

Recalling the Gap

Talk of a uranium supply gap has gathered steam this year, as indicated by topics covered in presentations at various conferences. In the April NEI Fuel Cycle Seminar, Dr. Thomas Neff gave a paper that warned of a shortfall in front-end supply capacity, including uranium, and the lack of needed investment to support supply expansion. In the September symposium held by the World Nuclear Association (WNA), the WNA issued its biannual supply and demand report, warning of a sizeable supply gap. And, in the current NEI International Seminar, Clark Beyer is presenting a paper discussing the gap and what can be done about it.

The impression one gets from these presentations is that the gap is so big that Arnold Schwarzenegger could drive his Hummer through it.

Our aim here is not to debate how large the gap is, or when it will occur. Instead, we will offer some observations that hopefully will add some perspective

to this issue. In this respect, there has been talk about the gap before, but one has failed to materialize (or, more properly, the devastating impact on price resulting from a gap has not materialized). There are also some analytical issues that need to be discussed about the gap. Beyond this, there are questions about how a potential supply gap in uranium can affect enrichment, as well as the relevance of a potential supply gap to discussions about U.S. government inventory policy.

The Gap and the Recent Price Rise – Several questions arise as to the relationship of the increased discussion about the gap and the market events, especially the large rise in price, that have taken place this year. First, has talk of a gap been intensified by the recent recovery in price? In this respect, discussions of a supply gap dominated the September 1996 Uranium Institute symposium, which was held shortly after the spot price shot up to the \$16 level. In hindsight, that discussion was a reaction to what had happened in the market, not what was about to happen. As we all know now, the market at that time was facing a surplus, and price was pushed down to less than half its level in the upcoming years.

That does not appear to be the case this time around. Dr. Neff gave his paper literally hours before the McArthur River flood announcement, which precipitated

the first sharp price rise of the year. The WNA report was issued just last month, before the second big jump in price, and certainly a draft of it was produced even earlier.

Flipping the question around, one can ask whether the recent updraft in price has anything to do with a perception of a future supply gap on the part of market participants. That is, have market players bid up the price because they believe such action is necessary to avoid a supply shortfall in the future. The answer to this question is also “no.” We know from a recent survey that we conducted that there is a wide differential in what buyers are willing to pay in 2006 versus what suppliers are willing to sell. In fact, there has been a fairly wide bid-offer range for current spot purchases as well. Price has been driven up by the relative scarcity of spot supply currently, not because it is perceived that supply will be scarce in the future.

While this year’s price rise is not due to the perception of a supply gap, it may be providing the market with a glimpse of what may happen in the future if supplies are straining to meet demand. Although the so-called supply gap does not exist now, there is quite clearly a “production gap.” This latter gap is filled by the use of inventories, as it has been for some time. The temporary shut down of the McArthur River mine earlier in the year exacerbated this production gap, and price rose sharply as more demand was placed on available inventory supplies to compensate for this production shortfall. The thinness of spot supplies was further revealed in September when price shot up further as spot offers were hard to come by.

One can legitimately ask if price is being bid up this much now, why wouldn’t it be bid up to even higher levels in the future when there are fewer inventories to fill the gap. In this respect, while it is true that inventory supplies will grow to the extent that the HEU feed quota grows, these supplies are not increasing as much as other inventory sources are declining, or as quickly as overall requirements are growing. And, since production is not yet responding to price, the only supply available to fill the gap is inventory.

The Gap and Static vs. Dynamic Analysis – Gap analyses involve comparing projections of supply or supply capac-

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Recalling the Gap cont...

ity and requirements. Where supplies (including assumed rates of inventory availability) fall short of requirements, a "gap" is deemed to exist. This is necessarily a static analysis, since by the time you get to any predetermined point in the future, the gap will have closed, because there is more supply, less demand, or, more than likely, some combination of the two. That is, a gap only exists in the future, not the present.

The interesting question is how this gap is closed, that is, what are the ramifications for supply, demand, and especially price. Introducing price and the subsequent reactions of supply and demand to price is what makes an analysis dynamic. Usually, there is an attempt to make this analysis somewhat dynamic by including other projects that can be expanded or brought on line based on the assumption that price will have to rise to close the gap.

What usually is not taken into account are the changes in demand that can serve to close the gap just as effectively as changes in supply. Demand changes can include anything from adjusting tails assays to shutting down reactors, but are much more likely to be the former than the latter. For instance, if the uranium price increased to \$20 per pound and SWU and conversion prices remained at their current levels, the optimal tails assay would drop to 0.30^w%. This represents a 12.5% reduction in uranium requirements from a 0.35^w% tails assay, which would equate to a little over 20 million pound reduction in Western requirements and would go a long way to closing any gap.

There is good reason to think that these adjustments in demand will contribute as much as adjustments in supply, and certainly sooner than adjustments in supply, to close any gap. The simple fact is that few projects are waiting in the wings to come on line, and while production from existing projects can be expanded, in some cases this is problematic. In contrast, changes in tails assay can be made on fairly short notice, and here enrichment can be substituted for uranium, reducing the demand for the latter. The problem from the standpoint of the buyer is that higher uranium prices will be needed to stimulate these supply and demand responses.

The Gap and the Role of Enrichment – Of course, the ability to substitute SWU for uranium depends on the availability of enrichment capacity, and from this perspective, you must consider the entire front-end nuclear fuel infrastructure. While it is the case that the enrichment market needs new capacity even when this market is viewed in isolation, concern about a uranium supply gap represents another reason to support the building of new enrichment plants. The same tails shift

that would lead to the 12.5% reduction in uranium demand would increase SWU demand by about 10% or around 3.5 million SWU, an amount roughly equal to the proposed production from USEC's American Centrifuge or LES' National Enrichment Facility.

The Gap and the HEU-II Deal – At the same time talk about a supply gap is being renewed, there are questions about whether or not there will be an HEU-II deal. In its recent report on the uranium market, the World Nuclear Association assumed that there would not be an HEU-II deal, placing even more pressure on production to expand.

A couple of observations are in order here. First, one needs to differentiate between an HEU-II deal and more uranium being made available from HEU in the future. There may not be a deal where Russia sells the uranium to the West, but Russia could use this material to meet its own consumption needs as well as to support its export of reactors. Thus, some HEU supply could go toward filling the gap when viewed on a worldwide basis, but not much of this supply may make its way to the West.

Second, it is likely that if there is a fundamental supply/demand imbalance, it will develop long before 2013, the year that the current HEU deal ends. In this respect, the unavailability of HEU supplies may not be the factor that precipitates a supply crisis. And, if this is the case and price is bid up to a high enough level, the resulting response in production and requirements could be of such a magnitude that the market will be much better able to handle the cessation of HEU supplies than is the case today.

The Gap and U.S. Government Uranium Policy – The gap question has relevance to the current discussion over the disposition of U.S. government inventories. With prices now rising, some might argue that it is prudent to release more government inventories sooner, thus mitigating any future price rise. However, if there is truly a supply gap of any magnitude, it would be unwise to blunt any nascent price recovery if such a recovery is needed to stimulate the additional production that would help close the gap. By releasing inventories too soon, you could not only end up with a much worse gap situation later on, but have no government reserve to fall back on. Of course, this problem would be compounded if there is no HEU-II deal. Clearly, this is an area that needs to be further studied so that a counterproductive policy does not get adopted. Or, looked at another way, any policy that does get adopted should be flexible enough to adapt to changing market and political conditions so that it does not produce undesirable results.

NEWS BRIEFS

French Industry Minister expresses support for new reactor construction

— In a move that could be seen as a move toward the revival of the French nuclear industry, France's Industry Minister, Nicole Fontaine, has stated that she supports the construction of one or more European Pressurized Reactors (EPR). "I will propose to the Prime Minister to choose EPR," said Fontaine. The new reactor design, which is a joint design from Framatome and German firm Siemens, has a capacity of 1,600 megawatts. Framatome's parent company, Areva, has been lobbying the government to build a demonstration unit, arguing that construction of an EPR in France would boost prospects for winning contracts to build EPRs in other nations such as Finland, which currently is in the process of choosing a vendor to build its fifth nuclear reactor. Fontaine says that the EPR is safer and more economical than current reactor designs, and fears that France could face supply shortages around the year 2020 if it does not build the reactor. By the year 2025, a third of France's reactors will reach 40 years of age, and although the Atomic Energy Commission is studying further life extensions it is not yet clear whether France's reactors will be allowed to operate past 40 years.

Although, Fontaine has expressed her support, France's Prime Minister, Jean-Pierre Raffarin, has stated that no decision has been made on whether to build a new reactor. According to a statement from the Prime Minister's office, "Mme Fontaine was acting fully within her role of making proposals. No decision has been taken by the prime minister." The statement went on to say that a paper on France's future energy policy would become available within a few weeks to provide a means of further discussion for the public. Besides examining nuclear power, the paper will include government proposals for a greater role for renewable energy sources, along with plans to keep demand for electricity under control. A decision on whether an EPR will be built is expected to be reached towards the end of the year, following parliamentary debate on energy policy. If the project is given approval, the first new EPR could begin operating within ten years from now. France currently has 58 nuclear reactors, which provide about 80 percent of its electricity needs.

German state may fight to keep nuclear power

— One of Germany's most powerful states, Baden-Wuerttemberg, said last Thursday that it may go to court to stop the national government from phasing out nuclear power over the next 20 years. The state said abandoning nuclear power would cause considerable economic and ecological damage, as it is unclear how

— Industry Calendar —

Details at: http://www.uxc.com/fuelcycle/uxw_industry-calendar.html

- **Oct 12-15, 2003** – NEI International Uranium Fuel Seminar will be held in San Diego, CA.
- **Oct 22, 2003** – The Institute for Foreign Policy Analysis will hold the "Nuclear Energy and Science for the 21st Century: Atoms for Peace Plus Fifty" in Washington, DC.
- **Nov 16-20, 2003** – ANS/ENS International Winter Conference to be held in New Orleans, LA.
- **Jan 21-23, 2004** – UxC's Nuclear Fuel Procurement Seminar will be held in Atlanta, GA.
- **Jan 28, 2004** – NEI will hold its winter Nuclear Fuel Supply Forum meeting in Washington, DC.

lost capacity would be replaced, if not through coal-fired plants, which it considers environmentally unfriendly.

A spokesman for the state's economic ministry said, "Baden-Wuerttemberg currently examines the option of going to the Federal Constitutional Court to stop Germany's nuclear exit." The spokesman added, "We are not against renewable energy sources, but they will not suffice to fill the supply gap." Baden-Wuerttemberg has five nuclear power stations with a combined capacity of 4,900 megawatts, which are due to be closed by 2022. The state's nuclear reactors supply 58 percent of its electricity, while wind turbines, one of the renewable energy technologies promoted by the federal government, generate only about 0.35 percent of total power output.

Parliament committee questions plan for EU to take over nuclear regulation

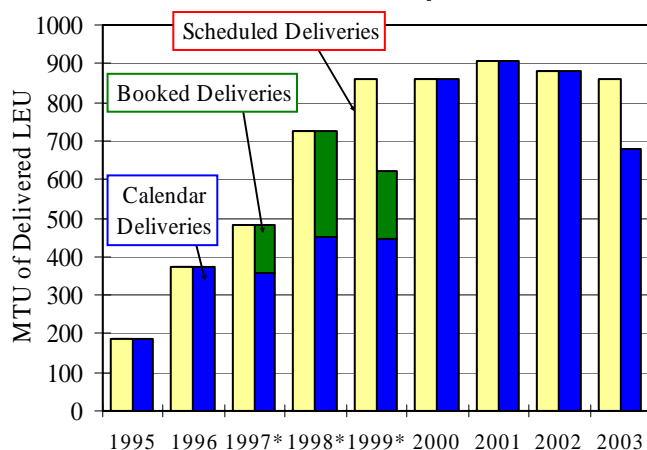
— The European Parliament's industry committee has questioned a European Commission (EC) proposal to make the European Union responsible for regulating nuclear power plant safety and the management of spent fuel. According to an article in *Euractiv*, nuclear power regulation in the EU is currently the responsibility of individual member nations, but the EC is seeking to change this because it believes that "only a common approach can guarantee that high nuclear safety standards will be maintained in an enlarged 25- or even 28-member Union."

The parliamentary committee's expert on nuclear safety, Esko Olavi Seppänen, takes issue with the EC's proposal because he does not think the EC has given any reason to think that the current system of national regulation is flawed. Seppänen also points out that the International Atomic Energy Agency, which all EU nations belong to, already provides international standards regulating the nuclear industry. In addition, a draft report

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prepared by Seppänen for the committee suggests that the EC has no legal basis to impose EU-wide nuclear regulations on individual members. However, another draft report that the committee discussed supports the EC's proposal for an EU-wide solution to spent nuclear fuel disposal. The industry committee will discuss the two reports further on November 3, and a vote on both is expected by mid-December. FORATOM, an organization representing Europe's nuclear industry, opposes the Commission's plan for EU-wide standards, believing that they would not be useful.

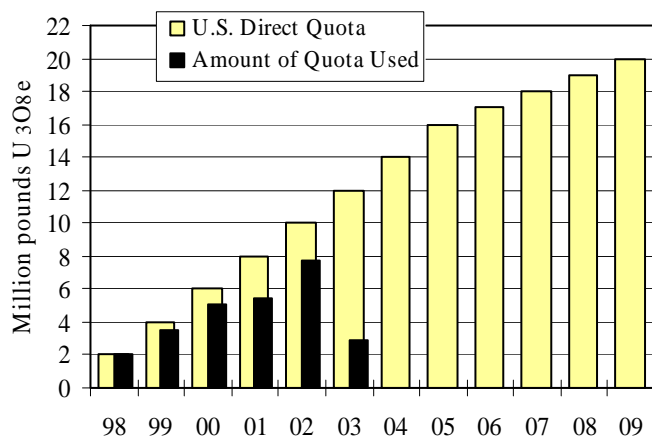
Russian LEU Deliveries as of September 30, 2003



* Booked deliveries were delivered in following calendar year.

Megatons to Megawatts Program Status				
As of Sep 30, 2003	HEU (MTU)	LEU (MTU)	SWU (000 SWU)	Warheads (Number)
Year-to-date	21.9	678	4,052	877
Program-to-date	193.0	5,705	35,576	7,733

U.S. Direct Use Quota for Russian HEU Feed



* Data as of June 2003. Reported quarterly.

Russian HEU Feed U.S. Quota Status (Mill lbs U ₃ O _{8e})						
As of June 2003	1998	1999	2000	2001	2002	2003*
Quota	2	4	6	8	10	12
Delivered	2.00	3.52	5.03	5.44	7.74	2.88
Percentage Used	100%	88%	84%	68%	77%	24%

Slovakia reopens sale of Slovenske Elektrarne – Slovakia has reopened the stalled tender for its electricity producer, Slovenske Elektrarne (SE). The sale for at least a 49 percent share and management control of SE was launched last year, but the process ran into trouble just after the September 2002 elections. At that time, eight companies were interested in buying at least part of SE, but none were interested in the utility's nuclear assets, which brought the process to a halt.

In an interview with *Reuters*, SE Chairman Miroslav Rapsik said that more than one firm could show interest in buying the whole company, not just its conventional hydroelectric and gas- and coal-fired plants. CEZ, seen as a frontrunner in the sale, has said that the Czech government, its majority owner, would support acquiring SE along with its nuclear interests. Other potential bidders are U.S. based AES Corp., Germany's E.ON and EnBW, Austria's Verbund, Italy's Enel, France's EDF, and Britain's International Power.

Early last week, Slovak Economy Minister Pavol Rusko said the new sale could take until mid-2006 if the government decides SE must be split and sold in separate nuclear and conventional parts. Rapsik added that SE will have to agree with the state on how to deal with some 44 billion crowns (US\$1.3 billion) in stranded costs linked to the nuclear assets, including two unfinished units at the Mochovce nuclear station. Additionally, Rapsik noted, "If blocks three and four (at Mochovce) are not solved, the burden would be so high that interest in the sale would be lower."

Russia, EDF reach agreement on safety project – Russian state-owned utility Rosenergoatom and Electricité de France (EDF) have signed a memorandum on the implementation of an estimated 30 million euro project to enhance the safety at Soviet-era VVER-1000 reactors over a four to five year period. The parties signed the document on October 6, which also helps Rosenergoatom in its effort to convert reactors to Mox fuel.

Iran continues uranium enrichment despite IAEA mandate to halt – On October 7, Iran's foreign minister, Karmal Kharazzi, said his country would continue to enrich uranium needed to generate nuclear power, defying an International Atomic Energy Agency (IAEA) resolution demanding a halt to the process. In addressing the media, Kharazzi said, "We will not allow anyone to deprive us of our legitimate right to use the nuclear technology, particularly enrichment, for providing fuel for our plants." The IAEA has given Iran a deadline of October 31 to temporarily suspend all its uranium enrichment programs and to sign an ad-

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ditional protocol to the nonproliferation treaty that would allow intensive inspections of its nuclear sites. Last month, inspectors found traces of weapons-grade uranium at two sites.

Brazil to enrich uranium next year – According to *BBC News*, Brazil's government has announced plans to begin enriching uranium as early as next year for the country's two nuclear reactors (Angra 1 & 2), and expects to export enriched uranium within a decade. Currently, Brazil uses uranium enriched in Europe to fuel its nuclear power reactors and spends between \$20-\$30 million importing fuel annually.

The \$40 million plan to begin enrichment was approved by Brazilian Science and Technology Minister Roberto Amaral and will be carried out by the state-owned Industrias Nucleares do Brasil (INB), in collaboration with the Brazilian navy. The minister said the team will try to go beyond simply supplying energy for the two plants in future. "The goal is for Brazil to be completely self-sufficient by 2012 and to become an exporter of enriched uranium by 2014," said Amaral.

Preliminary results of Davis-Besse pressure test positive; NRC still has concerns – FirstEnergy has announced that preliminary results from an eight-day pressure test indicate that there are no unforeseen problems at Davis-Besse, and no leaks have been detected on the bottom of the reactor. FirstEnergy hopes to restart the reactor in early November, but the NRC remains concerned about the performance of employees and could delay the restart. "At this point in a plant's recovery effort, it is easy to see the light at the end of the tunnel from a hardware perspective. It is harder on what I call the software," said Jack Grobe, the chairman of a special NRC panel that is supervising FirstEnergy's preparations to restart Davis-Besse. Specifically, the NRC is concerned about a failure to monitor cooling system pressure during last week's test. In another matter, due to concerns over design deficiencies, the NRC has decided to request more information from FirstEnergy regarding high pressure emergency cooling system pumps at Davis-Besse. Despite concerns, the NRC has expressed confidence that the reactor will eventually reach a safety level where it can reopen.

NRC gives environmental clearance to proposed BLEU Project Preparation Facility – The U.S. NRC found "no significant impact" in the environmental assessment of the proposed Blended Low-Enriched Uranium (BLEU) Preparation Facility at the Nuclear Fuel Services Inc. (NFS) site in Erwin, TN. The "no significant impact" finding is important toward the approval of the second of three license amendments,

which will allow NFS to pursue the BLEU project.

In the second amendment, filed last October, NFS is seeking NRC permission to commence processing operations at an existing building within its Erwin site. The third license amendment, which NFS has not yet applied for, will be for an oxide conversion facility. TVA anticipates that the processing of 33 metric tons of surplus-grade HEU into commercial fuel will yield it approximately 1.5 million pounds U_3O_8 over a ten year period from the BLEU project.

No clear path forward in Energy Conference

– Congress is set to return to Washington this week after a short fall recess, but there are no concrete plans to complete the conference on comprehensive energy legislation as of yet. Republican lawmakers had hoped to complete conference deliberations by early October, but recently delayed a meeting of the conference until after the recess, saying that the tax-writing committees providing input to the bill needed more time.

However, big issues such as reform of rules governing the electric transmission system and regulations related to alternative fuels and fuel additives remain highly controversial. In addition, both House and Senate Democrats have complained publicly that the process being followed by the conference committee has not been open enough for a thorough discussion of the issues.

Last week, Conference co-chair Senator Pete V. Domenici released a statement that said "I hope a conference meeting can occur next week and am working toward that objective." President Bush remains committed to an energy bill and hopes to see a bill by the end of this year. Although it has been rumored that the conference could be delayed until January, political observers note that with 2004 being a presidential election year, the chances of seeing a successful bill diminish the longer the process drags out.

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THE MARKET

Uranium – The spot market continues to be active, with new deals concluded and outstanding requests. A non-U.S. producer has offers due this week (October 16th) for 500,000 pounds U₃O₈ with delivery in 2004. Two U.S. utilities are evaluating offers, one for about 1.1 million pounds U₃O₈ equivalent with delivery split between this year and next, and the other for spot delivery of up to 600,000 pounds U₃O₈e. A number of transactions were booked last week, led by off-market deals concluded toward the end of the week that approached 600,000 pounds U₃O₈e and included significant quantities for year end delivery. Based on the most recent offers the Ux U₃O₈ Price moves up \$0.10 this week to \$12.30 per pound.

It should be noted that earlier last week, it was announced that a small 50,000-pound deal was completed at a price of \$11.75 for fourth quarter 2004 delivery on an online trading system. While we assume that this is a valid transaction, it did not factor into our determination of price for a number of reasons. First, it was below the minimum size of an offer (100,000 pounds) that we consider in setting price. Second, this material was no longer available to the market at the time we determine price (Monday), having been sold, and we cannot presume that additional material would be offered at this price. In this respect, from time to time, we encounter individual transactions such as this that, for a variety of reasons, take place at far below the prevailing market

price, and are not representative of the price at which a seller is willing to conclude a new deal. We will continue to consider all relevant information in our price determination to the extent that it meets our longstanding criteria.

In the term market, there are no changes from last week when eight utilities were either evaluating or awaiting offers totaling over 13.5 million pounds U₃O₈e.

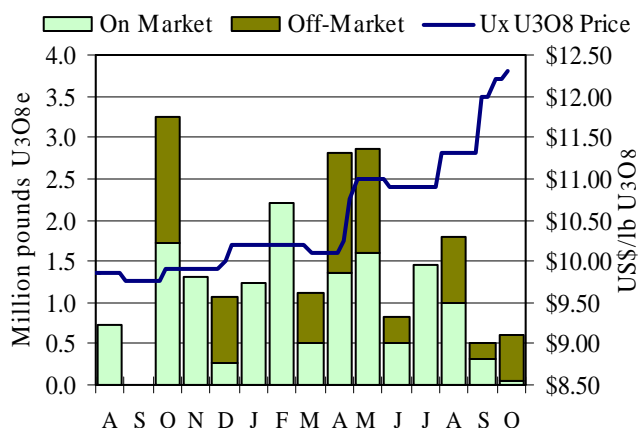
Conversion – In addition to the utilities evaluating spot and term offers with UF₆ options, a non-U.S. utility is evaluating term offers for up to 1.35 million kgU of conversion services with delivery in 2006-2008 and options through 2010. Another non-U.S. utility has offers due October 13th for 450,000 kgU as either UF₆ or conversion services with delivery in 2005-2009.

Enrichment – A non-U.S. utility has offers due October 13th for up to 250,000 SWU as enrichment services or EUP with delivery in 2005-2009. Another non-U.S. utility is evaluating offers that could include either 411,000 SWU as EUP or 303,000 SWU as enrichment services or both with delivery in 2005-2010.

Ux Spot Prices	
Weekly (10/13/03)	
U₃O₈	\$12.30
Quantities: 100-300,000	
Delivery: 6 months	
Month-end (9/29/03)	
U ₃ O ₈	\$12.20
RU Disc.	\$0.20
NA Conv.	\$4.80
EU Conv.	\$6.50
NA UF ₆ Val	\$36.67
EU UF ₆ Val	\$38.37
SWU	\$108.00
RU SWU	\$89.00

UxC Market Statistics				
Monthly (Oct)	Spot		Term	
	Volume	# Deals	Volume	# Deals
U ₃ O ₈ e (million lbs)	w	w	0	0
Conv. (thousand kgU)	w	w	0	0
SWU (thousand SWU)	0	0	0	0
2003 Y-T-D	Spot		Term	
	Volume	# Deals	Volume	# Deals
U ₃ O ₈ e (million lbs)	15.4	47	18.6	14
Conv. (thousand kgU)	>1,852	15	21,455	19
SWU (thousand SWU)	303	6	12,071	9
Key: N/A – Not available. W – Withheld due to client confidentiality.				
UxC Leading Spot Price Indicators				
Three-month forward looking spot price indicators, with publication delayed one month. Readings as of September 1, 2003.				
Uranium (Range: -17 to +17)		+6 [up 2 points]		
Conversion (Range: -16 to +16)		+3 [up 1 point]		
Enrichment (Range: -18 to +18)		+3 [unchanged]		
NuclearFuel Price Range - 10/13/03 (US\$/lb)			\$12.00-\$12.80	
RWE NUKEM	Spot Uranium (US\$/lb U ₃ O ₈)		\$11.40-\$12.25	
Price Ranges	Spot Conversion (US\$/kgU)		\$5.00-\$6.20	
As of 9/30/03	Spot SWU (US\$/SWU)		\$89.00-\$107.00	

Ux U₃O₈ Price vs. Spot Volume by Method



At the Border

Shortly after arriving at the University of Washington, I joined some new friends on a trip to nearby Vancouver, British Columbia. It was my first trip outside the United States.

At the border, a guard asked how long we would stay in Canada. Knowing it would be after midnight when we returned, I asked, "How late will we be able to get back across the border?"

"Any time, Ma'am," the guard said. "We never close Canada."