Uranium

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OVERVIEW

Uranium producers continued to face challenging market conditions in 2002 as abundant secondary supplies continued to compete for limited demand. However, the improving political climate for nuclear energy continued in 2002. This, combined with positive steps toward the long-term disposition of nuclear fuel waste in North America and a continued focus on clean air, could translate into nuclear power growth and improved market conditions for uranium producers over the next several years.

The uranium spot market price was remarkably stable through 2002, a situation that was brought about by ample inventory supplies compared to spot demand as government inventories in Russia and the United States continued to make their way to the market. Although this situation is expected to continue in the near term, Canadian uranium producers remain well positioned to capitalize on any additional market upturn as the transition to new production centres tapping high-grade, low-cost deposits in northern Saskatchewan continues.

Canadian uranium production in 2002 amounted to a total of 11 607 tU, down some 7% from the record 2001 total of 12 522 tU, mainly due to decreased contributions from the Rabbit Lake production centre. As Figure 1 shows, the world's two largest uranium-producing companies have operations in Canada. As of January 1, 2003, Canada's "known" recoverable uranium resources totalled 439 000 tU, compared with 452 000 tU as of January 1, 2002. This downward adjustment of some 3% is the result of mining depletion and ongoing deposit appraisal.

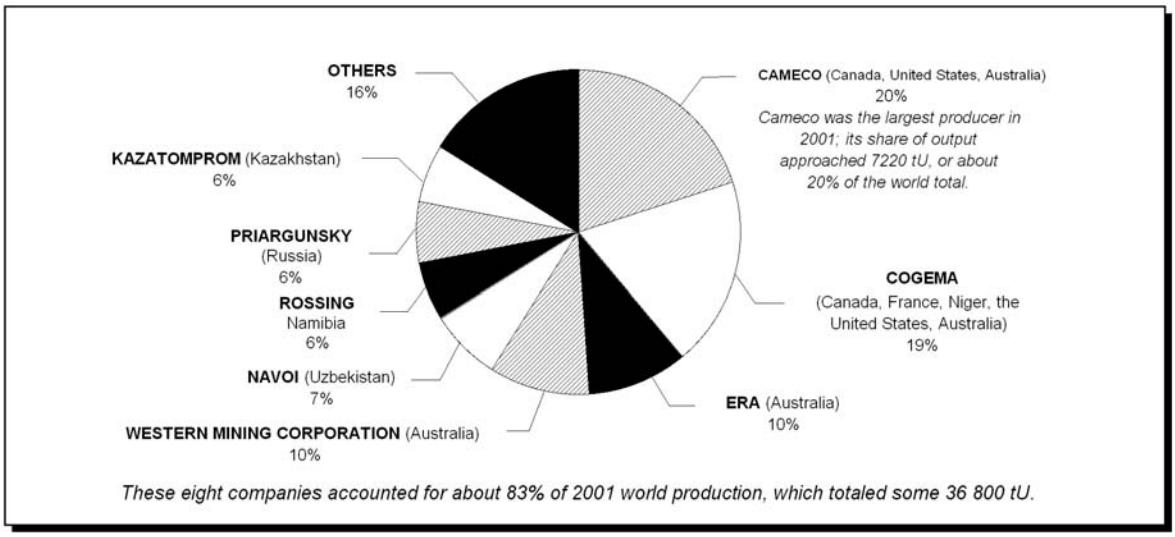
Canadian uranium production capability declined as the Cluff Lake production facility closed in December 2002 after all stockpiled ore was processed. In addition to the Cluff Lake closure, the flooding at the McArthur River mine in April 2003 that temporarily suspended production for some three months will reduce production somewhat in 2003. The timing of production at the Cigar Lake mine, which currently is not expected earlier than 2006, will depend upon market conditions and regulatory approvals.

DOMESTIC PRODUCTION AND DEVELOPMENTS

In 2001, the most recent year with complete data available, production amounted to a record total of 12 522 tU, a sharp increase of 17% from the 2000 total. Record 2001 production resulted from increased McArthur River and McClean Lake production as the mines ramped up toward full commercial production rates. Overall employment in Canada's uranium mining industry dropped slightly below 1000 in 2001 (Table 1). Shipments from mining centres increased dramatically in 2001, compared to 2000, and the total value of these shipments increased as well (Table 2). These data primarily reflect the successful transition that uranium producers are making to the new high-grade production centres as resources near depletion at older operations. With increased 2001 production, uranium continues to rank among Canada's top 10 metal commodities in terms of output value. Table 3 documents the main operational characteristics of the existing uranium production centres in Canada in 2001 and Table 4 updates the status of new projects that represent Canada's future production capability. All current production and new projects awaiting development are located in the Athabasca Basin of northern Saskatchewan. One property that is being considered for development, Kiggavik in Nunavut (Figure 2), is not likely to proceed in the foreseeable future due to market conditions and regulatory uncertainties. Uranium production in Canada in 2001 (Figure 3) was once again dominated by Cameco Corporation and COGEMA Resources Inc. (CRI).

On June 19, 2002, Cameco announced that it had acquired the Smith Ranch in situ leach (ISL) mine and related properties in Wyoming from Rio Algom Mining LLC, a subsidiary of BHP Billiton. The Smith Ranch production facility includes a mill with an annual capacity of about

Figure 1
World's Top Uranium Mining Companies in 2001



Source: *World Nuclear Association Pocket Guide.*
Note: Ranking reflects equity interest in production facilities, not market share.

770 tU, as well as proven and probable reserves totalling some 10 385 tU. To acquire the facility, Cameco agreed to assume all decommissioning liabilities associated with the mine (estimated at approximately US$11 million) and to purchase approximately US$6 million of Rio Algom's uranium inventory. The Smith Ranch ISL facility is adjacent to the Highland ISL mine operated by Power Resources Inc., a wholly owned subsidiary of Cameco.

On July 17, 2002, UEX Corporation was listed for trading on the Toronto Stock Exchange. UEX is a new Canadian uranium exploration company that was created on October 21, 2001, when Cameco and Pioneer Metals Corporation announced that they had entered into an agreement to form the company to focus on uranium exploration in the Athabasca Basin of northern Saskatchewan.

Environmental management systems at the McArthur River mine and the Key Lake mill were certified under the ISO 14001 standard in 2002. The McClean Lake mine and mill, as well as the Blind River refinery and Port Hope conversion plant, have already achieved this internationally recognized standard, which outlines the key requirements that companies should comply with in order to operate in an environmentally responsible manner. Thus, the front end of the nuclear fuel cycle meets rigorous international standards in Canada.

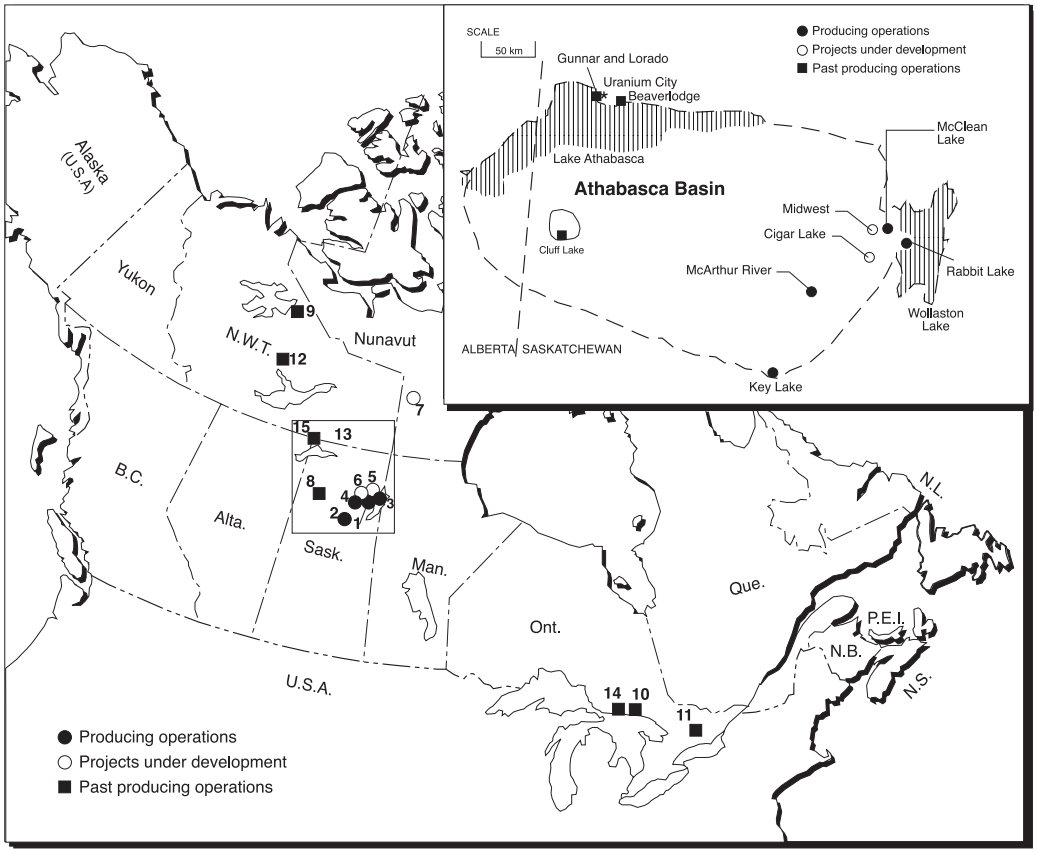
Elliot Lake, Ontario

Elliot Lake, Ontario, was a major uranium mining centre in Canada for over four decades. Since the last facility closed in 1996, Rio Algom Limited and Denison Mines Limited have completed an environmental assessment process and, by the late 1990s, had finalized the majority of the major reclamation work. Comprehensive environmental monitoring indicates that this decommissioning effort has been successful since the fish, benthic invertebrates and wildlife residing in the watershed that hosted the mining for over 40 years are displaying no adverse effects.

Some of the older, historic waste sites (containing uranium mine tailings and other uranium mine wastes produced prior to 1968) in the Elliot Lake area were stabilized with a vegetation cover to control dust and surface run-off during decommissioning in the 1970s and were then upgraded with remedial work performed in the 1990s. Run-off and seepage from these sites continue to be collected for treatment.

On August 16, 2002, the Canadian Nuclear Safety Commission (CNSC), following an environmental assessment and public hearings, issued a Radioactive Waste Facility Operating Licence to Rio Algom for these historic facilities (Spanish American, Milliken, Lacnor, Nordic/Buckles and Pronto) with a term ending December 31, 2005. These sites are designed for the storage of mine wastes produced during past mining operations and no other wastes are to be imported or added to them. Activities under this licence include regular inspection and maintenance, treatment of effluent water, and environmental monitoring. Rio Algom's environmental management system is certified under the ISO 14001 standard.

Figure 2
Uranium Mining in Canada, 2002



Numbers refer to locations on map above.

PRODUCING OPERATIONS

1. Rabbit Lake
2. Key Lake
3. McClean Lake
4. McArthur River

PROJECTS UNDER DEVELOPMENT

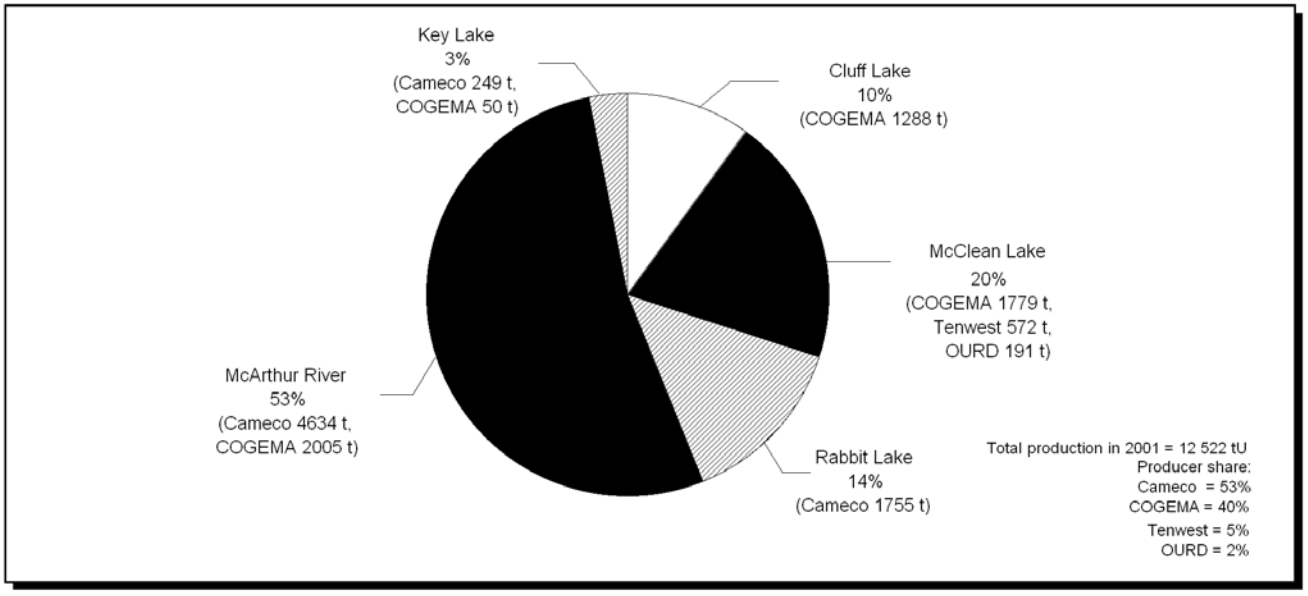
5. Midwest
6. Cigar Lake
7. Kiggavik

PAST PRODUCING OPERATIONS

8. Cluff Lake
9. Port Radium
10. Agnew Lake
11. Madawaska et al (Bancroft)
12. Rayrock (Marian River)
13. Beaverlodge et al
14. Quirke/Panel/Denison and Stanleigh et al (Elliot Lake)
15. Gunnar and Lorado et al

Source: Uranium and Radioactive Waste Division, Natural Resources Canada.

Figure 3
Canadian Uranium Production and Ownership, 2001



Source: Uranium and Radioactive Waste Division, Natural Resources Canada.
Cameco: Cameco Corporation; COGEMA: COGEMA Resources Inc.; OURD: OURD (Canada) Co., Ltd.; Tenwest: Tenwest Uranium Ltd.
Notes: Production reflects equity interest in production facilities. Tenwest is a wholly owned subsidiary of Denison Mines Limited.

Athabasca Basin, Saskatchewan

McArthur River

The McArthur River mine, the world's largest high-grade uranium deposit discovered to date, is a Cameco-CRI joint venture operated by Cameco. About 20% of total world production (7082 tU) came from the mine in 2002, compared to the 6639 tU produced in 2001.

On April 6, 2003, unstable ground conditions were encountered that caused the roof of an underground development drift to collapse. No one was injured in the incident as the mine had been evacuated prior to the collapse. Production was halted until all inflowing water was pumped to the surface and treated for release and a bulkhead was constructed to block additional inflows. It is expected that the mine will resume production in July 2003.

Key Lake

The Key Lake project is a Cameco and CRI joint venture operated by Cameco. Local deposits were mined out in 1997, but the mill continues operating as it is processing all McArthur River ore. In 2002, Key Lake produced a total of 7199 tU, an increase of about 4% over the 2001 total of 6938 tU. All but 117 tU of the 2002 production was derived from McArthur River. The small contribution from Key Lake came from stockpiled mineralized, low-grade waste rock that is used to lower the McArthur River ore grade to about 3.5% U before being run through the mill circuit.

On December 18, 2002, an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) of a proposal to recycle uranium by-products from the Blind River refinery and the Port Hope conversion plant at Key Lake was initiated. A screening report environmental assessment is required before the CNSC can make a decision on Cameco's application to amend the Key Lake uranium mill operating licence to permit the recycling. Following the closure of the last uranium mill in Elliot Lake, Ontario, recyclable products from the Blind River and Port Hope facilities in Ontario have been processed at the White Mesa mill in Utah.

McClean Lake

The McClean Lake uranium production facility is majority-owned and operated by CRI. In 2002, production amounted to 2342 tU, down slightly from the 2540 tU produced in 2001. Mining of the Sue C open pit was completed in early February 2002 and the McClean Lake mill

was fed throughout the year by stockpiled ore from the JEB and Sue C deposits. This ore stockpile is expected to be sufficient to provide feed for the mill until the end of 2005.

On September 23, 2002, the Federal Court of Canada issued an order to quash a McClean Lake operating licence on the grounds that an environmental assessment under the CEAA had not been conducted prior to issuing the licence. In November 2002, the CNSC and CRI successfully applied to the Federal Court of Appeal for a stay of the order until the appeal is heard. The Court order deals with the application of the transitional provision of the CEAA and is not a criticism of the environmental performance facility. The McClean Lake facility has performed as predicted and has met or exceeded all environmental requirements of the regulatory agencies.

The stay allows CRI to operate the facility until the appeal is heard. As of June 2003, a date had not been set for the appeal hearing. Early in 2003, CRI applied to the CNSC for the revocation of its current operating licence and the issuance of a new one for McClean Lake. On April 17, 2003, an environmental assessment of the project under the CEAA was initiated. Completion of the screening report environmental assessment is required before the CNSC makes a decision on the application from CRI.

A lockout in response to a strike notice by the Communications, Energy and Paperworkers Union closed the McClean Lake mill on June 9, 2003. Unionized workers at both McClean Lake and Cluff Lake ratified a new three-year contract agreement on June 11, 2003, and operations resumed at McClean Lake a few days thereafter.

Rabbit Lake

The Rabbit Lake production facility is wholly owned and operated by Cameco. Mill output in 2002 amounted to 440 tU, down significantly from 2001 production of 1755 tU, mainly due to a decision to suspend mining and milling operations in March 1999 and May 2001, respectively, due to market conditions. The Eagle Point underground mine was re-opened in April 2002 following a re-evaluation of the mining plan. The first ore was produced in July 2002 and the mill resumed operations at the end of August 2002.

The start-up of the mill proceeded smoothly and it has operated on a cyclical basis, dictated by mine output, since the re-opening. During the resumption of mining activities, however, Cameco faced challenges with respect to poor ground conditions and radiation protection. Although all regulatory requirements were met, the company developed a modified mining plan and implemented a number of new radiation protection initiatives to overcome these challenges. The time taken to develop and implement these actions reduced output.

Rabbit Lake reserves are expected to provide feed for the mill until early 2005. Cameco is conducting an exploration program to identify additional reserves to extend the life of the facility. In addition, an environmental assessment of a proposal to process approximately 50% of the ore from the Cigar Lake mine at Rabbit Lake (providing some 15 years of feed for the mill) is expected to be filed with regulatory agencies in 2004. Deliveries of Cigar Lake ore to Rabbit Lake may commence as early as 2008.

Cluff Lake

The Cluff Lake uranium production facility is wholly owned and operated by CRI. In 2002, its final year of operation, the mill operated on an alternate week schedule throughout most of the year and produced 1626 tU, up significantly from the 1288 tU produced in 2001. The increased production was the result of the higher ore grades encountered during the final phase of mining. Mining was stopped in May 2002 and all stockpiled ore was milled by the end of December 2002, bringing to a close a long and successful chapter in Canadian uranium mining.

In its 22 years of operation, the Cluff Lake facility produced some 24 000 tU, generated significant employment and business opportunities for residents of northern Saskatchewan, and set high standards for uranium production and workplace safety. Cluff Lake won the John T. Ryan Award for achieving the lowest lost-time accident rate at a Canadian metal mine in both 1998 and 2002.

Once an environmental assessment of the decommissioning plan (initiated on April 15, 1999) is completed and all regulatory approvals have been obtained, CRI will begin the decommissioning process. In the interim, CRI has initiated preliminary clean-up activities, such as mothballing the mill, demolishing surplus buildings, cleaning up ore storage areas, and adding a layer of soil material to level the lower solids area of the tailings management area.

Cigar Lake

The Cigar Lake mine is a joint venture being developed by Cameco (Table 4). It is the world's second largest high-grade uranium deposit discovered to date with reserves totalling more than 85 000 tU at an average grade of over 17% U. In January 2003, Cameco applied for a CNSC licence to begin construction of commercial facilities at the site where test mining has been conducted at various times since the discovery of the deposit in 1981. Envisaged construction includes development of a second mine access shaft, an underground ore preparation circuit, surface ore storage and loading facilities, and upgraded water treatment and camp facilities.

Since the federal court decision that quashed a McClean Lake operating licence has introduced uncertainty in environmental assessment requirements, the CNSC exercised

caution in the Cigar Lake construction licence application and determined that an environmental assessment screening report pursuant to the CEAA must be prepared in support of the application for a construction licence. Subject to favourable regulatory approvals and market conditions, the Cigar Lake mine is now expected to begin production no earlier than 2006.

In August 2002, Cameco and CRI submitted an addendum to the 2001 environmental assessment of options for disposing of potentially acid-generating waste rock from the Cigar Lake mine in response to comments and questions received during regulatory reviews of the report. Although disposal of Cigar Lake waste rock in the mined-out Sue C pit at McClean Lake remains the preferred option, the proponents have determined that two two-year long-haul campaigns (roughly 20 and 40 years into the Cigar Lake project life) is the environmentally preferred transport option. The CNSC has scheduled a one-day public hearing on June 25, 2003, to review the environmental assessment screening report.

Additional Production Possibilities

Beyond the existing and committed centres of uranium production mentioned above, there are two projects that could be brought on stream in the future, subject to market conditions and the receipt of environmental and regulatory approvals. Table 4 updates, as of June 1, 2003, recent developments at the mining projects that could contribute to Canada's future uranium production capability.

Other Developments Affecting Canada's Uranium Industry

On December 23, 2002, Cameco announced its intention to increase its stake in the Bruce Power Limited Partnership. Bruce Power was initially a joint venture involving British Energy plc (80%), Cameco (15%), the Power Workers' Union (4%) and The Society of Energy Professionals (1.2%). As the result of a transaction that closed on February 14, 2003, British Energy divested all of its interests in the Bruce nuclear power generating station to a Canadian consortium. Cameco acquired an additional 16.6% ownership stake for a combined 31.6% ownership. TransCanada PipeLines and BPC Generation Infrastructure Trust (a trust established by the Ontario Municipal Employees Retirement System) each acquired 31.6% with the two unions maintaining the balance.

The Bruce nuclear power station consists of four Bruce B reactors currently in operation and four laid-up Bruce A reactors. Bruce Power continues to work toward the restart of two of the laid-up Bruce A reactors (Units 3 and 4, an additional 1500 MWe) with both expected to be back in operation in 2003, subject to regulatory approvals.

On July 22, 2002, Cameco announced that it had entered into a memorandum of agreement (MOA) that represented an initial step toward a formal agreement with a consortium that is working toward establishing a $1.5 billion uranium enrichment facility in the United States. Under the terms of the MOA, Cameco was to have obtained, upon entering into the partnership, a 20% interest in the project. Following receipt of a licence and a final restructuring of the partnership, Cameco's interest would have increased to 25%. However, on March 10, 2003, Cameco announced that it was withdrawing from the partnership because the venture did not meet the company's requirements.

EXPLORATION

Natural Resources Canada (NRCan) completed its 27th annual assessment of Canada's uranium supply capabilities and reported[2] the results in October 2002. Uranium exploration activity remains concentrated in areas favourable for the occurrence of deposits associated with Proterozoic unconformities, notably in the Athabasca Basin of Saskatchewan and the Thelon Basin of the Northwest Territories and Nunavut. In 2001, overall uranium exploration expenditures amounted to $25 million while uranium exploration and surface development drilling totalled over 48 000 m, down from the 77 000 m reported for 2000.

In 2001, slightly less than half of the overall exploration expenditures can be attributed to advanced underground exploration, deposit-appraisal activities and care-and-maintenance expenditures associated with those Saskatchewan projects awaiting production approvals. In comparison, the Saskatchewan government estimates that "grass-roots" uranium exploration in the province amounted to $14 million in 2001, down slightly from the 2000 total of $18 million. Table 5 summarizes uranium exploration activity in Canada from 1988 to 2001.

In recent years, the number of companies with major exploration programs in Canada has declined. The top five operators,[3] accounting for a major portion of the $25 million expended in 2001, were: Cameco Corporation, CRI, JNR Resources Inc., Kennecott Canada Exploration, and Pioneer Metals Corporation. Expenditures by CRI include those of Urangesellschaft Canada Limited.

RESOURCES

NRCan's annual assessment of domestic uranium supply capability provides a compilation of Canada's "known" uranium resources based on the results of an evaluation of company data. Uranium supply from Canada in the next decade will come from known resources, estimates of

which are divided into three major categories (measured, indicated and inferred) that reflect different levels of confidence in the reported quantities. Most of these resources are associated with deposits identified in Figure 2.

Recent NRCan assessments of Canada's uranium resources have been restricted to those recoverable from mineable ore at prices of $100/kgU or less. Table 6 shows the breakdown of the latest resource estimates, compared with those of the previous year. As of January 1, 2002, total recoverable known uranium resources were estimated at 452 000 tU, compared with 437 000 tU as of January 1, 2001. This upward adjustment of some 3% is the result of ongoing resource assessment.

SUPPLY CAPABILITY

At the end of 2002, Canada's uranium supply capability declined as production at Cluff Lake had ended. A continued smooth transition to other new mines, notably Cigar Lake, combined with timely licensing approvals and improved market conditions, will be required to allow Canada's production capability to expand to its full potential of some 16 000 tU annually.

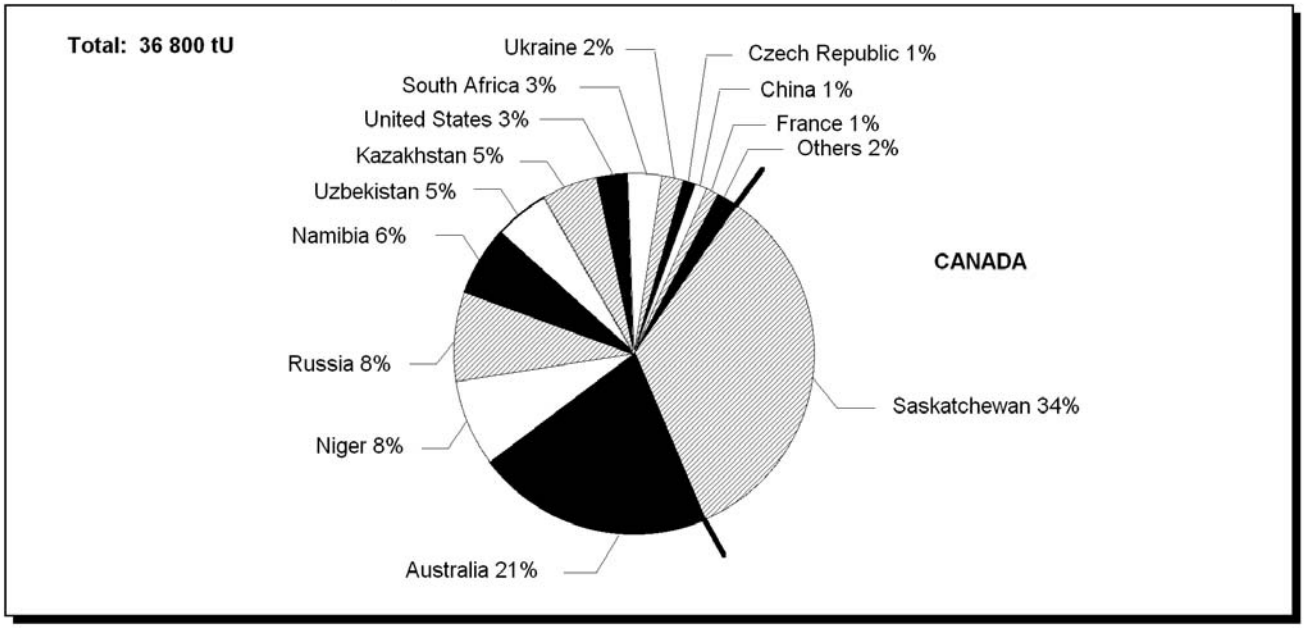
Developments in the international uranium market, the rate at which projects receive environmental approvals, and uncertainty regarding the costs associated with certain of the planned new projects preclude projecting future production capability levels with much certainty. Table 7 ranks Canada among the world's major producers, showing actual uranium production from 1997 through 2001. Figure 4 illustrates Canada's share of world output in 2001 compared with other major producers.

GOVERNMENT INITIATIVES

The *Nuclear Fuel Waste (NFW) Act* came into force on November 15, 2002. The act requires nuclear utilities to form a waste management organization. Under the act, the organization's mandate is to propose to the Government of Canada approaches for the long-term management of nuclear fuel waste and to implement the approach that is selected by the Government. The NFW Act also requires the utilities and Atomic Energy of Canada Limited to establish trust funds to finance the implementation of the selected long-term nuclear fuel waste management approach.

The *Nuclear Safety and Control (NSC) Act*, replacing the existing *Atomic Energy Control Act* of 1946, received Royal Assent in March 1997. The new act created the CNSC to replace the Atomic Energy Control Board. It came into force on May 31, 2000, with new regulations. In February 2003, subsection 46(3) of the NSC Act was amended to clarify a point concerning site remediation

Figure 4
World Uranium Production, 2001



Source: Uranium and Radioactive Waste Division, Natural Resources Canada.

obligations that had the consequence of discouraging private-sector lending to companies that own and operate nuclear facilities.

URANIUM MARKET

Overview

The improving political climate for nuclear energy continued into 2002, perhaps setting the stage for renewal of new nuclear build a few years from now. In the United States, three major utilities secured government funding to complete the Nuclear Regulatory Commission's Early Site Permit Process. This will help the utilities evaluate whether selected nuclear sites are suitable for additional reactors and will serve as a pre-approval for the construction of new reactors at those sites. This will shorten the regulatory process in the event that the utilities decide to invest in additional plants.

The year also saw Congressional approval of the Yucca Mountain site in Nevada as the U.S. repository for spent nuclear fuel. Although still faced with a licensing process that will take several years, as well as a number of legal actions aimed at stopping it, this legislation represents a major milestone on the road to closing the back end of the nuclear fuel cycle. The political solution to this perceived problem should negate one of the strongest arguments levelled against nuclear power by its opponents and remove an important obstacle to the expansion of nuclear power.

The climate for nuclear power in Europe also improved. Britain's chief science advisor came out strongly in support of expanding nuclear power, at least to the extent of replacing those reactors that will have to be decommissioned over the next two decades. He said that nuclear power is vital for the nation to meet its goals of reducing greenhouse gas emissions. The European Union also released a new energy policy that called for greater diversity of supply and emphasized nuclear power's role in reducing greenhouse gas emissions while leaving the decision of whether to support nuclear power up to individual nations. During the year, the Finnish Parliament approved the construction of a new nuclear reactor and the utility involved initiated the bidding process on the first new reactor approved in Europe in over a decade.

Uranium Prices

The uranium spot market price, as reported by TradeTech,[4] was remarkably stable during 2002. After opening the year at US$9.50/lb U_3O_8 (a standard measure of uranium metal content), it spent the next 11 months in the narrow band of $9.75-$9.95/lb before breaking the $10 barrier and closing the year at $10.20/lb (Figure 5). This stability was brought about by ample inventory supplies compared to spot demand as Russian and U.S. government inventories continued to make their way to the market. This situation is expected to continue in the near term.

Commencing in 2002, Natural Resources Canada has decided to suspend the publication of the *Average Price of Deliveries under Export Contracts for Uranium* for a period of three to five years pending a policy review and assessment of market conditions. Table 8 indicates actual exports of Canadian-origin uranium to principal customers from 1996 to 2001. The destination of Canada's exports of uranium on a cumulative basis (1997-2001 inclusive) is illustrated in Figure 6, which highlights the importance of the United States as a customer.

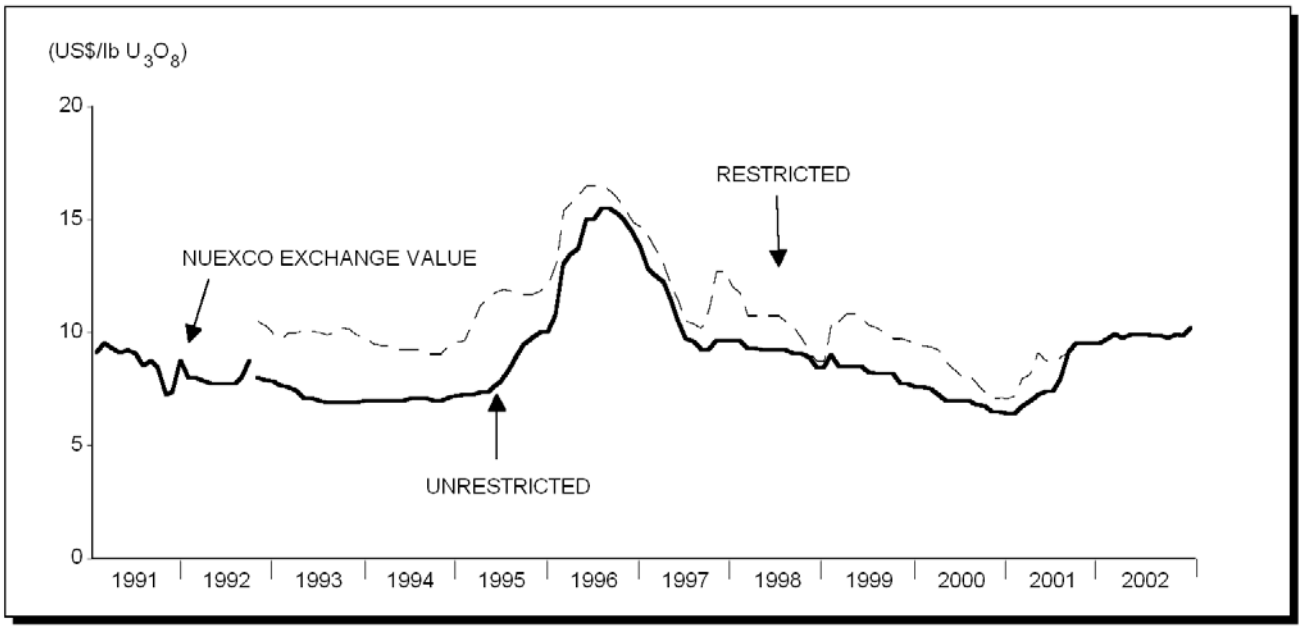
REFINING AND CONVERSION

Cameco operates Canada's only uranium refining and conversion facilities, located at Blind River and Port Hope, Ontario, respectively. At the Blind River refinery ~ the world's largest ~ uranium mine concentrates from Canada and abroad are refined to uranium trioxide (UO_3), an intermediate product. The UO_3 is then trucked to the Port Hope facilities, which have about one quarter of the Western World's annual uranium hexafluoride (UF_6) conversion capacity and currently provide the only commercial supply of fuel-grade natural uranium dioxide (UO_2). UF_6 is enriched outside Canada for use in foreign light-water reactors while natural UO_2 is used to fabricate fuel bundles for CANDU reactors in Canada and abroad. About 80% of the UO_3 from Blind River is converted to UF_6 while the remaining 20% is converted to UO_2. Table 9 tabulates Canada's production of refined and converted uranium, and notes the associated work force, from 1998 to 2001 inclusive.

OUTLOOK

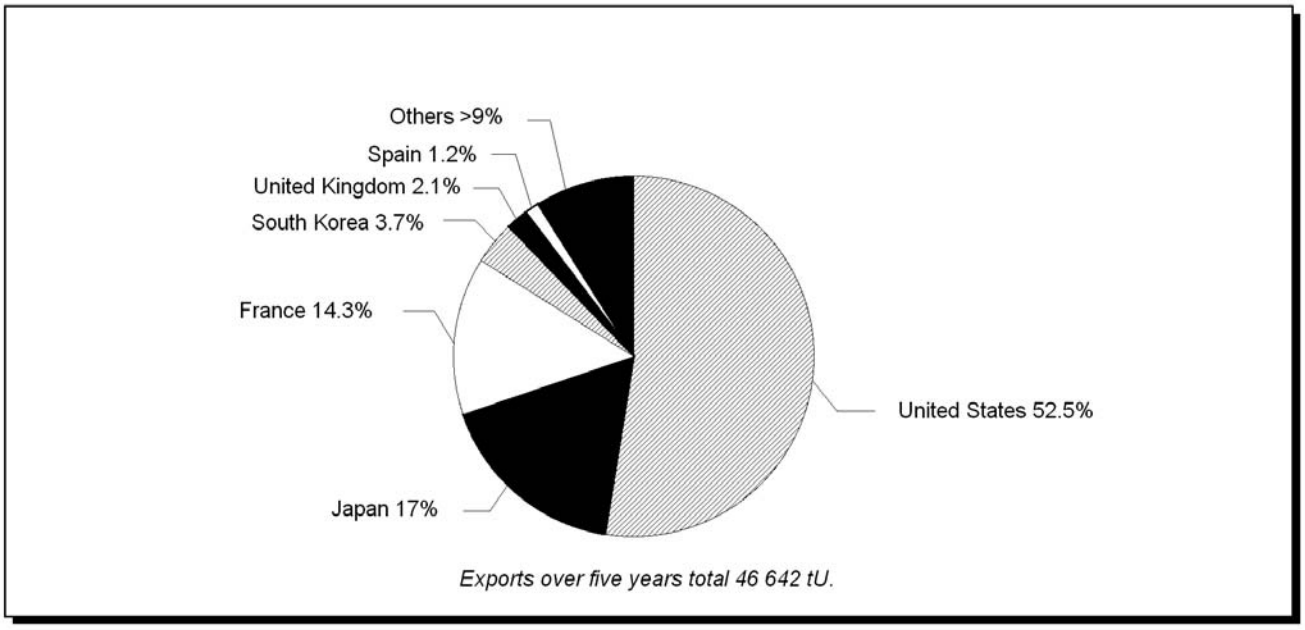
Continued improvement in the political climate for nuclear energy in 2002, particularly in the United States, was good news for uranium producers in Canada. This, combined with positive steps toward the long-term disposition of nuclear fuel waste, could pave the way for growth in the nuclear power sector. Improved market conditions will be welcomed by Canadian producers as the transition to a new generation of uranium mines continues in northern Saskatchewan. Continued success in bringing these environmentally sustainable operations on stream, notably the Cigar Lake mine, will ensure that Canada remains the world's premier uranium producer well into the 21st century.

Figure 5
Trend in Uranium Spot Prices, 1992-2002



Source: TradeTech.

Figure 6
Canadian Uranium Exports, by Country of Final Destination, 1997-2001



Source: Canadian Nuclear Safety Commission.

REFERENCES

1 John French, Advisor, Uranium Markets (tel. 613-995-7474), has contributed to the text in those sections dealing with international uranium market developments and uranium prices.

2 *Canada's Uranium Industry - Record Production in 2001*, NRCan mailing, October 2002.

3 In certain cases, the identified operator has reported the total expenditures of a joint-venture effort. Therefore, contributions by other parties not responding to the NRCan survey are accounted for in the $25 million total expenditure for 2001.

4 NUEXCO, an international uranium brokerage firm, was originally called the Nuclear Exchange Corporation. Several companies in the NUEXCO organization that were associated with uranium trading declared bankruptcy in early 1995. Certain of these have been reorganized and continue to provide brokerage services. NUEXCO's publication activities are carried on by TradeTech.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to chapter 64. (2) Information in this review was current as of June 1, 2003. (3) This paper on uranium and other information on developments in Canadian nuclear policy can be accessed on the Internet at http://nuclear.nrcan.gc.ca. (4) This and other reviews, including previous editions, are also available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

TABLE 1. URANIUM PRODUCTION AND ASSOCIATED WORK FORCE IN CANADA, 1999-2001

Production Centre and Producer	Company Work Force (1) (Dec. 31)			Annual Output (2) (tU)		
	1999	2000	2001	1999	2000	2001
ATHABASCA BASIN, SASKATCHEWAN						
Cluff Mining (COGEMA Resources Inc., 100%)	151	105	98	1 234	1 443	1 288
Key Lake JV (Cameco operator)	277	260	289	3 715	402	299
Rabbit Lake JV (Cameco, 100%)	155	156	66	2 705	2 790	1 755
McClean Lake JV (COGEMA Resources Inc. operator)	283	258	238	560	2 308	2 540
McArthur River JV (Cameco operator)	157	225	263	–	3 740	6 639
Cigar Lake JV (pre-production)	53	22	19	–	–	–
Total	1 134	1 026	973	8 214	10 683	12 522

Sources: Company annual reports; Canadian Nuclear Safety Commission open files.
– Nil.
(1) Figures are for company payroll employees only; on-site contractors (mining, construction, services, etc.) are not included. (2) Primary output only. With the closure of Rio Algom Limited's Stanleigh operation at Elliot Lake in mid-1996, by-products from Cameco's refinery/conversion facilities are no longer processed in Canada.

TABLE 2. VALUE[1] OF URANIUM SHIPMENTS[2] BY PRODUCERS IN CANADA, 1997-2001

	Unit	1997	1998	1999	2000	2001 (p)
Total producer shipments	tU	11 127	9 984	10 157	9 921	12 922
Total value of shipments	$ millions	554	500	500	485	600

Source: Natural Resources Canada.
(p) Preliminary.
(1) Value of shipments is estimated from an average market price. (2) Shipments in tonnes of uranium (tU), contained in concentrate, from ore-processing plants.

TABLE 3. OPERATIONAL CHARACTERISTICS OF EXISTING CANADIAN URANIUM PRODUCTION CENTRES, 2001

Operating Entity (Operator)/Location	Ore-Processing Plant (1)			
	Capacity	Recovery	Annual Throughput	
	Nameplate	Overall	Total Ore	Ore Grade
	(t/d)	(%)	(t)	(%)
Cluff Mining (COGEMA Resources Inc.)/ Cluff Lake, Saskatchewan	800	97	58 500	2.27
McClean Lake JV (COGEMA Resources Inc.)/ McClean Lake, Saskatchewan	300	98	98 400	2.63
Rabbit Lake (Cameco Corporation)/ Rabbit Lake, Saskatchewan	1 920	97	139 300	1.14
Key Lake JV (Cameco Corporation)/ Key Lake, Saskatchewan (2)	750	98	192 700	3.65

Sources: Corporate annual reports; Canadian Nuclear Safety Commission open files.
(1) Figures are rounded. (2) All McArthur River ore is processed at Key Lake.

TABLE 4. CANADIAN URANIUM MINING PROJECTS PLANNED FOR PRODUCTION AS OF JUNE 1, 2003

Project, Province or Territory/Operator	Owners Share	Deposit Type/ Discoverer and Discovery Date	Resources (Company Estimates as of May 29, 2003)	Ore Grade and Notes on Deposits	Mining Method, Milling Rate and Capacity	Project Particulars and Status	Location of Project/ Notes of Interest
	(%)						
Cigar Lake, Sask./ Cameco Corporation	Cameco (50.025), COGEMA Resources Inc. (37.100), Idemitsu (7.875), TEPCO (5)	Unconformity-related/ COGEMA Resources Inc., 1981	Overall property 135 000 tU *mineable*	Overall property grade of 14% U; grades vary from 5% to 70% U; orebody at depth of 450 m	"Non-entry" underground; "jet-boring" mining method; milling at McClean Lake and Rabbit Lake; contributing from 2300 to 6900 tU/y	$555 million project; test mining completed in 1992; EIS submitted in October 1995; Joint Panel reports November 1997; government response April 1998; EA process for construction licence initiated in June 2003	670 km N of Saskatoon; 500-m-deep shaft sunk; brine freezing of ground is required to mine the ore; production to begin as early as 2006
Midwest, Sask./ COGEMA Resources Inc.	COGEMA Resources Inc. (54.8), Redstone Resources Inc. (20.7), Tenwest Uranium Ltd. (20), OURD (4.5)	Unconformity-related/ Esso Minerals Canada, 1977 (interests of Bow Valley, Numac Oil & Gas, *et al* bought by partners)	Overall property 13 800 tU *mineable*	Overall property grade of 4.5% U; grades vary from 2% to 30% U; orebody at depth of 200 m	"Non-entry" underground; "jet-boring" mining method or open-pit; milling at McClean Lake; contributing 2300 tU/y	$80 million co-venture with McClean; in 1993, Joint Panel rejects proposal; new EIS in 1995; final hearings August 1997; Joint Panel report November 1997; government response April 1998	710 km N of Saskatoon; 185-m-deep test-mine shaft; new operator, COGEMA Resources Inc. revised EIS; start-up subject to feasibility study
Kiggavik, Nunavut/ Urangesellschaft Canada Limited	Urangesellschaft (79), COGEMA Resources Inc. (20), Daewoo Corporation (1)	Unconformity-related/ Urangesellschaft, 1977	Overall property 15 000 tU *mineable*; (more incl. Andrew Lake *et al*)	0.41% U average overall; Centre pit depth 100 m, Main pit 200 m	Open-pit mining methods; mill feed at 1200 t/d; output rate of 1200 tU/y originally expected	EIS submitted but project deemed deficient by Panel; new EIS required before project start-up	75 km W of Baker Lake; start-up not expected in the foreseeable future; >11-year mine life with tributary ore included

Notes: OURD (Canada) Co., Ltd. is a subsidiary of the Overseas Uranium Resources Development Corporation (OURD) of Japan. Urangesellschaft Canada Limited, operated by COGEMA Resources Inc., is a subsidiary of COGEMA S.A., which is wholly owned by the AREVA Group of France. Idemitsu Uranium Exploration Canada Ltd. is a wholly owned subsidiary of Idemitsu Kosan Co. Ltd. of Japan. TEPCO Resources Inc., is a subsidiary of Tokyo Electric Power Co., Inc. (TEPCO), Japan's largest nuclear power utility. Redstone Resources Inc. is a subsidiary of Franco-Nevada Mining Corporation Limited. Tenwest Uranium Ltd. is a wholly owned subsidiary of Denison Energy Inc.

TABLE 5. URANIUM EXPLORATION ACTIVITY IN CANADA, 1988-2001

	Expenditures (1)	Drilling (2)	Million-Dollar Projects (3)
	($ millions)	(km)	(no.)
1988	59	201	11
1989	58	158	11
1990	45	66	6
1991	44	67	4
1992	46	79	4
1993	40	62	5
1994	36	67	8
1995	44	75	10
1996	39	79	8
1997	58	104	6
1998	60	95	6
1999	49	89	3
2000	46	77	3
2001	25	48	3

Source: Natural Resources Canada.
(1) Direct exploration and drilling expenditures in current dollars; from the late 1980s, includes advanced underground exploration and deposit appraisal expenditures; from the mid-1990s, may also include care-and-maintenance costs associated with deposits awaiting production approvals. (2) Exploration and surface development drilling; excludes development drilling on producing properties. (3) Number of projects where direct exploration and drilling expenditures exceeded $1 million in current dollars.

TABLE 6. ESTIMATES OF CANADA'S URANIUM RESOURCES RECOVERABLE FROM MINEABLE ORE,(1) JANUARY 1, 2001, AND JANUARY 1, 2002

Price Ranges Within Which Mineable Ore is Assessed (2)	Measured		Indicated		Inferred	
	1/1/01	1/1/02	1/1/01	1/1/02	1/1/01	1/1/02
			(000 tU)			
Up to $50/kgU	258	301	20	10	103	86
$50 to $100/kgU	–	–	36	37	20	18
Total	258	301	56	47	123	104

Source: Natural Resources Canada.
– Nil.
(1) Actual or expected losses in mining recovery and ore processing have been accounted for; these factors were individually applied to resources tributary to existing or prospective production centres. In underground operations, mineable ore is generally 75-85% of the ore-in-place; higher mining recoveries are achievable in open-pit operations. Canada's weighted average ore processing recovery for existing conventional operations exceeded 97% over the 2001/2002 survey period. (2) The Canadian dollar figures reflect the price of a quantity of uranium concentrate containing 1 kg of elemental uranium. The prices were used in determining the cut-off grade at each deposit assessed, taking into account the mining method used and the processing losses expected. The price of $100/kgU was used by Natural Resources Canada to illustrate those resources that were of economic interest to Canada during the survey period.
Note: $1/lb U_3O_8 = $2.6/kgU.

TABLE 7. PRODUCTION OF URANIUM IN CONCENTRATES BY SELECTED MAJOR PRODUCING COUNTRIES, 1997-2001

	1997	1998	1999	2000	2001
	(tonnes U)				
Canada	12 030	10 920	8 210	10 680	12 520
Australia	5 520	4 910	5 980	7 580	7 580
China	500	500	500	500	700
France	750	510	440	310	180
Gabon	470	730	290	–	–
Kazakhstan	1 000	1 270	1 350	1 740	2 110
Namibia	2 900	2 760	2 690	2 710	2 240
Niger	3 500	3 730	2 920	2 900	2 920
Russia	2 000	2 000	2 000	2 000	3 000
South Africa	1 100	990	980	870	880
Uzbekistan	1 760	1 930	2 130	2 350	1 950
United States	2 170	1 810	1 810	1 460	1 010
Other (1)	1 990	1 730	1 770	1 860	1 710
Total (2)	35 690	33 790	31 070	34 960	36 800

Sources: *Uranium: Resources, Production and Demand*, a biennial report published jointly by the Nuclear Energy Agency of the OECD and the International Atomic Energy Agency, and miscellaneous corporate, national and international reports.
– Nil.
(1) Includes Argentina, Belgium, Brazil, Bulgaria, the Czech Republic, Germany, Hungary, India, Israel, Japan, Mongolia, Pakistan, Portugal, Romania, Spain, Ukraine and Yugoslavia. (2) Totals are of the listed figures only and represent global production.
Note: Country figures are rounded to the nearest 10 tU.

TABLE 8. EXPORTS OF URANIUM OF CANADIAN ORIGIN, 1996-2001

Country of Final Destination	1996	1997	1998	1999	2000	2001
	(tonnes of contained uranium(1))					
Argentina	–	–	–	–	1	–
Belgium	115	–	–	–	110	126
Czech Republic	–	–	–	–	246	–
France	679	587	67	1 819	3 505	3 302
Germany	776	184	–	–	–	–
Japan	1 490	1 968	1 310	1 116	2 386	1 127
Mexico	–	–	–	–	–	93
South Korea	261	315	444	309	172	496
Spain	103	160	–	121	97	180
Sweden	142	450	147	–	–	–
Taiwan	–	–	–	107	26	212
United Kingdom	250	374	345	–	193	58
United States	7 407	6 187	5 962	3 674	4 230	4 437
Total	11 223	10 225	8 274	7 146	10 966	10 031

Source: Canadian Nuclear Safety Commission.
– Nil.
(1) Some of this uranium was first exported to an intermediate country for conversion and/or enrichment prior to transfer to the country of final destination.

TABLE 9. URANIUM PROCESSING PRODUCTION AND ASSOCIATED WORK FORCE IN CANADA, 1998-2001

Process and Location (Nameplate Capacity)	Production				Site Work Force			
	1998	1999	2000	2001	1998	1999	2000	2001
	(tonnes U)				(number)			
Refining at Blind River (18 000 tU as UO_3)	12 031	11 360	9 605	(1) . .	96	98	98	98
Conversion at Port Hope (12 500 tU as UF_6 and 2800 tU as UO_2)	11 169	11 231	9 327	10 958	271	272	267	264

Source: Cameco Corporation.
. . Not available.
(1) For commercial confidentiality reasons, Cameco no longer reports a production figure for Blind River.