichment supply availability until new, economically competitive advanced enrichment technology can be commercially deployed in the United States, replacing the void created by the inevitable cessation of all domestic gaseous diffusion enrichment operations.

Closure of the Portsmouth Gaseous Diffusion Plant - Due to a decrease in market share and an increase in purchases under the HEU Agreement, USEC Inc. had a capacity utilization of only 25 percent of its total operations (includes both the Portsmouth, Ohio, and Paducah, Kentucky plants)²². USEC Inc. announced in June 2000, that it would close the Portsmouth Gaseous Diffusion Plant in 2001, in order to increase its capacity utilization to 50 percent. The Portsmouth plant closure was expected to reduce USEC Inc.'s fixed production costs by approximately \$55 million in fiscal year 2002. USEC Inc. officially ceased production of enriched uranium at the Portsmouth plant on May 11, 2001.

Paducah Gaseous Diffusion Plant - During 2000, USEC Inc. announced its choice of Paducah as the sole remaining domestic enrichment plant was because Paducah offered long-term financial benefits, more attractive power price arrangements, greater operational flexibility and a history of reliable operations. During March 2001, the Nuclear Regulatory Commission authorized USEC Inc. to increase the enrichment level at the Paducah plant from 2.75% up to 5.5% ²³⁵U. This was a necessary prerequisite to closing the Portsmouth plant, and relying upon single plant operations.

New Enrichment Technology - During 2001, USEC Inc. continued to investigate options for a new, lower-cost enrichment technology. Although USEC Inc. had canceled development of the Atomic Vapor Laser Isotope Separation (AVLIS) program in 1999, it continued to evaluate other alternative enrichment technologies. USEC Inc. focused upon two possibilities. One advanced enrichment technology being evaluated is the laser-based technology developed by Silex Systems Ltd. of Australia. In 2001, the third-generation Silex /USEC Inc. project moved into the pilot engineering study phase, which includes the construction and testing of prototype equipment.

USEC Inc. has also been evaluating an enhanced gas centrifuge process using advanced carbon fiber rotors based upon U.S. Department of Energy technology. During 2001, USEC Inc. continued to pursue the development of U.S. centrifuge technology under a Cooperative Research and Development Agreement with the Department of Energy.

Alternatively, in October 2001, a consortium of U.S. nuclear utilities informed President Bush that they intended to file an application with the Nuclear Regulatory Commission "for a license

²² See Report to Congress on *Effect of U.S. / Russia Highly Enriched Uranium Agreement 2000*, dated December 31, 2000.

to build a new enrichment plant ... early next year.”²³ The consortium asserted that “the United States simply must have available more than a single source of supply for enriched uranium.”²⁴

Conclusions:

- The HEU Agreement has not negatively impacted the domestic uranium mining, conversion services, and enrichment industries during the past year as evidenced by the fact that the uranium mining, conversion, and enrichment services markets have all experienced significant price increases during 2001.
- The accomplishments of Russia and the Western Consortium in solidifying the sale of the natural uranium component of the agreement through 2013 will prove pivotal in lessening the potential market impact of the HEU Agreement on the domestic mining and conversion industries, as well as providing revenue to Russia and ensuring stability of the natural uranium and conversion components of the HEU Agreement.
- USEC Inc.’s closure of the Portsmouth Gaseous Diffusion Plant was caused by a combination of several factors, including the highly competitive enrichment market, the cost reductions required to remain competitive, management policies and actions of USEC Inc., as well as the availability of enriched uranium from the HEU Agreement.
- The reduction of production capacity brought about by the closure of the Portsmouth plant, and antidumping and countervailing duties investigations of European Union imports by the Department of Commerce and the U.S. International Trade Commission resulted in an increase in market price for enrichment services during 2001. The increase in the market price of enrichment services during 2001 helped increase the ability of USEC Inc.’s Paducah operation to continue contributing to the market.
- While the HEU Agreement is an integral element of U.S. nonproliferation policy, the maintenance of an economical and reliable domestic enrichment industry is vital to U.S. energy security. The aging U.S. gaseous diffusion plants are currently increasingly uncompetitive with gas centrifuge plants operating in the European Union and Russia.
- Without a reliable and competitive advanced technology option, the U.S. faces a significant risk of losing its domestic uranium enrichment industry to foreign competition.
- The HEU Agreement deliveries are important to meeting utility uranium enrichment requirements reliably and economically by (1) leveraging higher cost production from the aging and power intensive gaseous diffusion plant and (2) helping ensure competitive

²³ *Nuclear Fuel*, November 12, 2001, p. 17.

²⁴ *Ibid.*

enrichment supply is available until new cost competitive enrichment technology can be commercially deployed.

- The Department's priorities are: (1) to continue the successful implementation of the HEU Agreement, (2) the commercial deployment of an advanced enrichment technology for the future and (3) the commitment to assuring an appropriate future for the Paducah and Portsmouth sites that recognizes the contributions the surrounding communities have made to the Nation's energy and national security.